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ORGANIZATIONAL AMBIDEXTERITY FOR MEDIUM-SIZED FIRMS IN A CONTEXT OF GROWING UNCERTAINTY

Jean-Christophe Bogaert

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**UNIVERSITÉ LYON III
INSTITUT D'ADMINISTRATION
DES ENTREPRISES**

**BUSINESS SCIENCE
INSTITUTE**

DOCTORATE in BUSINESS ADMINISTRATION

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**ORGANIZATIONAL AMBIDEXTERITY FOR MEDIUM-SIZED FIRMS
IN A CONTEXT OF GROWING UNCERTAINTY**

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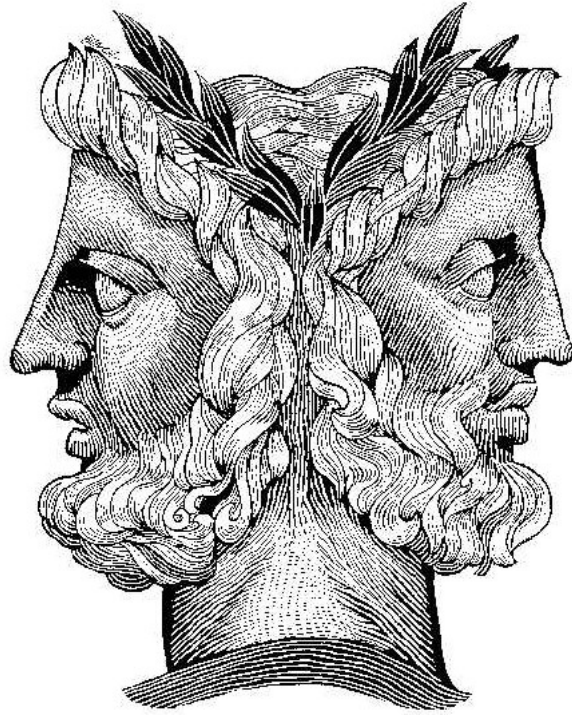
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The Business Science Institute and IAE Lyon do not intend to give any approval or dissatisfaction to the opinions expressed in this thesis. These opinions must be considered as peculiar to their author.

“There is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful in its success, than to be a leader in the introduction of changes. For he who innovates will have for enemies all those who are well off under the old order of things, and only lukewarm supporters in those who might be better off under the new.”

The Prince,
Niccolò Machiavelli



Janus,
God of Change and Time,
a face looking to the past,
a face looking into the future.

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Abstract

Managers are constantly exposed to the increasing complexity of our fast-paced, globalized, interconnected and hyper-competitive world. In such an increasingly unpredictable context, structuring an organization and designing a strategy that balances the needs for short-term profitability with long-term survival is becoming growingly difficult. Organizational ambidexterity has been proposed as a means of managing these contradictory objectives, but its effect on the longevity of organizations remains largely unproven. We discuss this issue by situating it in the academic literature and propose that business segments that are highly exposed to a very uncertain environment benefit from the application of an ambidextrous strategy according to a constantly evolving dynamic process superimposing different measures, varying in intensity; and from the regular modification of this mix in response to external stimuli and newly acquired internal capabilities. Hence the question pertaining to *how* to operate this, especially in medium-sized companies (SMEs) with constrained resources; a domain that has also been largely overlooked by management scholars so far.

Our analysis proceeds by a longitudinal single case study covering the 25 years of existence of a medium-sized company operating internationally in the field of industrial biotechnology. It relies on a mix of quantitative and qualitative methods with the aim to abductively search for explanations for the events observed so as to enrich the current view of the manner in which generative mechanisms are activated and underlying processes put to work in regards to contextual conditions.

In light of our findings, we argue that SMEs operating in turbulent environments with high technological content would benefit from combining a highly flexible organic-type of structure at the decision-making level with a more mechanistic structure at the execution level. We show that organizational ambidexterity can advantageously be achieved in medium-sized companies by nurturing a customer-centric effectual approach for projects belonging to short development cycles in combination with a strict stage-gate system resorting to a classical causal logic for projects imbedded in long development cycles. We also claim that the integration of effectual logic into business practices at the operational level creates an ongoing and affordable opportunity for the variation, selection and retention of new knowledge and capabilities that helps the company stay ambidextrous and makes it more robust in the face of environmental change. Overall, the integration of our observations, as diverse as they are varied, confirms that organizational ambidexterity is a rich, complex and multilayered concept that must be dynamically analyzed in the light of the company's available resources, especially when they are limited as for the majority of mid-sized firms; but also with regards to the surrounding environmental changes, especially when these are accelerating and becoming unpredictable.

Keywords

Organizational ambidexterity, corporate strategy, change management, uncertainty, chaos, exploitation/exploration, causation/effectuation, fragility/antigravity.

Résumé

Les managers sont constamment exposés à la complexité croissante de notre monde trépidant, globalisé, interconnecté et hyperconcurrentiel. Dans un tel contexte de moins en moins prévisible, structurer une organisation et concevoir une stratégie qui équilibre les besoins de rentabilité à court terme et la survie à long terme devient de plus en plus difficile. L'ambidextrie organisationnelle a été proposée comme moyen de gérer ces objectifs contradictoires mais son effet sur la longévité des organisations reste largement non-démonstré. Nous discutons cette problématique en la situant dans la littérature académique et proposons que les métiers fortement exposés à un environnement très incertain bénéficient de la mise en pratique d'une stratégie ambidextre selon un processus évolutif et dynamique superposant différentes mesures, variables en intensité, à plusieurs niveaux de l'entreprise et par la modification régulière de ce mix en réponse aux stimuli extérieurs et aux capacités internes nouvellement acquises. Dès lors la question de savoir *comment* mettre ça en place, en particulier dans les moyennes entreprises (PME) ayant des ressources limitées, un domaine qui a été largement négligé par les chercheurs en gestion jusqu'à présent.

Notre analyse consiste en l'étude longitudinale d'un cas unique couvrant les 25 années d'existence d'une entreprise de taille moyenne opérant à l'international dans le domaine de la biotechnologie industrielle. Il s'appuie sur une combinaison de méthodes quantitative et qualitative dans le but de rechercher de manière abductive des explications pour les événements observés afin d'enrichir la vue actuelle de la manière dont les mécanismes générateurs sont activés et les processus sous-jacents mis en oeuvre en fonction des conditions contextuelles.

À la lumière de nos constatations, nous soutenons que les PME opérant dans des environnements turbulents avec un contenu technologique élevé bénéficieront de la combinaison d'une structure de type organique hautement flexible au niveau décisionnel avec une structure plus mécanistique au niveau de l'exécution. Nous montrons que l'ambidextrie organisationnelle peut être atteinte dans les entreprises de taille moyenne en favorisant une approche effective axée sur le client pour les projets appartenant à des cycles de développement courts combinée à un strict système d'étapes qui recourt à une logique causale classique pour des projets intégrés dans les cycles de développement longs. Nous prétendons également que l'intégration de la logique effective dans les pratiques commerciales au niveau opérationnel est de nature à créer une opportunité constante et peu coûteuse pour la variation, la sélection et la rétention de nouvelles connaissances et capacités qui aident l'entreprise à rester ambidextre et la rendent plus robuste face à un environnement changeant. Dans l'ensemble, l'intégration de nos observations, aussi diverses que variées, confirme que l'ambidextrie organisationnelle est un concept riche, complexe et multicouches qui doit être analysé dynamiquement à la lumière des ressources disponibles de l'entreprise, en particulier lorsque celles-ci sont limitées comme pour la majorité des entreprises de taille moyenne; mais aussi au vu des changements contextuels qui entourent l'entreprise, en particulier lorsque ceux-ci s'accélèrent et deviennent imprévisibles.

Mots clés

Ambidextrie organisationnelle, stratégie d'entreprise, management du changement, incertitude, chaos, exploitation/exploration, causation/effectuation, fragilité/antigrabilité.

Acknowledgements

Conducting research work as part of a doctorate in parallel with a dense professional life, and avoiding interferences between both, requires a great deal of structure and compromise. In a way, such a dual adventure integrates in itself the principles of organizational ambidexterity, the central subject of this thesis, and offers perhaps a good means to grasp from the inside, on a daily basis, at the level of our personal small scale, the tensions that make ambidexterity so indispensable, so difficult to achieve in practice, but also so rewarding when properly managed.

As I come to the twilight of this thesis project, and before tomorrow presents itself with new challenges, I would like to thank all those who made this work possible.

First of all, I would like to thank my thesis supervisor, Professor Caroline Mothe, for the quality of her guidance, for her knowledge of the subject, for her availability, for her unfailing enthusiasm, and for our exciting conversations on the shores of Lake Geneva. I am also grateful to Professor Jean Moscarola for the excellent advice he gave me especially in terms of methodological approach for this work.

I also express my gratitude to the Business Science Institute and the Institut d'Administration des Entreprises of the University of Lyon III, and particularly to Professor Michel Kalika, Scientific Advisor of the former and professor at the second, for having created this Doctorate in Business Administration. Such a program allows managers to take a step back from their practice, reflect on the implications of their work at a broader level, and participate at their modest individual scale in knowledge creation and sharing. Moreover, the distance education character offered by the Business Science Institute makes it possible to combine this type of program with an active life, a formula without which I would never have been able to finish such a work.

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To all, thank you.

Ligne,

May 31st, 2017

Introduction

“It is not the strongest of the species that survive, nor the most intelligent, but the one that is most responsive to change”

Charles Darwin

Foreword

Some authors argued that research in strategy and organizations would be better served if it were more grounded in the phenomena and they suggested that the context of executive education offers an underused framework for faculty and doctoral students to develop relationships with practitioners (Tushman & O'Reilly, 2007). What closer relationship between researcher and practitioner than to have both in the same person? This is precisely the opportunity offered by an Executive Doctorate in Business Administration but the posture of manager-researcher is hard to hold because the manager must be operational, hands-on, close to the subject, in the heart of action; while the researcher must maintain a critical distance with the subject of his/her study to ensure neutrality and objectivity¹. Moreover, this posture is not deprived of risks and bias: risk of circularity and risk of ignoring the principle of equifinality (Dumez, 2012), risk of narrative fallacy (Taleb, 2012), single-informant bias (Kumar, Stern, & Anderson, 1993), *ad hoc* hypothesis (Bamford, 1999) etc... Therefore, to be useful, research in the social sciences conducted by managers-researchers, even more perhaps than other types of studies, must combine relevance and methodological rigor (Stokes, 1997).

We believe that the subject of our dissertation and the research question that arose from it are relevant because they correspond to theoretical gaps identified in academic literature but also and foremost because they were inspired by our own experience as a business manager in various geographical and conjunctural contexts. As for the methodology, with a background of engineer we feel spontaneously more attracted by positivist or post-positivist approaches but management is about people² (social science) and reducing management's complexity to general and average patterns (normal distributions) leads to missing its local idiosyncratic dimension (sometimes located "in the tails") which is precisely what practitioners are confronted with. Consequently, as explained further in this dissertation, we have adopted a critical realist posture and a rigorous multi-method qualitative and quantitative study design which we hope will reveal useful to the matter in generating new knowledge of both academic relevance and pragmatic interest.

¹ Except for certain streams of research in social science and especially in management science such as action-research for instance.

² Hence the question to know if engineers make good managers... A question that falls far beyond the scope of this dissertation, tough.

General context

« We need to learn to deal with a rain forest of individuals and firms and markets and societies, intermeshed and woven together with completely coherent yet vastly diverse local patterns that add up to a complex, interdependent ecology of human artifacts. We need to move away from the vision of the "market" as a monolithic construct that rides roughshod over vast farmlands of homogenous commodities, relentlessly separating the wheat from the chaff, and start researching "markets" as groups of individuals and communities developing a variety of gardens and parks based on their particular tastes in landscaping and architecture. Only then can we begin to explain why people of all types seem to build successful companies.»

(Sarasvathy, 2001, p.258)

A question of survival

There has been a lot of debates about why do firms exist. Some see the purpose of companies' existence in profit generation while others believe growth should be the main target for managers. Academics approached this question from a transaction cost perspective (Coase, 1937), an agency cost perspective (Jensen & Meckling, 1976), a resource-based perspective (Penrose, 1959) or a knowledge-based perspective (Barney, 1991; Kogut & Zander, 1992). Birkinshaw and Gupta (2013) highlighted a slightly different but interesting viewpoint initially developed by Moran and Ghoshal (Ghoshal & Moran, 1996; Moran & Ghoshal, 1999) by which they argue that firms do things markets cannot. In substance, they claim that markets allocate resources to short-term best uses and firms then transform these resources into long-term outputs to create value. This is why, according to these authors, we need both markets and companies to sustain economic development. However, because corporations are built on the assumption of continuity (long-term operations) and markets are built on the assumption of discontinuity (short-term creation and destruction)(Foster & Kaplan, 2001b), the former are not able to change at the pace and scale of the latter. This lends further credence to McKelvey's contention (1999) that the environment changes more rapidly than organizations. The markets remove the weaker performers and, while some corporations thrive to survive for quite long periods of time, they don't have the ability to

perform as well or better than the markets and to earn average or above-average shareholders returns over the long run. Foster and Kaplan (2001b) for instance, using their research on the performance of more than 1,000 corporations in 15 industries over a 36-years period, show that the long-term survivors, these few companies that survived the “perennial gale of creative destruction” (Schumpeter, 1934), earned as a group a long-term return for their investors 20% lower than that of the overall market. They did not find any long-term survivor that had significant sustained outperformance. There were many new entrants that had stronger performance than that of their peers but the phase of exceptional performance always came to an end after a certain period of time. Hence the question: what should matter for managers and companies’ stakeholders: short-term profits, growth or long-term survival?

Profits

The idea that the only purpose of a firm is to make money for its shareholders is largely related to the Chicago School of Economics and its 1976 Nobel Prize-winning leader Milton Friedman who published a provocative article in the New York Times on September 13, 1970 titled “The Social Responsibility of Business is to Increase its Profits”(M. Friedman, 1970). Almost half a century later, there is a growing consensus that focusing on short-term shareholder value is certainly questionable for society but also leads to poor business results (Murray, 2013). Indeed, as recently showed in the US (Asker, Farre-mensa, & Ljungqvist, 2015), companies listed on the stock market invest only about 3.7 per cent of their total assets whereas privately-held companies invest about twice as much, this because executives at publicly traded companies are paid to generate higher share prices by hitting quarterly earnings targets, therefore reducing investments that will only impact profits at longer term. Even Jack Welch, the iconic former President and CEO of General Electric and true-believer of the shareholder value theory, mitigated the idea in an interview with the Financial Times in 2009 when he said that “Shareholder value is a result, not a strategy (...) Your main constituencies are your employees, your customers and your products (...) Managers and investors should not set share price increases as their overarching goal (...) Short-term profits should be allied with an increase in the long-term value of a company”. In a similar way, de Geus (1997) observed that “corporations fail because the prevailing thinking and language of management are too narrowly based on the prevailing thinking and language of economics. (...)

Companies die because their managers focus on the economic activity of producing goods and services, and they forget that their organizations' true nature is that of a community of humans" (p.3). Collins and Porras (1994), drawing upon a six-year research project looking in depth at eighteen long-lasting companies in direct comparison to their top competitors came to conclude that "profitability is a necessary condition for existence and a means to more important ends, but it is not the end in itself" (p.55).

Therefore, while most research to date has highlighted revenue as the primary performance outcome (Gibson & Birkinshaw, 2004; He & Wong, 2004), an accent on this single trait alone provides an incomplete picture of the firm's overall success and a finer-grained view of firm performance is needed (Chakravarthy, 1986).

Growth

The literature on organizational success implicitly regards growth as another adequate indicator of success.

Whetten (1980, p.577) noticed a bias in organizational theories in favor of growth with implied assumptions such as "there is a positive correlation between size and age", hence the greatest need of organizations as they mature would be to manage growth; "size is a desirable characteristic" as large size is supposed to enable organizations to function more efficiently owing to economies of scale and to help absorb environmental changes; and "size is an indicator of effectiveness" as it is common to assume that firms grow thanks to appropriate strategies and effective management. Whetten (1980) further remarked the intertwined relationship between growth and effectiveness in system theory that views organizations as "living entities" with growth becoming the preferred organizational states as "it denotes youth and vitality" (p.578).

Conversely, numerous old and large organizations have had to substantially reduce the size of their operations or redefine their outputs in order to maintain their level of effectiveness, and there are several examples of companies that have failed to respond to declining environmental conditions because their management was primarily preoccupied with growth (Starbuck, Greve, & Hedberg, 1978). Organizational growth may also induce negative or dysfunctional consequences as large

organizations are likely to become “too complex, too rigid, too impersonal, too inefficient, and too inaccessible to outsiders” (Whetten, 1987, p.341).

Additionally, Hanks *et al.* (1993) describe two apparently stable and sustainable disengagement configurations in their taxonomic life-cycle model by which enterprises appear to disengage from the growth process after establishing their viability at relatively modest size because owners consciously chose to keep their firms small as they believe that the negative effects of growth outweigh the positive outcomes, respectively the “life-style disengagement” (also described by Davidsson (1989)) and what McMahon (1998) called “capped-growth disengagement” (similar to Churchill & Lewis (1983) “success-disengagement”). Hanks *et al.* (1993) observed that these disengagements patterns can be justified for firms operating in small market niches for instance and McMahon (1998) asserted the disinclination of some entrepreneurs and managers to surrender control and/or be accountable to others.

Consequently, although growth is praised by many in mainstream business magazines and size is generally regarded as a positive indicator of success, there are situations in which decision makers may not want to seek to grow their business beyond a certain point or may even be forced to take actions to reduce the size of their operations in order to fulfil other goals.

Survival

« Social scientists from different disciplines have different views on the importance of corporate longevity. Economists, who view companies as instruments for organizing economic transactions that cannot be performed with market mechanisms and/or for maximizing financial benefits for their owners, do not consider company longevity a goal per se. Sociologists, who view companies as institutions that inherently seek to survive study why and how they do so, primarily in terms of legitimacy as a determinant of longevity. Strategy scholars combine aspects of the economic and sociological perspectives by focusing on the determinants of a company's economic performance and viewing this as a condition for its continued survival.»

(Burgelman, 2015, p.73)

Notwithstanding the evidence that generating profits is of paramount importance and that achieving growth may be seen as an equi-important driver in managing a company, companies also exist

because of their social impact. This stakeholders' perspective is evidenced, for instance, by the growing interest towards Corporate Social Responsibility (Lewis, Andriopoulos, & Smith, 2014). Contrary to traditional economic thinking, some investors do value the sustainability and long-term survival of their investments as much as, or sometimes even more than, the short-term returns they are generating (Collins & Porras, 1994; de Geus, 1997; Stadler, 2007; Stadler & Hinterhuber, 2005). A typical example of such a long-term investor/shareholder standpoint, as opposed to the one of speculators, short-sellers and some activist investors, comes with the family offices where “the family ownership brings the family values alive in a vision, which deeply cares for the next generation, not just for the next five years” (Schwass, 2013, p.9).

De Geus (1997) goes even further in his book “The Living Company: Habits for Survival in a Turbulent Business Environment” in which he summarizes 38 years of high-level management at Royal Dutch/Shell and the findings of an in-depth study of 27 corporations that had successfully weathered some fundamental changes in the world around them such that they still existed with their corporate identity intact. He asserts that providing financial returns, products or services, serving customers, making human life more comfortable, creating jobs and ensuring a stable economic platform for all the stakeholders of society, for important as these goals are, are all secondary. He states that, from the point of view of the organization itself, “like all organisms, the living company exists primarily for its own survival and improvement” (de Geus, 1997, p.11).

For the anecdote, let us remind that the word “business” was known in traditional Chinese as 生意, pronounced “Shēngyì”, in which the first character - “Shēng” - stands for life, livelihood, and the second character - “yì” – means purpose, sense, intention, and significance but also desire or wish. Hence, as per the ancient Chinese, business can be assimilated to “the purpose of life” or “the desire of life” and the term “survive” has the same root: 生存, “Shēngcún”, “to retain life”.

Many researchers have attempted to better understand the organizational causes of success and failure (Fleck, 2009; Miles & Snow, 1992; Miller, 1993; Weitzel & Jonsson, 1989), archetypes of organizational success and failure have been proposed (Miller & Friesen, 1978; Miller & Friesen, 1977) and broad longitudinal studies on American (Foster & Kaplan, 2001b), European (Stadler, 2007) or international (Collins & Porras, 1994; de Geus, 1997) long-lasting companies have been published. In addition to several other attributes such as cohesion, identity and tolerance (de Geus, 1997), integrity and diversity (Fleck, 2009) or conservatism (de Geus, 1997; Stadler, 2007), all

these authors stress out the necessity for organizations to learn from and adapt to their surroundings, to explore new avenues and exploit existing competences, to enterprising and at the same time navigate a dynamic environment. Other authors (e.g. Gibson & Birkinshaw, 2004) have referred to adaptability (capacity to evolve rapidly) and alignment (capacity to work coherently).

This “ability of organizations to compete in mature technologies and markets where efficiency, control, and incremental improvement are prized and to also compete in new technologies and markets where flexibility, autonomy, and experimentation are needed”(O’reilly & Tushman, 2013, p. 324) is often referred to as “Organizational ambidexterity” in organizational scholarship.

In a seminal article published in 1991, March explains that “the basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and, at the same time, devote enough energy to exploration to ensure its future viability” (March, 1991, p.105). The relationship between organizational ambidexterity and firm viability, i.e. firm survival, is straightforward. Pointing at some confusion or ambiguity about what precisely the term “organizational ambidexterity” refers to, O’reilly & Tushman (2013, p.330) insist that “the long-term *survival* of the firm is the sine qua non of organizational ambidexterity”, and they add that “Ambidexterity is not simply about whether a firm can pursue efficiency and innovation or compete in multiple markets but about developing the capabilities necessary to compete in new markets and technologies that enable the firm to *survive* in the face of changed market conditions”(O’Reilly & Tushman, 2007, emphasis is ours).

In conclusion, long term survival appears to be of importance for organization’s stakeholders and developing ambidextrous capabilities may be an efficient way to deal with apparently opposed short term and long term pressures. Our research aims precisely to add additional specificity and insights into this view in order to help substantiate it. Nonetheless, before going further, some clarity must be brought upon the very definition of survival or related terms such as longevity and sustainability, which is what is addressed in the next section.

Survival, longevity or sustainability?

The term *sustainability* seems too broad in its first sense (“the ability to be maintained at a certain rate of level”) and too narrowly linked to ecology in its more common meaning (“the ability to

preserve an ecological balance by avoiding depletion of natural resources”). This term will therefore not be used here.

The Oxford dictionary defines *longevity* as “long life, long existence or service”. Similarly, *survival* is defined as “the state or fact of continuing to live or exist”. Both terms therefore apply to our subject. They both appear for that reason in this dissertation, we use them indifferently in the following sections to improve the narrative flow and avoid too many repetitions. Doing so, we follow several scholars who use the two terms without nuance in their publications (Laplume, 2010; Weitzel & Jonsson, 1989) while others use only one of these terms but without elaborating on the meaning of the word chosen or on the reason of their choice (a.o. for “longevity”: Burgelman & Grove, 2007; de Geus, 1997; Hannan & Freeman, 1984; Laplume & Dass, 2009; Malik & Hine, 2011; Piao, 2014; Stadler, 2007 ; for “survival”: Blank, 2013; Boumgarden, Nickerson, & Zenger, 2012; Carmeli & Schaubroeck, 2008; Christensen, Suarez, & Utterback, 1998; Foss, 1998; Foster & Kaplan, 2001b; Junni, Sarala, Taras, & Tarba, 2013; Kogut & Zander, 1992; Lin, Yang, & Demirkan, 2007; March, 1991; Miller & Friesen, 1977; O’Reilly & Tushman, 2013; Stadler & Hinterhuber, 2005; Winter, 1964).

The Oxford dictionary adds to the definition of survival “typically in spite of an accident, ordeal, or difficult circumstances” which makes this term even more appropriate to our reference frame, i.e. the context of growing uncertainty in which organizations are evolving. Furthermore, the Darwinian idea of “survival of the fittest”, meaning the continued existence of organisms that are best adapted to changes in their environment, applies perfectly to the underlying dimension of our questioning: how organizations can better adapt to environmental uncertainty. Yet, the purpose of our study is not to look at how companies can get prepared to, and deal with, unexpected punctual events of accidental nature, such as in high-reliability organizations theory (Weick & Sutcliffe, 2007) or in normal accidents theory (Perrow, 1984), but more to see how they can cope with evolutionary or revolutionary trends in a longer run. The word “*longevity*” contains already this long term dimension, but for the sake of clarity and to avoid any misunderstanding, instead of the term “*survival*” alone we use generally in this document the expression “*long term survival*”.

A changing world

“Historians may well look back on the first years of the 21st century as a decisive moment in human history. The different societies that make up the human family are today interconnected as never before.”

Kofi Annan, UN secretary-general, 1997-2006

“Madness *is* afoot” (Peters, 1987, p.17, emphasis original). The world has always been changing but the pace of change is obviously increasing, and increasing fast. Globalisation is one of the core factors behind changing economic conditions. For Friedman (2005), the world that has entered a third phase of globalization is flattening which brings new opportunities to entrepreneurs but also increases risks such as, without limitations, trans-border competition and currency fluctuations. Despite protectionist movements in the United States and other nations, transactions that cross international borders are sharply on the rise. The very notion of frontiers disappears in the face of technological developments: not only the borders between countries, but also between markets, and even the boundaries of the companies themselves.

Indeed, the progression of technology – taken in a broad sense – is changing the economic landscape and hence the companies’ environment. More than ever in history, “creative destruction” (Schumpeter, 1942) is accelerating exponentially: everyone is increasingly connected, high-speed computers and communications technology facilitate the development of global sourcing and allows outsourcing routine tasks, science makes disruptive progress in many field thanks to genetics and process intensification, etc.

Also often associated with periods of heightened uncertainty are periods of crisis and the resulting intense restructuring. Over the last years, the financial environment has changed as a result of recent crisis (especially the financial crisis of 2008). On the one hand, interest rates are kept at a very low level to prevent inflation to spur and to try kick-starting economic growth, but on the other hand, the financial authorities have tightened the regulatory framework for credit institutions

and investment firms (Basel III³) which hinders the access to capital for companies, especially the small ones, the more fragile and hence, maybe, the ones the more in need.

Another important change affecting companies lies in a profound mutation of their organization due to a shift of power from the management team (from the 1929 crisis till the 1980ies) to the shareholders (since the eighties). For instance, notions like Value-Based Management focussing more on ROCE (return on capital employed, a typical shareholder standpoint) than on ROS (return on sales, an enterprise perspective) spur companies to increase their capital turnover and outsource some of their competencies making them weaker in tough times.

In the modern world, the list of evolutions and revolutions triggering change at a global level is endless. Where this observation assumes its significance for companies, and especially for the managers called to lead them, is when one remark that systematic and unsystematic risks are related by the way economies manage changes in economic conditions (Haltiwanger, 2011): the variance of idiosyncratic shocks (i.e. at the microlevel of companies) is at least an order of magnitude larger than the variance of aggregate (systematic) shocks (i.e. at the macrolevel of markets or economies)(Cooper & Haltiwanger, 2006). In other words, a ripple across an economy can become a tsunami at the scale of a business.

That is why it is more essential than ever for companies to adopt the right organizational methods to take the waves when they arise and, more than simply preventing capsizing, be able to surf them at best and, even, be able to benefit from them.

³ “Basel III: a global regulatory framework for more resilient banks and banking systems”, Basel Committee on Banking Supervision, Bank for International Settlements, ISBN 92-9131-859-0, December 2010 (rev. June 2011).

Uncertainty and unpredictability

“Man-made complex systems tend to develop cascades and runaway chains of reactions that decrease, even eliminate, predictability and cause outsized events. So the modern world may be increasing in technological knowledge, but, paradoxically, it is making things a lot more unpredictable.”⁴

(Taleb, 2012, p.7)

De Meyer, Loch and Pich (2002) postulated four types of uncertainty surrounding organizations which can be put in relation with the ones outlined by Courtney, Kirkland and Viguerie (1997). The former authors primarily look at the level of projects whereas the latter investigate more broadly the impact on corporate strategy.

De Meyer <i>et al.</i> (2002)	Courtney <i>et al.</i> (1997)	How to deal with this situation?
<u>Variation</u> Internal and external factors vary randomly but in a predictable range.	<u>A clear enough future</u> Traditional strategic approach of laying out a vision of the future.	Simple forecasting precise enough to be captured in discounted cash-flow analysis and other classical tools.
<u>Foreseen uncertainties</u> A few known factors are of influence in unpredictable ways.	<u>Alternate futures</u> A few discrete outcomes define the future.	Decision trees, option valuation models, game theory, scenario planning.
<u>Unforeseen uncertainties</u> Some major factors of influence cannot be predicted.	<u>A range of futures</u> A range of possible outcomes but no natural scenarios.	This form of uncertainty requires businesses to work more flexibly, employ more novel strategic approaches and work more closely with suppliers and customers.
<u>Chaos</u> Unforeseen events completely invalidate any kind of planning or strategy.	<u>True ambiguity</u> No basis to forecast the future.	Some tools can be used such as analogies, pattern recognition, and nonlinear dynamic models but with limited success. Organizational learning is key. Managers must be resilient, adaptable and creative.

*Table 0.1: Four types of uncertainty as proposed by De Meyer (2002) *et al.* and Courtney *et al.* (1997).*

Whereas uncertainty can be equated with unpredictability (Özsomer, Calantone, & Di Benedetto, 1997), its perception is nevertheless relative. A context that is perceived as simple, static, and with

⁴ Paul Valéry went even further claiming a causal link between scientific or technological knowledge and unpredictability, he said : “Unpredictability in every field is the result of the conquest of the whole of the present world by scientific power” (cited in Schwartz, 1996).

little uncertainty by one organization may be perceived as complex, dynamic, and with a high degree of uncertainty by another. Similarly, an event can come as a surprise for one organization while it is obvious and well anticipated by another. Therefore, if uncertainty is a fact, the perception of uncertainty is not an objective phenomenon (Taleb, 2007b). This said, Anderson and Tushman (2001) have shown in a longitudinal study of the American cement industry covering 92 years and of the minicomputer industry over 24 years that uncertainty is the key environmental dimension associated with organizational mortality. The greater the uncertainty, the higher the failure rate. Their results indicate that organizations can better deal with complexity, economic conditions and environmental munificence than with uncertainty which they qualify as “a lethal characteristic of organizational environments” (opcit., p.675).

Of course, the type of activity in which organizations are involved defines their sensitivity to uncertainty. Indeed, some market segments are less exposed to volatility; activities in these segments are non-scalable in the sense that the returns generated are simply dependent on the labor or effort invested. An example comes with convenience food stores, fast-food restaurants or retail businesses. There is a relation between the size of a local population, the purchasing power of its members and the number of stores or fast-food restaurants that could survive and progress in this environment. Other sectors such as the ones with a high technology content, the pharmaceutical industry, the art industry, the movie industry, the internet industry etc... are much more exposed to volatility. In these industries, a single technological breakthrough or a blockbuster can propel a company to new heights never expected: they are scalable. The former follow normal (Gaussian) distribution of outcomes and are therefore not much impacted by surrounding volatility; the latter are much more exposed and they follow pareto-like power laws.

In a world such as ours, managers must understand the fundamentals that support the sector of activity in which they evolve in order to define the most appropriate type of organization. Indeed, uncertainty precludes rationalization, and some well-known management methods (Kroc's McDonaldization, Weber's bureaucracy, Taylor's scientific management, and Ford's assembly line)(Tsoukas, 2011) no longer apply to some industries evolving in fast changing, highly volatile, environments.

The dangers of forecasting

“Organizations create plans to prepare for the inevitable, preempt the undesirable, and control the controllable. Rational as all this may sound, planning has its shortcomings. Because planners plan in stable, predictable contexts, they are lulled into thinking that the world will unfold in the expected manner.”

(Weick & Sutcliffe, 2007, p.66)

The citation above summarizes what Mintzberg calls “the fallacy of predetermination” (Mintzberg, 1994, p.227). Beyond the fact that planning assumes predetermination and contains a good level of prediction (which accuracy can be highly hypothetical), Weick tells us that planning can be dangerous⁵. It influences perception by reducing the number of things people notice (slight deviations from the expected course of events are smoothed over and quickly lose their salience); planning also undercuts organizational functioning by limiting the organization’s view of its capabilities to those it has already (contingency plans preclude improvisation); and finally, forecasting naturally tends to push organizations to replicate pattern of activities that they know well and that have worked in the past (a kind of “success trap” to which we will return later in this work).

In any case, as pointed by Antoine de Saint-Exupéry: “Your task is not to foresee the future, but to enable it”⁶.

⁵ In fact, Popper presented the limits of searching for underlying patterns that allow future predictions, in short the limits of forecasting, much earlier than Weick and Mintzberg in “*The Poverty of Historicism*” published as a series of 3 papers in *Economica* 11 and 12 in 1944 and 1945 before being published as a book in 1957 (Murphy, 2009; Popper, 1957).

⁶ In *The Wisdom of the Sands (Citadelle)* (1948).

Uncertainty: an opportunity

“Violent and accelerating change, now commonplace, will become the grist of the opportunistic winner’s mill. The losers will view such confusion as a “problem” to be “dealt” with.”

(Peters, 1987, p.21)

Oscar Wilde once said that “To expect the unexpected shows a thoroughly modern intellect”. He was living, already, in a fast changing world. During his lifetime, great inventions revolutionized life and business: the steam machine that would change transports, the internal combustion machine that would lead to modern cars, the telephone and the telegraph that would ring the bell of telecommunications, electricity and the light bulb that would pave the way for everything from the television and the radio to the refrigerator and the curling iron, and many others. Philosophers tell us since long time already that it is useless to try to change the world, we should better enjoy it and take benefit from it as it is. It is part of Nietzsche’s line of thought who proposed, with his “*Amor Fati*”, not to try to change the world but to love it as it is, to want nothing but what is. For Nietzsche, the world is not a *Cosmos* well ordered, nor natural as for the Ancients, nor constructed by the will of men as for the Moderns. On the contrary, it is a *Chaos*, an irreducible plurality of forces that are constantly confronting each other (Ferry, 2006). And chaos should be seen as a chance: “Chaos is a state of endless variety that is creativity” (Stacey, 1994, p.55). Financial traders have understood that volatility brings value because it increases the likelihood of upsides whereas option pricing tools help them mitigate the risk of downsides. Similarly, volatility offers opportunities to managers by widening the realm of possibilities. Figure 0.1 illustrates this graphically.

Therefore, uncertainty leads to a much wider distribution of possible outcomes⁷; “injecting uncertainty into the system (...) causes an increase of both positive and negative surprises” (Taleb, 2012, p.438).

⁷ In mathematical terms, injecting uncertainty changes the probability distribution from a normal (Gaussian) distribution to a Cauchy density function with heavier tails.

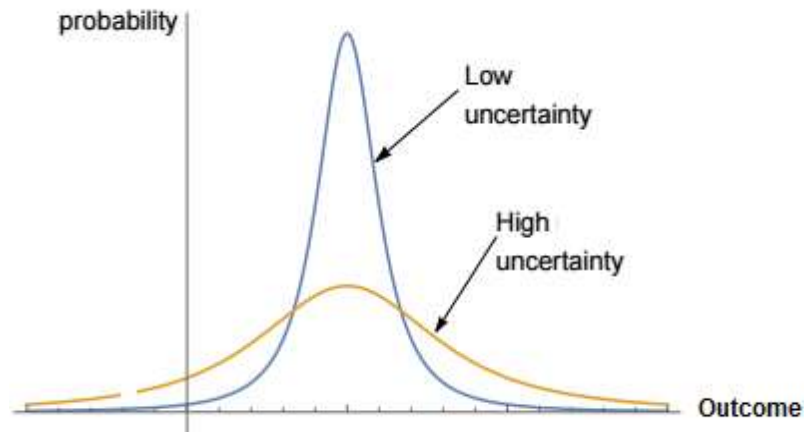


Figure 0.1: Impact of an increase of uncertainty on probability distribution of possible outcomes (reproduced from Taleb, 2012, p.438)

As the pace of technological, socioeconomic and regulatory change accelerates, survival depends increasingly on devising entrepreneurial responses to these unforeseen discontinuities (Meyer, Brooks, & Goes, 1990). Managers have to cope with this uncertainty and, instead of trying in vein to predict the unpredictable, they should devise strategies to navigate tough waters, survive stormy weathers, seize opportunities when they arise and, at the same time, protect their organizations against major threats. It is our belief that organizational ambidexterity might offer a frame for such strategies provided that the trade-offs at its core (that will be described further in this dissertation) be properly managed, especially in turbulent environments which volatility functions precisely as an amplifier of these trade-offs (Schmitt, Probst, & Tushman, 2010).

Main goal of the research

“The greatest danger in times of turbulence is not the turbulence, it is to act with yesterday’s logic.”

Peter Drucker

As we have seen in the previous chapters, the purpose for a business is not necessarily and solely to grow and make profits, but also, simply, to survive. The world around us is however increasingly volatile, hence uncertain, and this uncertainty leads to unpredictability that makes many actors utterly unable to properly plan their future actions; and the very fact of trying to predict the future does not come without danger. So what can companies do to prepare for their future without forgetting their present activities?

This question emerged from our prior experience as manager and from new insights gathered during our literature survey. As manager, and especially as Managing Director of a sino-western joint venture during seven years, we have often been confronted with the difficulty of aligning short term and long term perspectives. Studying the academic literature on corporate success and failure, especially through an evolutionary lens, we found a relative consensus among authors about the necessity for long-lasting organizations to learn from and adapt to their surroundings, to explore new avenues and exploit existing competencies, to enterprise and at the same time navigate a dynamic environment. This led us naturally to research on organizational ambidexterity, and particularly on the still under-studied aspects of it pertaining to how it can be practically operated in medium-sized organizations often characterized by constrained resources.

Our study therefore intends to address the subject on the basis of a specific and fine-grained analysis answering the following question:

How can organizational ambidexterity be operated in medium-sized companies to dynamically adapt to unanticipated environmental changes and increase their survival chances?

Whereas organizational ambidexterity has been studied through various theoretical lenses (e.g. organizational learning, organizational design, knowledge management, dynamic capabilities) almost exclusively with the help of cross-sectional research design neglecting the influence of time in the conceptualization (Simsek, Heavey, Veiga, & Souder, 2009), our study aims to contribute to the strategic management literature by identifying some new aspects of an evolutionary and dynamic perspective on strategy-making processes (Burgelman, 1991) and by drawing more explicit attention to the simultaneity of multiple layers of these processes within the organizations. The purpose is to investigate how an ambidextrous medium-sized organization highly exposed to a very dynamic environment adapts its exploration-exploitation balance, the crux of organizational ambidexterity, to the varying environmental conditions over time.

With this study, it is our intention to generate new knowledge of academic relevance and pragmatic interest.

General structure of the thesis

This dissertation defends the thesis that medium-sized companies can implement organizational ambidexterity to dynamically adapt to unanticipated changes in their environment and thereby improve their chances of long-term survival. Our study, mostly of abductive explanatory nature, focuses particularly on finding explanations for the events observed so as to enrich the current view of the manner in which generative mechanisms are activated and underlying processes put to work with regards to contextual conditions.

To introduce the subject and come to our research question, we start by reminding that of importance for managers should not only be profit generation or growth but also, and maybe above all, long term survival. As obvious as it sounds, this dimension is often neglected in academic research whereas it takes on even more significance in the context of increasing uncertainty into which the modern world plunges us. But if this world becomes ever more unpredictable and threatening, it also offers more opportunities.

Then, the core of our work is articulated around three sections according to a rather classic architecture:

- The **first section** contains a **literature review** to identify the main theories and concepts. In this section, we present the origin of organizational ambidexterity and the main methods used to operationalize the construct. We elaborate on the different conceptualizations of the two dimensions that form the construct, i.e. exploration and exploitation, and we review the extant literature pertaining to their interactions with the different aspects of interest for our research question such as long term survival, environmental dynamism and particularly the case of medium-sized enterprises. We conclude this section by highlighting the theoretical gaps that we intend to address and by framing the scope of our study.
- The **second section** details the **design of our research** with respect to our epistemological posture (critical realism), research setting (industrial biotechnology), unit of analysis (the company Galactic) and research methodology (longitudinal case study). We also expose in detail the source of our data and the way they have been treated to feed our analysis.
- In the **third section**, we present and discuss our **results** and we put them into perspective with the intention to generalize what can be. To answer our research question, we have adopted a four-steps approach:
 - As **Step 1**, we look at **the company** (Chapter 3.1) **and its environment** (Chapter 3.2). On the basis of a narrative of the history of the company covering its 25 years of existence, we identify four main epochs characterized by different strategic intents and clear underlying dynamics. For the environment, we first investigate whether it is dynamic and then we confirm its unpredictable nature. We conclude this step by relating the evolution of the company to the major changes in its environment which suggests that it would benefit from a truly ambidextrous organization.
 - In **Step 2**, we **quantify organizational ambidexterity and its components** (exploration intensity and exploitation intensity), and we look at their evolution over time (Chapter 3.3). We also investigate further into different forms of ambidexterity (Chapter 3.4) from a perspective internal to the company (structural ambidexterity) as well as external to the company (network ambidexterity); and we measure which form matters the most and should be

favoured by managers of medium-sized companies in case a trade-off becomes necessary because of constrained resources for instance. In addition, we condense our data in a few simple relationships so as to better let emerge the links between the key-components of organizational ambidexterity and to better measure their respective impacts on three principal indicators, i.e. exploration intensity, exploitation intensity and ambidexterity score. This part enables us to highlight the most relevant elements of an ambidextrous approach applied to SMEs in order to prioritize the actions to be eventually taken by the managers who wish to develop the present activities of their organizations without jeopardizing their chances to survive the long run.

- In **Step 3**, we search for underlying processes supporting organizational ambidexterity. We identify and discuss two of these processes. The first one consists to nurture corporate plasticity by combining an organic structure of management at the top of the company with a mechanistic type of organization at the execution level. The second process relies on the combination of a customer-centric effectual approach for projects belonging to short development cycles with a strict stage-gate system resorting to a classical causal logic for projects imbedded in long development cycles.
- Finally, in **Step 4**, we wrap up our results, we put them into perspective and we discuss their generalization to other fields of activity and other domains. We also try to identify what is symptomatic of medium-sized companies and what can be extended to other types of organizations.

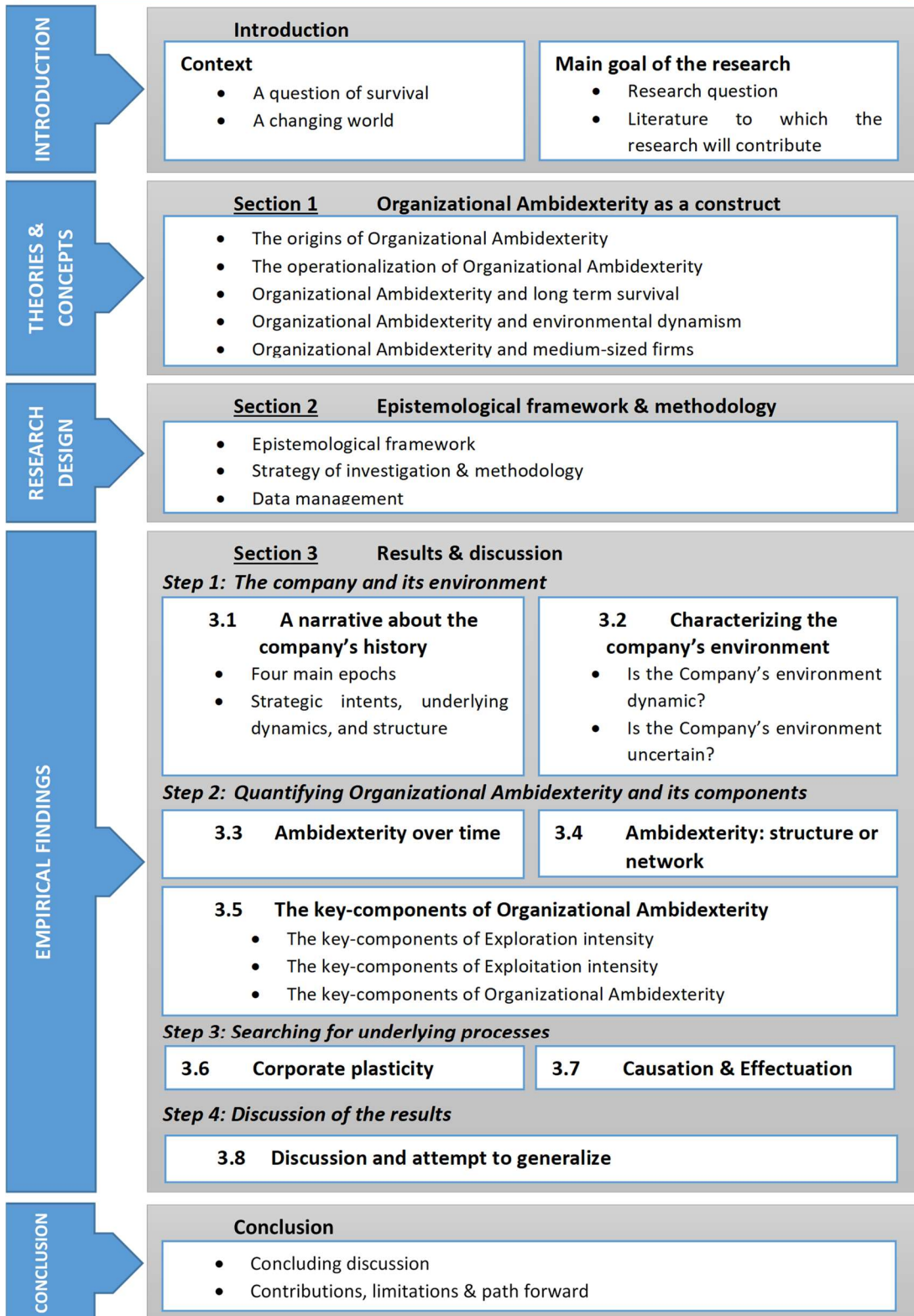
Finally, we conclude by highlighting academic contributions, managerial recommendations, limitations, and avenues that remain open for future research.

Attached to our study are also various supporting documents among which an 87 page-long narration of the four main phases (epochs) in the company's development (Appendix II). We chose for this level of detail so as to reconstruct the company's history and identify the internal and external changes that have paved its evolution until now.

The general approach adopted is summarized in a diagram on the next page.

Thesis defended

Medium-sized companies can operate Organizational Ambidexterity to dynamically adapt to unanticipated environmental changes and hence improve their survival chances



Section 1. Organizational ambidexterity as a construct

“The test of a first-rate intelligence is the ability to hold two opposed ideas in the mind at the same time, and still retain the ability to function.”

F. Scott Fitzgerald

Thesis defended
 Medium-sized companies can operate Organizational Ambidexterity to dynamically adapt to unanticipated environmental changes and hence improve their survival chances

INTRODUCTION

Introduction

<p>Context</p> <ul style="list-style-type: none"> • A question of survival • A changing world 	<p>Main goal of the research</p> <ul style="list-style-type: none"> • Research question • Literature to which the research will contribute
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THEORIES & CONCEPTS

Section 1 Organizational Ambidexterity as a construct

- The origins of Organizational Ambidexterity
- The operationalization of Organizational Ambidexterity
- Organizational Ambidexterity and long term survival
- Organizational Ambidexterity and environmental dynamism
- Organizational Ambidexterity and medium-sized firms

RESEARCH DESIGN

Section 2 Epistemological framework & methodology

- Epistemological framework
- Strategy of investigation & methodology
- Data management

EMPIRICAL FINDINGS

Section 3 Results & discussion

Step 1: The company and its environment

<p>3.1 A narrative about the company's history</p> <ul style="list-style-type: none"> • Four main epochs • Strategic intents, underlying dynamics, and structure 	<p>3.2 Characterizing the company's environment</p> <ul style="list-style-type: none"> • Is the Company's environment dynamic? • Is the Company's environment uncertain?
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Step 2: Quantifying Organizational Ambidexterity and its components

<p>3.3 Ambidexterity over time</p>	<p>3.4 Ambidexterity: structure or network</p>
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3.5 The key-components of Organizational Ambidexterity

- The key-components of Exploration intensity
- The key-components of Exploitation intensity
- The key-components of Organizational Ambidexterity

Step 3: Searching for underlying processes

<p>3.6 Corporate plasticity</p>	<p>3.7 Causation & Effectuation</p>
----------------------------------------	------------------------------------------------

Step 4: Discussion of the results

3.8 Discussion and attempt to generalize

CONCLUSION

Conclusion

- Concluding discussion
- Contributions, limitations & path forward

In this section⁸, we aim to present the different facets of Organizational ambidexterity as a construct, the different streams that have evolved in researching this concept, as well as some of its peculiar conceptualizations. Setting the scene in this somewhat broad fashion will help us identify, in the qualitative part of our study, the ambidextrous patterns eventually implemented intentionally or unwittingly by the company under review in reaction to changes in its environment and to the ever growing uncertainty in which it operates. We then look at the various methods used to operationalize the construct and to measure its components: exploration and exploitation.

Next, after having reported about the different authors having voiced to bring the concept of organizational ambidexterity back to its fundamentals, i.e. developing the capabilities necessary to enable the firms to survive in the face of changed market conditions (O'Reilly & Tushman, 2007), we identify theoretical gaps in the research on the subject matter and we determine avenues for our own research.

1.1. The origins of organizational ambidexterity as a construct

Despite its relative novelty, the concept of organizational ambidexterity rooted in March's framework of exploration and exploitation (March, 1991) has drawn substantial interest among scholars and several literature reviews as well as special issues and unplugged thematic series of articles have been published in prominent journals (Birkinshaw & Gupta, 2013; Lavie, Stettner, & Tushman, 2010; O'Reilly & Tushman, 2013; Raisch, Birkinshaw, Probst, & Tushman, 2009). We refer the interested reader to these sources, especially Lavie *et al.* (2010) for a comprehensive overview of the antecedents of exploration and exploitation within and across organizations.

As noted by Birkinshaw and Gupta (2013), organizational ambidexterity is an academic construction and practitioners never use the term which has in fact no intuitive meaning. Hence, they say, "a discussion of the underlying meaning of ambidexterity has to start from theory" (p. 290). Beyond the human trait allowing individuals to use both hands with equal dexterity, the

⁸ A summary of this section has been published in French in *Revue Economique et Sociale* in its March 2016 issue under the title: "Survie à Long Terme dans un Contexte d'Incertitude Croissante: L'Ambidextrie Opérationnelle est-elle la réponse?" (see Appendix I).

ambidexterity metaphor refers to the ability exhibited by some organizations to exploit existing competencies and explore new opportunities with equal skillfulness.

1.1.1. The rise of ambidexterity research

Research on ambidexterity as an organizational concept has seen a meteoric ascent over the last 10 years (Birkinshaw & Gupta, 2013), it is now viewed as an emerging research paradigm in organizational theory. As such, organizational ambidexterity has taken shape as “a theoretical framework of a scientific school or discipline within which theories, generalizations, and the methods to test them are formulated” (Raisch & Birkinshaw, 2008, p.396) and its genesis is well documented. The purpose of the next section is however not to analyze exhaustively each and every literature stream that has been reported on the subject (e.g., organizational learning, technological innovation, organizational adaptation, strategic management, organization design) but more to account for the main milestones along which the construct evolved and the leading conceptualizations through which organizational ambidexterity can be examined.

March and Simon (1958) posited that organizations can improve their performance by separating units making use of existing successes from those trying to identify new opportunities. Burns and Stalker (1961) argued that “mechanistic management systems” characterized by clear hierarchical relations and well defined responsibilities are more efficient in stable environment whereas less formal “organic systems” perform better in more turbulent conditions. Building on this insight, researchers came to agree that organizations’ structures must be aligned with different strategies and environments (Tushman & O’Reilly, 2002). Thompson (1967) asserted that organizational potency relies on a trade-off between efficiency and flexibility that he characterized as a paradox of administration. He argued that efficiency in existing practices is needed for the organization to maintain its competitive advantage, whereas flexibility is necessary to prevent being trapped into obsolete routines and procedures, a situation often described as organizational inertia (Hannan & Freeman, 1984; Volberda, 1996), organizational simplicity (Miller, 1993) or cultural lock-in (Foster & Kaplan, 2001b). Duncan (1976) was the first to coin the term “Ambidextrous Organization” when he advocated for companies to put in place “dual structures” requiring different time perspectives and management capabilities to accommodate simultaneously the conflicting alignments needed for efficiency and innovation.

In 1991, March who had worked previously on bounded rationality (March, 1978) started to look at the duality between efficiency and flexibility from a learning perspective and noted that the main adaptive challenge companies are facing is the need to exploit existing assets and capabilities while, at the same time, they provide for sufficient exploration to adapt to changes in markets and technologies (March, 1991). Following the same knowledge-based view, Levinthal and March (1993) pointed out “the confusing experience and the complicated problem of balancing the competing goals of developing new knowledge (i.e., exploring) and exploiting current competencies in the face of dynamic tendencies to emphasize one or the other” (p.95). They concluded that organizations approach this problem of tradeoff between “exploitation of old certainties” and “exploration of new possibilities” through simplification and specialization which leads to different forms of “learning myopia” and biases. Two decades after Duncan, Tushman and O’Reilly (1996) picked up on the concept of “dual structures” and emphasized structural separation between activities aiming at managing evolutionary (incremental) change and revolutionary (discontinuous) change in simultaneous fashion. That was the emergence of what is now called *structural* or *simultaneous ambidexterity*.

As an extension of their previous work on technological discontinuities, dominant designs (Anderson & Tushman, 1990) and punctuated equilibrium (Romanelli & Tushman, 1994; Tushman & Romanelli, 1985), Tushman and colleagues described an evolutionary pattern contrary to Darwinian evolution theory in which relatively long periods of incremental change are punctuated by short bursts of intense discontinuous change and they concluded with the need to align organizational strategy, structure and culture on the short-term but also to periodically destroy this alignment in order to adapt to environmental shifts in a sequential process (Tushman & O’Reilly, 1996). Time made its entry and gave birth to the concept of “*sequential ambidexterity*” (Geerts, Blindenbach-Driessen, & Gemmel, 2010), a notion again alluded by O’Reilly and Tushman in 2007 (p.192) and a term they later used explicitly (2013, p.327), whereas other authors referred to it more recently as “sequential alternation” (Birkinshaw, Zimmermann, & Raisch, 2016). In this vein, firms have been described to use “rhythmic switching” (Brown & Eisenhardt, 1997) or to “vacillate” (Boumgarden et al., 2012) back and forth between periods of exploration and periods of exploitation. The rationale behind this argument is that it is easier for firms to switch between different formal structures from time to time than to change their organizational culture. It’s worth noting however that scholars are not unanimous towards the concept of sequential ambidexterity:

Gupta, Smith and Shalley (2006) for instance consider that ambidexterity refers to the *synchronous* pursuit of exploration and exploitation, whereas temporal differentiation, such as punctuated equilibrium, constitutes a radically different mechanism. They are joined in this viewpoint by Boundarden, Nickerson and Zenger (2012) who consider that the static approach in which firms adopt ambidextrous organizational structures to balance exploration and exploitation, and the dynamic approach in which firms sequence structures that target either one or the other, are fundamentally distinct; the former being true organizational ambidexterity and the latter being defined as organizational vacillation. Still, both simultaneous and sequential ambidexterity (or punctuated equilibrium or vacillation) strive at resolving the exploration/exploitation dilemma through structural measures.

Then came the year 2004 which marked another turning point in the conceptualization of organizational ambidexterity with Gibson and Birkinshaw (Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004) when they parted from the existing corpus of structural ambidexterity to introduce the notion of *contextual ambidexterity*, sometimes called “behavioral integration” (Birkinshaw et al., 2016). They argued that a context characterized by a combination of stretch, discipline, support and trust (the four attributes describing organizational context as per Ghoshal and Bartlett (1994)) allows individuals to use their own judgement as to how they divide their time between alignment-oriented and adaptation-oriented activities. Promoting ambidexterity in an organization is no longer only a question of deciding what organizational structure is the most appropriate but becomes also a reflection on how to initiate the right set of stimuli and pressures to motivate people to act in a certain way. It displaces the decision process from a centralized top management team to decentralized sub-units or even to the individual employees themselves. Kauppila (2010) and O’Reilly and Tushman (2013) objected however that, while contextual ambidexterity might well help within a given stable technological regime, it does not consider how to adjust to discontinuous and disruptive environmental changes or to conduct radical forms of exploration or exploitation.

1.1.2. New directions and peculiar conceptualizations

Until the late 90^{ies}, most work on exploration and exploitation had focused essentially on the organization level. About at the same time as scholars started to research the impact of

ambidexterity at the sub-unit and individual levels with the contextual ambidexterity, articles about the inter-organizational level started to flourish. Alliance formation and partnerships can be seen as forms of exploration and exploitation (Park, Chen, & Gallagher, 2002; Rothaermel & Deeds, 2004) in the sense that exploratory alliances provide opportunities to access new knowledge and investigate new market and technologies (Grant & Baden-Fuller, 2004) while exploitative alliances can be used to make the most of complementary resources and leverage existing competencies across organizational boundaries (Lin et al., 2007; Rothaermel & Deeds, 2004). We will refer to this type of ambidextrous approach hereinafter as *network ambidexterity*, also sometimes called *interorganizational ambidexterity* (Kauppila, 2010).

More recently, scholars have started to investigate the importance of leadership characteristics in the management of contradictions and tradeoffs organizations are facing (De Clercq, Thongpapanl, & Dimov, 2014; Lubatkin, Simsek, Ling, & Veiga, 2006; Smith & Tushman, 2005; Tushman & O'Reilly, 2011; Tushman, Smith, & Binns, 2011; Vaccaro, Jansen, van den Bosch, & Volberda, 2012). Burgelman and Grove (2007, p.965, brackets added) asserted that “corporate longevity depends on matching cycles of autonomous [exploration] and induced [exploitation] strategy processes to different forms of strategic dynamics, and that the role of alert strategic leadership is to appropriately balance the induced and autonomous processes”, with ‘strategic leadership’ defined as “how top management designs the strategy-making process” (p.967). Building on this insight, Laplume and Dass (2009) suggested the concept of *adaptive ambidexterity*, which relates to a mixed form of simultaneous ambidexterity and sequential ambidexterity to dynamically adapt the balance of exploration and exploitation to organizational and contextual circumstances over time. More recently, Luger (2014) introduced the same concept under the term *dynamic ambidexterity* which he described as the firm’s ability to align its exploration-exploitation balance over time with the environment’s shifting demands, while constantly maintaining the two activities in order to capture their synergistic qualities. He explained that “while static ambidexterity is focused on operating at a given intermediate point on the exploration-exploitation continuum, dynamic ambidexterity enables the firm to adjust this point in response to changing environmental requirements” (p.33). Tushman *et al.*, in an article explicitly titled “The Ambidextrous CEO” (2011), contended that decisions about the firm’s present and future must be made at the senior-executive level and they propose different approaches to holding the tensions at the top. This perspective highlights the role of senior teams in shaping competitive advantage over time

(O'Reilly & Tushman, 2007). Actually, the ability of senior managers to seize opportunities through integration and coordination of both existing and new assets to overcome inertia and path dependencies is at the core of *dynamic capabilities*, defined as “the firm’s ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece, Pisano, & Shuen, 1999, p.516). This ability of the firm to “synthesize and apply current and acquired knowledge” has also sometimes been referred to as “combinative capabilities” (Kogut & Zander, 1992, p.384) or “architectural competence” (Henderson & Cockburn, 1994). As stressed out by Raisch and his colleagues (2009), organizational ambidexterity implies therefore the managerial challenge not only to balance exploration and exploitation but also to integrate internal and external knowledge. Considering organizational ambidexterity implicitly (Eisenhardt & Martin, 2000) or explicitly (O'Reilly & Tushman, 2007) as a dynamic capability essentially in the hands of the senior management team may help organizations to substitute an external selection environment in which wrong choices lead to firm failure with an internal selection process that allows local failure without the destruction of the whole organization (Burgelman, 2002). It is worth noting however that, while some authors focus primarily on the role of the Top Management Teams (Lubatkin et al., 2006; O'Reilly & Tushman, 2007; Sidhu, Volberda, & Commandeur, 2004; Volberda, Van Den Bosch & Heij, 2013), others like Burgelman and Grove (2007) acknowledge that autonomous processes may also be informal and decentralized and may come about by the efforts of middle-managers seeking to divert resources to new businesses to replace their own obsolescing ones. In short, top management could be regarded as the main driver of discontinuous or radical change, whereas middle management may be expected to enact incremental change (Raisch & Birkinshaw, 2008).

Other peculiar forms or variants of ambidexterity have been reported. Let's just cite a few such as peripatric ambidexterity (a form of punctuated ambidexterity in which the top management or founding team is replaced when the company is changing its focus from exploitation to exploration and vice versa) (Prange & Schlegelmilch, 2009), or reciprocal ambidexterity (a form of structural ambidexterity that assumes a reciprocal interdependence between sub-units performing exploitation and exploration in which the outputs of exploitation from unit A become the inputs for exploration by unit B and vice versa) (Simsek et al., 2009).

These various conceptualization patterns illustrate that organizations are facing very different situations which undoubtedly impact the intensity of exploration and exploitation needed and the way to achieve ambidexterity. For instance, a sequential approach may be more adapted to stable environments (Geerts et al., 2010), whereas simultaneous ambidexterity may be more appropriate in turbulent markets (O'Reilly & Tushman, 2013). Similarly, a contextual approach is presumably well adapted to support and enhance incremental innovation at a local level but might be difficult to manage efficiently while facing disruptive technological changes (O'Reilly & Tushman, 2013). In addition, it seems conspicuous that organizations may actually be implementing different forms of ambidexterity at different levels, i.e. local level, intra-firm level and inter-firm level, concomitantly (Kauppila, 2010).

1.1.3. The ambiguity of the construct and the need to refocus

Despite the fact that most studies on the subject refer to exploitation and exploration, scholars have started to encompass in the ambidexterity framework many different conceptualizations as long as they are related to opposed, polarized and sometimes conflicting capabilities or traits: operational tasks vs. strategic tasks, implementation vs. initiation, evolutionary change vs. revolutionary change, efficiency vs. flexibility to name a few (refer to Table 1.1 for a more complete list). This situation has led to considerable ambiguity regarding the theoretical nature of the construct itself (Cao, Gedajlovic, & Zhang, 2009; O'Reilly & Tushman, 2013); it has contributed to a lack of consistency in theory building (Simsek et al., 2009) and a lack of clarity in meaning and measurement (Birkinshaw & Gupta, 2013).

There is a need therefore to come back to March's very conception of balancing exploration and exploitation to ensure organization's long term viability (Lavie et al., 2010; O'Reilly & Tushman, 2013) and, by doing so, avoid "devolving into a catch-all phrase applied to a smorgasbord of organizational topics" (O'Reilly & Tushman, 2013, p.334).

Table 1.1: Sample of prominent publications and the explorative and exploitative aspects they oppose.

Reference	Year	Exploitative aspect	Explorative aspect	Type of study
Ansoff & Brandenburg, 1971	1971	Operational tasks	Strategic tasks	Conceptual
Duncan, 1976	1976	Implementation	Initiation	Conceptual
March, 1991	1991	Exploitation	Exploration	Theoretical
Tushman & O'Reilly, 1996	1996	Evolutionary change	Revolutionary change	Conceptual
Adler, Goldoftas & Levine, 1999	1999	Efficiency	Flexibility	Empirical
Kogut & Kulatilaka, 2001	2001	Exploitation	Exploration	Conceptual
Katila & Ahuja, 2002	2002	Search depth	Search scope	Empirical
Rothaermel & Deeds, 2004	2004	Exploitation	Exploration	Empirical
Kyriakopoulos & Moorman, 2004	2004	Exploitation	Exploration	Empirical
Gibson & Birkinshaw, 2004	2004	Alignment	Adaptability	Empirical
He & Wong, 2004	2004	Exploitative innovation	Exploratory innovation	Empirical
Sidhu, Volberda & Commandeur, 2004	2004	Local search	Boundary-spanning exploration	Empirical
Chen, 2005	2005	Exploitation	Exploration	Theoretical
Jansen, Van den Bosch & Volberda, 2005	2005	Exploitative innovation	Exploratory innovation	Empirical
Atuahene-Gima, 2005	2005	Competence exploitation	Competence exploration	Empirical
Han, 2005	2005	Pro-profit strategy	Pro-growth strategy	Empirical
Chanal & Mothe, 2005	2005	Exploitation	Exploration	Empirical
Smith & Tushman (2005)	2005	Cognitive integration	Cognitive differentiation	Theoretical
Lavie & Rosenkopf, 2006	2006	Exploitation	Exploration	Empirical
Lubatkin, Simsek, Lin & Veiga, 2006	2006	Exploitation	Exploration	Empirical
Hill & Birkinshaw, 2006	2006	Exploitation	Exploration	Empirical
Jansen, Van den Bosch & Volberda, 2006	2006	Exploitative innovation	Exploratory innovation	Empirical
Bierly & Daly, 2007	2007	Exploitation	Exploration	Empirical
Lin, Yang & Demirkan, 2007	2007	Exploitation	Exploration	Empirical
Tiwana, Bharadwaj & Sambamurthy, 2007	2007	Alignment	Adaptability	Empirical
Andersen & Nielsen, 2007	2007	Centralized strategy processes	Decentralized strategy processes	Empirical
Tarafdar & Gordon, 2007	2007	Operational excellence	Strategic vision	Empirical
Swart & Kinnie, 2007	2007	Exploitative learning	Exploratory learning	Empirical
Burgelman & Grove, 2007	2007	Induced strategy process	Autonomous strategy process	Empirical
Menguc & Auh, 2008	2008	Exploitation	Exploration	Empirical
Jansen, George, Van den Bosch & Volberda, 2008	2008	Exploitation	Exploration	Empirical
Morgan & Berthon, 2008	2008	Exploitation	Exploration	Empirical
Tiwana, 2008	2008	Strong ties	Bridging ties	Empirical
Im & Rai, 2008	2008	Exploitative knowledge sharing	Exploratory knowledge sharing	Empirical
Brion, Mothe & Sabatier, 2008	2008	Exploitative innovation	Exploratory innovation	Empirical
Rothaermel & Alexandre, 2009	2009	Exploitation	Exploration	Empirical
Mom, Van den Bosch & Volberda, 2009	2009	Exploitation	Exploration	Empirical
Jansen, Tempelaar, Van den Bosch & Volberda, 2009	2009	Exploitation	Exploration	Empirical
Cao, Gedajlovic & Zhang, 2009	2009	Exploitation	Exploration	Empirical
Kollmann, Kuckertz & Stöckmann, 2009	2009	Exploitation	Exploration	Theoretical
Prange & Schlegelmilch, 2009	2009	Exploitation	Exploration	Empirical
Kim & Rhee, 2009	2009	Exploitation	Exploration	Empirical
Cao, Simsek & Zhang, 2010	2010	Exploitation	Exploration	Empirical
Tushman, Smith, Wood, Westerman & O'Reilly, 2010	2010	Exploitation	Exploration	Empirical
Laplume & Dass, 2009; Laplume, 2010	2010	Exploitation	Exploration	Empirical
Brion, Mothe & Sabatier, 2010	2010	Short-term organizational focus	Long-term organizational focus	Empirical
O'Reilly & Tushman, 2011	2011	Exploitation	Exploration	Empirical
Patel, Messersmith & Lepak, 2012	2012	Exploitation	Exploration	Empirical
Jansen, Simsek & Cao, 2012	2012	Exploitation	Exploration	Empirical
Fernhaber & Patel, 2012	2012	Exploitation	Exploration	Empirical
Boumgarden, Nickerson & Zenger, 2012	2012	Exploitation	Exploration	Empirical
Voss & Voss, 2012	2012	Exploitation	Exploration	Empirical
Dupouët, Bouzdine-Chameeva & Lackshman, 2013	2013	Exploitation	Exploration	Empirical
Cummings, 2013	2013	Alliances with repeat partners	Alliances with new partners	Empirical
Junni, Sarala, Taras & Tarba, 2013	2013	Exploitation	Exploration	Empirical
Ming, 2014	2014	Exploitation	Exploration	Empirical

1.2. Operationalization of the ambidexterity construct

1.2.1. *Apollo and Dionysus*

Every organization is a bundle of conflicts, oppositions, tensions, counteracting forces, contrasts and contradictions, hence dualities and paradoxes have long been of great interest for organization theorists. Among the numerous ambivalent characteristics of organizations, a central and recurring theme is the importance and difficulty to accommodate with stability and change (Cummings, 2013), with order and chaos (Forgues & Thietart, 1995).

In Greek mythology, Apollo and Dionysus are brothers, both sons of Zeus. For pre-Socratic philosophers Apollo represented measure, reason, rationality, craft and order, whereas Dionysus stood for excess, chaos, the irrational, “the force that gives seminal power to the continuation of life” (Taleb, 2012, p.256). A parallel comes to light with March’s definition of [the Apollonian] exploitation as “refinement, choice, production, efficiency, selection, implementation and execution” contrasting with [the Dionysian] exploration which involves “search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation” (March, 1991, p.71). As a further matter, the concept of “creative destruction”, developed by Karl Marx and Werner Sombart (Reinert & Reinert, 2006) and popularized by Joseph Schumpeter (1942) as a theory of economic innovation and business cycle can be considered either as an antecedent or as a product of exploration (Abernathy & Clark, 1985; Foster & Kaplan, 2001b). It was actually Nietzsche who first coined the term with reference to Dionysus whom he considered “creatively destructive” and “destructively creative” (Nietzsche, 1886; Taleb, 2012, p.256).

Interestingly, ancient Greek culture was not contemplating Apollo and Dionysus as opposites or rivals, at least until the influence of Socrates’ rationalism, but rather as two interlaced and complementary forces. Several authors conceptualize organizational ambidexterity in a similar fashion, considering that exploitation and exploration are not mutually exclusive but additive or multiplicative dimensions by nature (Gibson & Birkinshaw, 2004; He & Wong, 2004; Jansen, Van Den Bosch, & Volberda, 2006; Lubatkin et al., 2006). For these authors, exploration and exploitation are independent activities, orthogonal to each other (Fig. 2.1a). They have both to be maximized and an ambidextrous organization is one that has the capacity to **combine** high levels of the two activities concurrently (Brion et al., 2008; Gupta et al., 2006; Lavie & Rosenkopf, 2006).

To support the argument that exploration and exploitation may not be conflicting dimensions, Gupta *et al.* (2006) indicate for instance that exploration and exploitation may take place in complementing domains, e.g. R&D and marketing, that do not necessarily compete for the same resources. Accordingly, Lavie and Rosenkopf (2006) explain that alliances can be used for exploring and exploiting simultaneously in different domains. Going further than considering that exploration and exploitation may not be necessarily in competition, some authors defend that the two dimensions have actually a positive reinforcing effect on each other, i.e. that “a high degree of exploitative effort can often improve a firm’s effectiveness in exploring new knowledge” and, in an analogous manner, that “proficiency in a firm’s exploratory processes can also enhance its ability to engage in successful exploitation” (Cao, Gedajlovic, & Zhang, 2009, p.784).

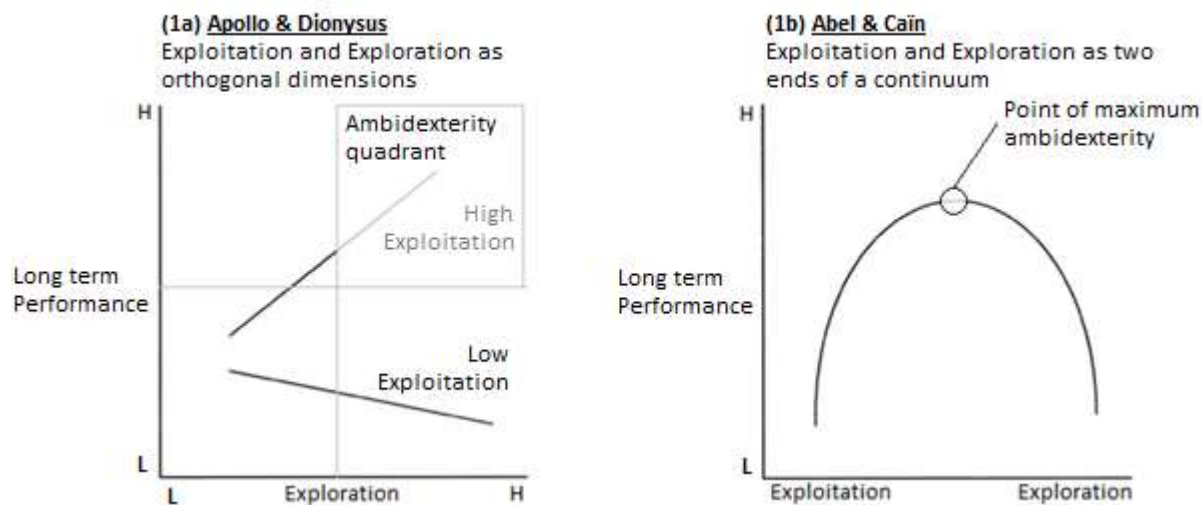


Figure 1.1: The two conceptualizations of Exploration and Exploitation: Opposite orthogonal dimensions versus two ends of a continuum (reproduced from Gupta et al., 2006)

In this view of combining exploration and exploitation, organizational ambidexterity is operationalized either as the sum (Brion et al., 2008; Laplume & Dass, 2009; Lubatkin et al., 2006) or as the product (Gibson & Birkinshaw, 2004; He & Wong, 2004) of the two dimensions (respectively represented by $A + B$ and $A \times B$ in Table 1.2).

Table 1.2 lists several empirical studies and describes, when applicable, the method used to operationalize organizational ambidexterity. Insofar as it is relevant, it seems that multiplying the two dimensions is more often used (15 studies) than adding those (6 studies).

1.2.2. *Abel and Cain*

Other authors however believe that the two dimensions are mutually exclusive (Auh & Menguc, 2005; March, 1991; Simsek, Heavey, Veiga, & Souder, 2009; Smith & Tushman, 2005) in that they compete for the same resources within an organization, i.e. budgets and people, and produce divergent organizational outcomes because the returns from exploration are “systematically less certain, more remote in time and organizationally more distant from the locus of action” than the returns from exploitation (March, 1991, p.73). The mythological metaphor no longer applies and we propose a biblical one with two other brothers, Abel and Cain, sons of Adam and Eve. According to the Book of Genesis, Cain killed his brother out of jealousy because God favored Abel over him.

Following this school of thought, exploration and exploitation stand at the two ends of a continuum (Lavie et al., 2010) and there exists a tradeoff between the two dimensions within organizations which can be modelled as an inverted U-shaped curvilinear relationship with organizational performance (Figure 1.1b) (Laplume & Dass, 2009; Laplume, 2010). Managing this tradeoff accrue to find an appropriate *balance* between exploration and exploitation and a firm is regarded as ambidextrous if it has relatively equal emphasis on both dimensions.

To operationalize this balance, He and Wong (2004) proposed to take the absolute difference between the scores measured separately for exploration and exploitation (symbolized by $|A - B|$ in Table 1.2). Their results showed that the relative imbalance between both dimensions is negatively related to firm performance (evidenced by its sales growth rate). They also concluded that low levels of both exploration and exploitation may not contribute to superior firm performance and that such firms should therefore not be regarded as ambidextrous. Detractors generally oppose to this balancing view the organizational coordination and communication costs involved in balancing the conflicting goals of exploration and exploitation but Cao *et al.* found that seeking for a balance (“Abel & Cain” view) is more beneficial to resource-constrained firms, whereas striving for a

combination (“Apollo & Dionysus” view) improves the performances of firms having a better access to internal and external resources (Cao et al., 2009). These results suggest that managers operating in contexts characterized by scarce resources may benefit from a focus on managing tradeoffs between exploration and exploitation demands instead of trying to maximize one dimension at the expense of the other.

Indeed, when a company’s exploration activity significantly outweighs its exploitation efforts, newly acquired knowledge may not be adequately absorbed and processed through existing knowledge. Similarly, when the level of exploration of a company is much lower than that of exploitation, less new knowledge is brought to the firm which may limit the impact of its exploitation on performance (Cao et al., 2009).

1.2.3. Measuring Exploration and Exploitation

Several methods have been applied to the measure of the two dimensions. Among these, probably the most commonly used consists of questionnaires with Likert scales by which respondents assess by themselves the level of adequacy of the proposed answer with the question asked (Table 1.2). In addition to the question of reliability and accuracy of methods based on self-perception, this approach only allows an instantaneous weighing that does not capture the temporal dynamics of organizational ambidexterity.

Other studies rely on quantitative measurements of different criterias such as the occurrence of keywords, patents (Andriopoulos & Lewis, 2009), new versus existing products or designs (Piao, 2014), or financial indicators (He & Wong, 2004; Junni et al., 2013) such as profit, sales or other return-based performance parameters (return on assets, return on equity, return on investment, return on capital employed). Counting words out of various documents eventually published by the company (e.g. financial statements and announcements) present the problem of selecting the keywords among many synonyms that make the richness of the language and limits the search to one language only even if the company operates in several geographies. As an example, Figure 1.2 shows the variety of words related to exploration and exploitation in only 25 questionnaires published *in extenso* in literature⁹. Moreover, here again, these methods offer a snapshot of the

⁹ See Table 2.4 in Section 2.4.2 for the list of papers.

situation at a given moment in time. The evolution of the parameters measured gives of course an idea of how organizational ambidexterity develops over time but this analysis remains restricted to a few indicators and does not present a comprehensive holistical measure of the matter. Moreover, methods based on financials are generally backward-looking in the sense that these indicators somewhat reflect the situation as a result of past decisions or actions. To circumvent this problem, some authors have used Tobin's Q ratio to capture both short-term and long-term effects of exploration and exploitation (Goossen, Bazzazian, & Phelps, 2012; Junni et al., 2013). The numerator, the market capitalization of the company, comprises all expected future cash flows; whereas the denominator includes the company's asset value. It hypothesizes that the combined market value of the companies on the stock market should be about equal to their replacement costs. The first issue with this ratio is that it is limited to stock-listed companies. The second issue is that the hypothesis holds at the scale of the stock market, for very large numbers of companies. The third issue lies in the fact that assuming that market capitalization incorporates all expected future cash flows relies on the assumption that markets are efficient, a highly controversial and often disputed hypothesis (Shiller, 2003).

A different approach to measuring exploration and exploitation is actually not to measure the two dimensions but to model their evolution with the help of computer simulations (Laplume & Dass, 2009; Lin et al., 2007; Siggelkow & Levinthal, 2003). Powerful as it can be, this approach limits the analysis to the equations used for the simulations, often agent-based models, considering the usual conditions of *ceteris paribus* (i.e. all other things remaining the same) and, here again, assuming that agents behave rationally.

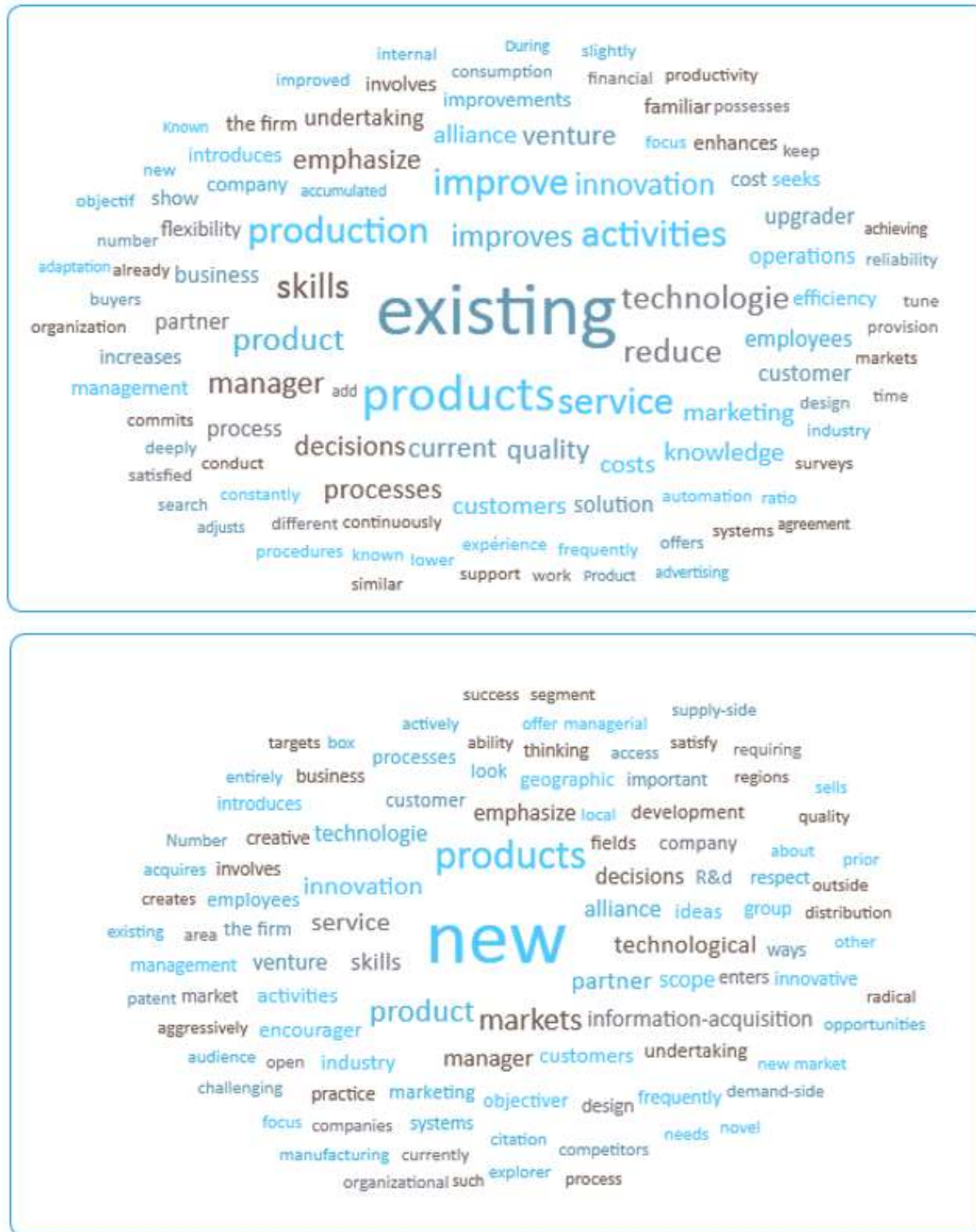


Figure 1.2: Word clouds related to Exploitation (above) and Exploration (below) from the questionnaires of 20 studies published in literature (obtained with Sphinx iQ2 software).

Table 1.2: Empirical studies on explorative and exploitative aspects and the methods used to operationalize organizational ambidexterity

(A and B represent arbitrarily the explorative and the exploitative aspects)

Reference	Level of analysis	Sector	Method	Sample	Measure of Exploitative aspect	Measure of Explorative aspect	Measure of Ambidexterity
Gibson & Birkinshaw, 2004	Business unit	Various	Survey + interviews	41 BLU's from 10 MNC's	Likert-scale items	Likert-scale items	A x B
He & Wong, 2004	Firm	Manufacturing	Survey + interviews	206 firms	Likert-scale items	Likert-scale items	A x B and A-B
Lubatkin, Simsek, Lin & Veiga, 2006	Firm		Survey	139 SME's			A + B
Hill & Birkinshaw, 2006	Corporate venture units		Survey	95 corporate venture units			A x B
Lin, Yang & Demirkan, 2007	Alliance	Various	Archival study + simulation	95 companies in 5 US industr	(1 - Exploration index)	Exploration index = Total of new alliance partners / Total of all alliance partners	A - B
Jansen, George, Van den Bosch & Volberda, 2008	Business unit	Financial services	Survey	89 branches			A x B
Morgan & Berthon, 2008	Firm						A x B
Tiwana, 2008	Alliance		Survey	42 project alliances			A x B
Im & Rai, 2008	Inter-organization		Survey				A x B
Brion, Mothe & Sabatier, 2008	Firm	Various	Survey	307 firms	Likert-scale items (based on He & Wong, 2004; Lubatkin <i>et al.</i> , 2006)	Likert-scale items (based on He & Wong, 2004; Lubatkin <i>et al.</i> , 2006)	A + B
Rothaermel & Alexandre, 2009	Firm						A - B
Mom, Van den Bosch & Volberda, 2009	Individual						A x B
Jansen, Tempelaar, Van den Bosch & Volberda, 2009	Firm						A + B
Cao, Gedajlovic & Zhang, 2009	Firm	High technologies	Survey	122 SME's in China	Likert-scale items	Likert-scale items	A x B and A-B
Cao, Simsek & Zhang, 2010	Firm						A + B
Tushman, Smith, Wood, Westerman & O'Reilly, 2010	Firm & Business unit						A x B
Laplume & Dass, 2009; Laplume, 2010	Firm	n.a.	Simulation	n.a.	Depth of knowledge a firm attains in a given dimension of its knowledge	Number of dimensions in a firm's knowledge structure	A + B
Brion, Mothe & Sabatier, 2010	Firm	Various	Survey + interviews	108 large French firms	Performance management formalization (4-item Likert scale each)	Creativity & risk-taking (4-item Likert scale each)	A x B
Jansen, Simsek & Cao, 2012	Business unit						A x B
Fernhaber & Patel, 2012	Firm						A - B
Boumgarden, Nickerson & Zenger, 2012	Firm & Business unit						A - B
Voss & Voss, 2012	Firm	Non-profit professional	Survey	173 theaters in the US	Product exploitation & Market exploitation (3 items scale for each)	Product exploration & Market exploration (3 items scale for each)	A x B
Cummings, 2013	Alliance	Motion picture industry	Archival study	490 films produced by 285 companies	Film production companies with only repeat partners	Film production companies with only new partners	continuous
Junni, Sarala, Taras & Tarba, 2013	Various	Various	Meta-analysis	17 studies on impact of ER or ET; 52 studies on impact of ER and ET	Various	Various	A x B; A + B; A - B ; continuous
Ming, 2014	Firm	Hard disk drive (HDD) industry	Survey	98 firms	Number of existing designs produced by the firm in a year	Number of new existing designs first introduced by the firm in a year	A x B

1.2.4. Reconciling the brothers or the paradox of Exploration and Exploitation

Organizations make conscious choices to support exploitation or exploration activities by allocating resources, thereby facing tradeoffs as in all cases those resources are finite (Park et al., 2002). By supporting the improvement of existing technologies and current competencies instead of developing new skills and capabilities, organizations achieve immediate reliability at the future risk of becoming outdated (Leonard-Barton, 1992). Likewise, by investing resources in the search of new knowledge at the expense of the upgrade of available knowledge, organizations trade off short-term productivity for long-term survival (March & Simon, 1958). The problem is central as it comes down to “deciding whether the present should be hedged for the future” (Lavie et al., 2010, p.116), but the problem is also delicate as tradeoffs undoubtedly generate tensions, and the effectiveness in managing these tensions impacts the very survival propensity of the whole organization.

Indeed, according to Barnard (1938), few organizations survive among innumerable failures because successful cooperation in organizations is the abnormal condition. The norm in human history, according to him, is faulty cooperation, disorganization, disintegration and the destruction of the organization. In line with this view, Selznick (1957) contends that organizational rivalry may be the most important, perennial problem in organizational life because it threatens the unity of the enterprise. Poor cooperation and ill-managed rivalry may cause the organization’s disbanding.

However, when properly managed, the tradeoffs between exploration and exploitation tend to strengthen the relationship between these activities on the long run despite the tensions they might induce at any given moment in time (Brown & Eisenhardt, 1997). Indeed, as summarized in Figure 1.3, exploitation produces income that can be used to spur future exploration while exploration triggers opportunities that the organization can later exploit to generate a new stream of income (Lavie et al., 2010).

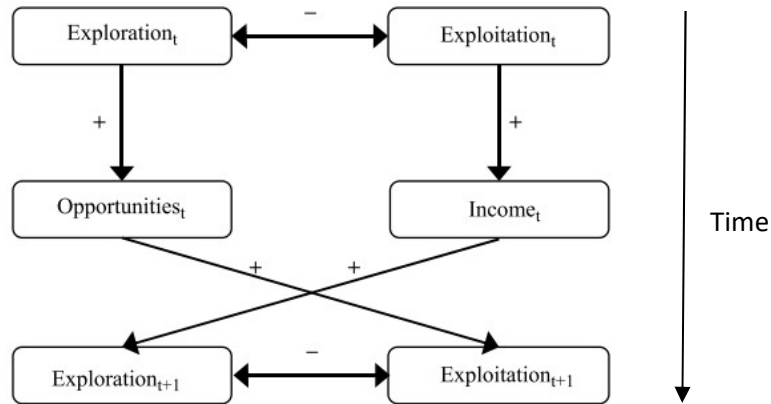


Figure 1.3: The paradox of Exploration and Exploitation competing for resources but stiffening each other over time (reproduced from Lavie et al., 2010, p.117)

Going further than showing a long term synergy between exploration and exploitation, Cao, Gedajlovic and Zhang (2009) showed in their study of 122 China-based small- and medium-sized private high-tech enterprises that **simultaneously combining** the two dimensions **and balancing** them positively impacts firm performance (measured by a mix of sales growth, profit growth, market share growth, operational efficiency, cash flow and market reputation). In other words, there seems to be a synergistic effect from achieving high levels of both balancing and combining exploration and exploitation activities because it provides a greater base for the firm to take advantage of its existing and new competencies, and it brings more opportunities to leverage knowledge and resources across activities.

Hence, as Gupta, Smith and Shalley concluded (2006, p.697): “we do not believe that a universal argument can be made in favor of either continuity or orthogonality. The relationship between exploration and exploitation depends very much on whether the two compete for scarce resources and whether or not the analysis focuses on a single or on multiple domains”. They argued that within a single domain (i.e., one individual or one subsystem), both dimensions are generally mutually exclusive (two ends of a continuum, our “Abel and Caïn” perspective); whereas they are orthogonal (our “Apolo and Dionysus” perspective) across different and loosely coupled domains (i.e., individuals or subsystems) so that high levels of one dimension may coexist with high levels of the other dimension in another domain.

1.3. Organizational ambidexterity and long term survival

“I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor yet riches to men of understanding, nor yet favour to men of skill; but time and chance happeneth to them all.”

Ecclesiastes 9:11
(King James Version)

1.3.1. Organizational ambidexterity and long term survival

A McKinsey study of the life expectancy of firms in the S&P 500 showed that their average lifespan was 90 years in 1935, and that it had dropped to 30 years in 1975. The authors estimated it to be only 15 years by 2005 (Foster & Kaplan, 2001). In a more recent study, one of the same authors predicted that, at the current churn rate, 75% of the S&P 500 firms in 2011 will be replaced in 2027 by new firms entering the index (Foster, 2012). Similarly, the average half time of a business competency has dropped from 30 years in 1984 to 5 years in 2014 (Ismail, Malone, & Van Geest, 2014). In their study of the largest American manufacturing firms of the 20th century, Louca and Mendonca (2002) reported that out of the 266 companies that were existing in 1917, only 28 remained alive by 1997. And, likewise, of the top 100 U.S.-based industrial companies listed in *Fortune* magazine in 1965, only 19 remained in this top ranking in 2005 (Burgelman & Grove, 2007). It is even worse for SMEs whose population changes constantly, with many new businesses being born every year and many ceasing to operate. In particular young and small firms show high mortality rates as they are generally less resilient to crisis, they are more fragile financially with more restrictions to access fundings, and they rely much more on domestic economic growth than do major companies with international operations. Yet, companies who survive the first years of existence are not “off the hook” and their survival remains at risk. During the last financial crisis for instance, the number of firms with 10 to 250 employees has decreased much more sharply in Europe than has the number of large companies, while the number of micro enterprises with less than 10 employees has remained relatively stable (Vetter & Köhler, 2014). Hence, medium-sized companies who have usually passed the first years of existence as micro-enterprises and have succeeded to grow nevertheless endure difficulties to survive on the longer run.

There are many observations of this kind, they support the ecological contention that organizations increasingly endure inertia as they age (Hannan & Freeman, 1984; Winter, 1964), as they suffer from path dependencies (Leonard-Barton, 1992; Teece et al., 1999) and as they become unable to change (Lavie, 2006; Leonard-Barton, 1992; Miller, 1993; Volberda, 1996). Dew and colleagues even came to conclude cynically that “the strategic manager’s job is in fact futile in the face of environmental disruption” (Dew, Goldfarb, & Sarasvathy, 2006).

As noted above, many researchers have attempted to better understand the organizational causes of success and failure, and most of them acknowledged that exploring new avenues *and* exploiting existing competencies is, among other elements, necessary to cope with changes in organizational environment. To cite a few: “Maintaining an appropriate balance between exploration and exploitation is a primary factor in system survival” said March (1991, p.71); “different nonlinear strategic dynamics situations require different balances of induced [exploitation] and autonomous [exploration] strategy processes, and the balanced cycles of these processes are at the heart of corporate longevity” Burgelman and Grove argued (2007, p.967, brackets added); and Levinthal and March (Levinthal & March, 1993, p.105) claimed that “survival requires a balance, and the precise mix of exploitation and exploration that is optimal (...)”. The implicit assumption that organizational ambidexterity is necessary for long-term performance was even referred to by some as the “ambidexterity premise” (Raisch & Birkinshaw, 2008, p.392). These statements became an enduring belief among management scholars but remained largely a normative assumption. Indeed, as Piao observed very recently (2014), this proposition received surprisingly very little scrutiny and has never been really substantiated empirically. As it can be seen from table 1.3 taken as a representative sample of the most prominent empirical studies on the matter, much of the work to date has considered financial performance (profitability, earnings, sales over assets, cash flows), sales performance (sales growth, market share growth) or eventually knowledge and innovation (patents, Tobin Q’s) as dependent variables, but very few publications have looked into longevity implications. Precisely, two publications out of a total of 48 empirical studies in our sample address the subject: Burgelman and Grove’s (2007) and Piao’s (2014).

In her survey of 98 firms in hard disk drive industry (HDD) over a period of 20 years, Piao measured longevity as the number of years firms have remained in the industry until the year of exit, assuming that the exit of a firm corresponds to its dissolution. However, following

Christensen, Suarez, & Utterback (1998) observation that *virtually* all the exits in the HDD had been dissolutions, she neglected the possibility that firms may have voluntarily divested their HDD activities or restructured their portfolio of activities at some point in time. Moreover, she defines the term ‘dissolution’ as “the demise of a company or *part of a company*” (p.214, emphasis is ours), which indicates that exiting the industry does not mean *per se* that the whole company has filed for bankruptcy or has been totally disbanded. There are ample examples of companies that have adapted to environmental change by profoundly re-inventing their business models and are now operating in industries or technologies totally different from the one they began in. IBM, the manufacturer of mechanical office equipment turned into a service and consulting company, is probably the most iconic example of such a revolutionary change. O’Reilly & Tushman (2007) give a non-exhaustive list of 23 of such long-lived companies averaging 105 years of existence that have moved from one industry to a totally different one. This said, Piao findings give support to a positive effect on organizational longevity of a form of skewed ambidexterity in the sense that, according to her, firms need to find the right balance between a high intensity of exploitation and a moderate intensity of exploration in order to benefit from the strong main effects of both dimensions while avoiding overly strong interactions and the tensions a high intensity of both can create.

Burgelman and Grove (2007) take a different approach by combining longitudinal field research and executive experience about Intel Corporation’s evolution over a period of more than 35 years. This somewhat unique approach was made possible as one of the authors, Andrew Grove, hired in 1968 as the third employee of the just-incorporated young company Intel, actively participated in transforming Intel from a start-up firm into a multi-billion dollars giant. He was appointed as Intel’s president in 1979, CEO in 1987 and Chairman and CEO in 1997. This study contributes to reconciling the common view that attributes organization’s long-term success to strategy, with the proposition that leadership style is the main determinant of long-term performance. They argue that “corporate longevity depends on matching cycles of autonomous and induced strategy processes to different forms of strategic dynamics, and that the role of alert strategic leadership is to appropriately balance the induced and autonomous processes throughout these cycles” (p.965). In this proposition, the authors recognize the importance of balancing exploration (equated to

autonomous processes or strategies)¹⁰ and exploitation (assimilated to induced processes or strategies) with regards to environmental changes and especially to “rule-changing” ones (i.e. changes that materially alter the competitive value of existing product-market positions and/or distinctive competences of the players).

1.3.2. The effect of exploitation on long term survival

An increase in exploitation intensity is positively related to financial performance (Lavie et al., 2010). Organizations engaged in exploitation to the exclusion of exploration often generate “returns that are proximate and predictable but not necessarily sustainable” (Raisch & Birkinshaw, 2008, p.392). They endure the risk of being trapped in suboptimal equilibrium (Levinthal & March, 1993), a situation that renders adaptation to change difficult. Indeed, by funneling most available resources and efforts to exploitation, companies seize opportunities in their familiar environments. Because they survived environmental selection, they want to continue abide by the rules (Burgelman & Grove, 2007), search for solutions in the neighborhood of their current knowledge or expertise and become ever more expert in their current domains (Foster and Kaplan’s “cultural lock-in” (Foster & Kaplan, 2001b)). While these competences may lead to competitive advantage and success, at least initially, environmental changes could turn them into competency traps, what Kogut and Kulatilaka (2001, p.754) call “an accumulated learning in old techniques”, or core-rigidities (Leonard-Barton, 1992). Exploitation also drives learning by doing which increases the rigidity of the firm (Kogut & Kulatilaka, 2001). As Miller (1993, p.116) said: “...most organizations lapse into decline precisely because they have developed too sharp an edge. They amplify and extend a single strength or function while neglecting most others. Ultimately, a rich and complex organization becomes excessively *simple* – it turns into a monolithic, narrowly focused version of its former self, converting a formula for success into a path toward failure”. In this situation, information systems and routines reflect only a narrow range of skills and concerns, and the lion’s share of resources is going to one central activity which leads to momentum – the

¹⁰ Burgelman, interviewed by Germain and Lacolley (2010), makes explicitly the link between autonomous and induced strategic processes with exploration and exploitation respectively, but he explains why he considers this link as rather superficial. Nevertheless, he further emphasizes the need for organisations to balance the generation of new opportunities, such as in exploration processes, and the exploitation of existing opportunities, which is the point stressed out here.

tendency to extrapolate previous directions of evolution in strategy and structure (Miller & Friesen, 1984); to convergence – the idea that organizations incrementally refine an existing orientation (Tushman & Romanelli, 1985); and ultimately to organizational inertia – a resistance to changes that runs against a fundamental existing orientation (Hannan & Freeman, 1984).

That said, Piao's empirical findings seem to contradict this well documented conventional wisdom by suggesting that a high exploitation intensity, independent of exploration, actually helps prolong organizational longevity (Piao, 2014).

1.3.3. The effect of exploration on long term survival

Smith (1986) insists upon the fact that organizations necessarily need to undertake experimentation if they want to survive. Experimentation, or exploration, implies shifting away from the organization's current knowledge base towards new technical skills, market expertise, or external alliances (Lavie & Rosenkopf, 2006; Smith & Tushman, 2005), hence allowing learning, diversification of activities and lower exposure to competition, which results in better chances to resist "the gale of change" (Foster & Kaplan, 2001b). Thiéart and Forgues (1995, p.28) further explain that "experimentation with new organizational paradigms permits the development of catalogues of configurations from which the organization will be able to choose when the forces of change are more powerful than organizational viscosity and resistance". Yet, researchers in organizational learning and adaptation cautionary advice against the risk of exploration because, whereas the upside of good decisions may be very high, the downside of bad ones can lead to "major disasters" (Burgelman & Grove, 2007, p.966). Organizations engaged in exploration to the exclusion of exploitation bear the costs of experimentation without gaining the benefits generated by new opportunities (March, 1991), they are trapped into an "endless cycle of failure and unrewarding change" (Levinthal & March, 1993, p.106) with "too many underdeveloped new ideas and too little distinctive competence to sustain their long-term viability" (March, 1991, p.71). In this situation, innovations are replaced by new ideas before they have had the opportunity to contribute to the company's revenues (Junni et al., 2013).

Table 1.3: Empirical studies on explorative and exploitative aspects and the main variables studied

(ER stands for ExploRation and ET for ExploiTation)

Reference	Exploitative aspect	Explorative aspect	Main dependent var. / Main dependent var.	Measure of Dep. Var.	Environmental Dynamism Measure	Effect	Environmental Competitiveness Measure	Effect	Other Indep., Control & Moderating Var.	Length of the study
Adler, Goldoftas & Levine, 1999 Katila & Ahuja, 2002 Rothaermel & Deeds, 2004 Kyriakopoulos & Moorman, 2004 Gibson & Birkinshaw, 2004	Efficiency Search depth Exploitation Exploitation Alignment	Flexibility Search scope Exploration Exploration Adaptability	Performance	Self-assessed with 4-item scale					Performance management, social context, organization context	
He & Wong, 2004	Exploitative innovation	Exploratory innovation	Performance	Sales growth rate	n.a.	n.a.	n.a.	n.a.	Location, level of technology, firm age, firm size, 3 years share of export in turnover	
Sidhu, Volberda & Commandeur, 2004	Local search	Boundary-spanning exploration	Exploration orientation	16 items Likert-scale	3 out of the 4 item instrument from Miller (1987)	Higher environmental dynamism induces stronger ER orientation.	n.a.	n.a.	Organization mission, strategic orientation, technology inflexibility, environment monitoring resources, Organization size	
Jansen, Van den Bosch & Volberda, 2005 Aluahene-Gima, 2005 Han, 2005 Chanal & Mothe, 2005 Lavie & Rosenkopf, 2006 Lubatkin, Simsek, Lin & Veiga, 2006 Hill & Birkinshaw, 2006 Jansen, Van den Bosch & Volberda, 2006	Exploitative innovation Competence exploitation Pro-profit strategy Exploitation Exploitation Exploitation Exploitation Exploitative innovation	Exploratory innovation Competence exploration Pro-growth strategy Exploration Exploration Exploration Exploration Exploratory innovation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a. 11 years
Bierly & Daly, 2007 Lin, Yang & Demirkan, 2007	Exploitation Exploitation	Exploration Exploration	Performance	Net sales / current assets	Volatility of the net sales of all firms in the industry (= standard error of the regression in an slope	Having an uncertain environment but not in a	n.a.	n.a.	Firm size, centrality, structural holes in the network, 8 years network homogeneity, network size	
Tiwana, Bharadwaj & Sambamurthy, 2007 Andersen & Nielsen, 2007 Tarafdar & Gordon, 2007	Alignment Centralized strategy Operational excellence	Adaptability Decentralized strategy Strategic vision								
Swart & Kinnie, 2007 Burgelman & Grove, 2007	Exploitative learning Induced strategy process	Exploratory learning Autonomous process	Corporate longevity	n.a.	"rules of the game" (normative, technological, economic, cognitive)	Cycles of induced and autonomous strategy must be balanced to match different forms of strategic dynamics	n.a.	n.a.	Leadership style	35 years
Menguc & Auh, 2008 Jansen, George, Van den Bosch & Volberda, 2008 Morgan & Berthon, 2008 Tiwana, 2008	Exploitation Exploitation Exploitation Strong ties	Exploration Exploration Exploration Bridging ties								
Im & Rai, 2008 Brion, Mothe & Sabatier, 2008	Exploitative knowledge sharing Exploitative innovation	Exploratory knowledge sharing Exploratory innovation	Exploratory innovation exploitative	Likert-scale items (based on He & Wong, 2004; Lubatkin et al., 2006)	n.a.	n.a.	n.a.	n.a.	Creativity, risk-taking, performance management, n.a. size, sector, level of centralization, externalization of innovation.	
Rothaermel & Alexandre, 2009 Mom, Van den Bosch & Volberda, 2009 Jansen, Tempelaar, Van den Bosch & Volberda Cao, Gedajlovic & Zhang, 2009	Exploitation Exploitation Exploitation Exploitation	Exploration Exploration Exploration Exploration	Performance	Sales growth, profit growth, market share growth, operational efficiency, cash flow and reputation (self-reported by CEO's & CTO's)	Environmental munificence (3-years environmental industry sales growth instability (standard deviation of the sales performance of the same industry)	No effect of environmental munificence on the market impact of Balanced ambidexterity on Combined ambidexterity	n.a.	n.a.	Size, geographic location	1 year
Prange & Schlegelmilch, 2009	Exploitation	Exploration	Marketing strategy implementation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 1.3: Empirical studies on explorative and exploitative aspects and the main variables studied (continued)

Reference	Exploitative aspect		Explorative aspect		Main dependent var.		Environmental Dynamism		Environmental Competitiveness		Other Indep., Control & Moderating Var.	Length of the stud
	Exploitative aspect	Explorative aspect	Main dependent	Measure of Dep. Var.	Measure	Effect	Measure	Effect				
Kim & Rhee, 2009	Exploitation	Exploration	Knowledge	n.a.	Frequency & amplitude of environmental changes	Static negative effect of internal variety.	Dynamic environment: inverted U-shaped effect of internal variety	n.a.	n.a.	Internal variety (turnover rate, horizontal & vertical socialization)	n.a.	
Cao, Simsek & Zhang, 2010 Tushman, Smith, Wood, Westerman & O'Reilly Laplume & Dass, 2009; Laplume, 2010	Exploitation Exploitation	Exploration Exploration	Performance	Sales	Percentage of competence-enhancing and competence-destroying rule changes	More ER is needed in competence-destroying rule changes	Number of producers scanned by buyers in making their purchasing decision	Effect of ER is more pronounced when competitive intensity is high	Boundary conditions (mimicry & transparency)	n.a.		
Brion, Mothe & Sabatier, 2010	Short-term focus	organizational Long-term focus	organizational Innovation ambidexterity	4-item Likert scale for each of Exploitation innovation and Exploration innovation, product of both	n.a.	n.a.	n.a.	n.a.	Competence exploration, competence exploitation	3 years		
O'Reilly & Tushman, 2011	Exploitation	Exploration	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Strategic intent, common identity, reward system, n.a. ability to resolve tensions	n.a.		
Patel, Messersmith & Lepak, 2012 Jansen, Simsek & Cao, 2012 Fernhaber & Patel, 2012 Bounsgarden, Nickerson & Zenger, 2012 Voss & Voss, 2012	Exploitation Exploitation Exploitation Exploitation	Exploration Exploration Exploration Exploration	Ticket revenue per available seat	Total ticket revenue reported divided by theater's annual seating capacity	n.a.	n.a.	Competitive density scores based on IRS Form 990 by city and state	Number of competitors: positive impact on Product & Market ET, no negative impact on average price per seat.	Firm size (lagged firm budget size, number of seats), firm age, marketing expenditures per seat & average price per seat.	3 years		
Dupouët, Bouzidine-Chameeva & Lackshman, 2013 Cummings, 2013	Exploitation	Exploration	Innovation from Information Systems	Cumulated earnings	n.a.	n.a.	n.a.	n.a.	Learning process, real option reasoning	5 years		
Junni, Sarala, Taras & Tarba, 2013	Alliances with partners Exploitation	repeat Alliances with new partners Exploration	Performance	Growth, profit, patents, Tobin's Q (objective & perceptual)	n.a.	n.a.	n.a.	n.a.	Generalists vs. Specialists	n.a.		
Ming, 2014	Exploitation	Exploration	Corporate	Number of years firms	n.a.	n.a.	Density as a proxy for general	No impact on organizational	Form factors, years lapse, leap, nation, age, sales &	20 years		

If a moderate intensity of exploration has a positive impact on longevity, it seems therefore that too much of it puts the organization's long-term survival at jeopardy. Piao's results suggest a curvilinear inverted-U-shaped relationship between the level of exploration and organizational sustainability (Piao, 2014) indicating that an optimum must exist in the amount of exploratory efforts to be exerted in order to extend the organization's lifespan. Kim et al. (Kim & Huh, 2015) confirmed such an inverted U-shaped curvilinear relationship between the extent of exploratory innovation and organizational longevity in their recent analysis of data from the Korean IT industry during a period extending from 1981 to 2011.

1.3.4. The effect of organizational ambidexterity on long term survival

If organizational ambidexterity is the ability of an organization to both explore and exploit (O'Reilly & Tushman, 2013), whatever it is achieved by combining the two activities or by balancing them should have a positive impact on long-term survival since exploitation ensures its current viability, whereas exploration secures its future success (March, 1991). This holds true if the two dimensions do not interfere with each other. Yet, they do compete for scarce resources and for the skills and attention of top management teams. Piao (2014) has shown that the interaction between exploration and exploitation in the same timeframe triggers a partial offsetting effect in the sense that an increase in exploitation intensity weakens, without annihilating completely, the positive effect of exploration on organizational longevity. In her study, exploitation intensity appears to moderate the relationship between exploration and survival, hence her conclusion that firms may need to find the right balance between a *high* intensity of exploitation and a *moderate* intensity of exploration. They should not strive at maximizing both.

1.4. Organizational ambidexterity and environmental dynamism

“The history of life contains long periods of boredom and short periods of terror.”

Stephen Jay Gould

As Anderson and Tushman put it (Anderson & Tushman, 2001, p.676): “organizations are imbedded in their environments, even as they influence those environments, and some environmental conditions must pose much sterner challenges to organizational survival than others do”.

Interactions between organizations and their environment (Starbuck, 1979), especially the relationships between environmental variation and organizational actions (Wholey & Brittain, 1989), have long been an important topic in organization theory and strategic management. The causal relation between a firm and its environment is not assumed to be unidirectional (Volberda, 1996). This assertion is at the core of the co-evolutionary perspective which emerges as an important organizing framework (Sidhu et al., 2004). This framework considers that organizations and their environments co-evolve through multidirectional influences within and between organizations, their environment and the other interacting organizational populations (Lewin & Volberda, 1999; Volberda & Lewin, 2003). It focuses on the juncture between managerial efforts and selection pressures imposed by the environment. This approach differs from previous theoretical frameworks such as strategic-choice theory (Child, 1997), which is essentially centered on managerial intentions in adaptation processes at the level of the firm; or organization ecology theories (Hannan & Freeman, 1977), whose focus is on variation-selection-retention processes at the population-level with no regards for managerial intent.

But, what characterizes the organization’s environment? Aldrich (1979) proposed six environmental dimensions that Dess and Beard (1984) formalized for profit-making organizations in a more parsimonious set of three main characteristics: *munificence* (Aldrich’s capacity of the environment to provide the resources needed to sustain growth), *dynamism* (combining Aldrich’s stability vs. instability and turbulence) and *complexity* (Aldrich’s homogeneity vs. heterogeneity and concentration vs. dispersion).

Focusing on organizational environments’ stability patterns, Farjoun (2007) distinguished two polar types of industry contexts: an *evolutionary context* where the environment is stable; and

a *perpetual change context* in which the environment changes continuously. He also considered two intermediate and integrative contexts: a *punctuated equilibrium* where stable periods alternate with periods of flux and exogenous discontinuity; and a *differential change context* characterized by the coexistence of continuity and change triggered either by exogenous sources or by rapid intense rivalry.

In their attempts to conceptualize and measure changes in organizational environments, Wholey and Brittain (1989) decomposed environmental dynamism, that they equated with environmental “variation”, “instability” or “volatility” (p.867, p. 869), into three components: the *frequency* of environmental change indicates whether the time between changes is short (fine-grained) or long (coarse-grained); the *amplitude* measures the distance between the environmental state before and after the change; and the *predictability* which is the portion of change that can be foreseen and which appears to be inversely related to the degree of unanticipated variability in frequency and amplitude (Kim & Rhee, 2009). Surprisingly, some authors (Kim & Rhee, 2009; Suarez & Oliva, 2005) withdrew predictability from their models even though studies have revealed that it is precisely the key environmental dimension associated with organizational mortality. Indeed, a longitudinal comparative study of the American cement industry from 1888 to 1980 and the minicomputer industry from 1958 till 1982 (Anderson & Tushman, 2001) has showed that, when controlling for ecological and macroeconomic conditions, exit rates are strongly associated with uncertainty but not to complexity or munificence. This study revealed two kinds of uncertainty creating hazardous environmental conditions: unpredictable changes in demand on the one hand, and technological discontinuities on the other hand.

Contrary to the authors who disregarded the level of environmental predictability, Lavie *et al.* (2010) differentiated *environmental dynamism*, which presumes a certain degree of predictability, from *exogenous shocks*, which refer to “sudden and unexpected environmental jolts beyond the control of any organization” (p.119). Meyer (1982, p.515) defines those “jolts” as “transient perturbations whose occurrences are difficult to foresee and whose impacts on organizations are disruptive and potentially inimical” (figure 1.4). Burgelman, on his side, differentiates “continuities”, which are patterns that extend for a long time, from “contingencies”, which are events that do not form a pattern and hence are “unexpected good luck or bad luck events” (Burgelman, 2015, p.9).

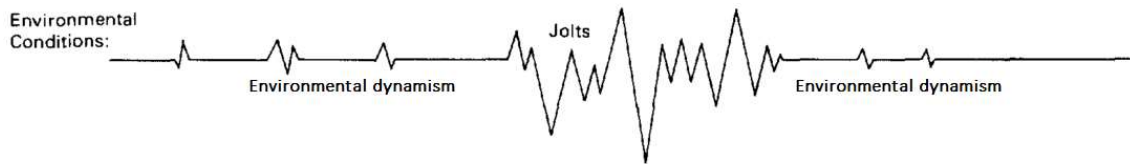


Figure 1.4: Schematic representation of environmental dynamism versus exogenous shocks or jolts
(adapted from Meyer, 1982, p.534)

This differentiation between continuous, incremental change (referred to as first-order change by Meyer *et al.*, 1990) and discontinuous, radical change (referred to as second-order) has been applied to almost all levels of analysis by organizational scholars: industry (evolution vs. revolution: Schumpeter, 1942), organizations (adaptation vs. metamorphosis: Miller & Friesen, 1984), technology (competence-enhancing vs. competence-destroying changes: Tushman & Anderson, 1986), and even at the individual level (single-loop and double-loop learning: Argyris & Schön, 1978). However, as stressed out by Meyer and colleagues, first-order change has received considerably more attention than second-order change in the field of strategic management (Meyer, Brooks, & Goes, 1990). Table 1.4 compares different aspects of both dimensions.

Several academics have claimed that the level of dynamism and competitiveness in an organization's environment may be an important boundary condition for organizational ambidexterity (Gibson & Birkinshaw, 2004; Levinthal & March, 1993), and the binary concept of exploration and exploitation has recently come to prominence in research about organizational adaptation to environmental changes (Gupta *et al.*, 2006). However, as observed by Lavie and colleagues (Lavie *et al.*, 2010), empirical evidence on the environmental antecedents of exploration and exploitation has been scarce with more attention centered on the organizational factors that spur propensity to explore instead of exploit. A similar observation was made by Sidhu *et al.* (Sidhu, Commandeur, & Volberda, 2007) when they were saying that "scholars have thus far excluded environment from the analysis when inquiring into the effect of exploration-exploitation (...), assuming the effect to be invariant across different dynamism levels" (p.24).

Nonetheless, despite this relative paucity, we summarize hereafter the main reported findings, sometimes contradictory, that describe the complex relationships between organizational

ambidexterity and each of the two uncertainty-related environmental dimension, i.e. dynamism and exogenous shocks.

	Environmental Dynamism	Exogeneous Shocks
Form of change	Incremental evolution First-order change (Meyer <i>et al.</i> , 1990)	Punctuated discontinuities Second-order change (Meyer <i>et al.</i> , 1990)
Level of uncertainty	(relatively) <u>Low</u>	<u>High</u>
Categories	"Clear enough future" & "Alternate future" (Courtney <i>et al.</i> , 1997) "Variation" & "Foreseen uncertainty" (De Meyer <i>et al.</i> , 2002) "Known unknowns" (Hillson, 2004) "White swans" (Taleb, 2007)	"A range of futures" & "True ambiguity" (Courtney <i>et al.</i> , 1997) "Unforeseen uncertainty" & "Chaos" (De Meyer <i>et al.</i> , 2002) "Unknown unknowns" (Hillson, 2004) "Black swans" (Taleb, 2007)
Examples of antecedents	Globalization & interconnectedness (Friedman, 2005) Competitive intensity (Volberda, 1996) Costs fluctuations (raw materials, utilities, currencies, labor) & speculation Market trends (variations in customer's demand and supplier's offer) (Jansen <i>et al.</i> , 2006) Change of capitalistic paradigm (power shift from managers to shareholders)	Crises (financial, economic, political) and resulting measures (e.g. credit crunch) (Schmitt <i>et al.</i> , 2010) "Disruptive technologies" (Christensen, 1998) "Creative destruction" (Schumpeter, 1934) Changes in normative & regulatory framework

Table 1.4: Forms of changes and examples of antecedents

(Courtney, Kirkland, & Viguerie, 1997; De Meyer, Loch, & Pich, 2002; Friedman, 2005; Hillson, 2004; Jansen *et al.*, 2006; Meyer *et al.*, 1990; Schmitt, Probst, & Tushman, 2010; Schumpeter, 1934; Taleb, 2007; Volberda, 1996)

1.4.1. Environmental dynamism

Environmental dynamism encompasses, among others, changes in technologies, variations in customer preferences, fluctuations in product demand or supply of materials (Jansen *et al.*, 2006; Lavie *et al.*, 2010), and globalization (Friedman, 2005)(Table 1.4). In addition to simple fluctuations, these progressive changes are driven by large, social, political, environmental (in the ecological sense) or technological underlying trends sometimes called “megatrends” which are generally slow to form¹¹.

¹¹ The consulting and research firm Frost & Sullivan has listed the following megatrends as World’s top global ones to 2020: urbanization; smart cities; generation Y; women empowerment; rise of middle class (especially in

Some authors (e.g., Jansen et al., 2006) make a difference between environmental dynamism (the rate of change and the degree of instability of the environment) and environmental competitiveness (the extent to which external environment is characterized by intense competition), but we consider here that the latter constitutes actually a component of the former in the fact that competition intensity impacts the degree of instability of the environment. This simplification allows us to concentrate our survey on the central subject of this dissertation: the context of growing uncertainty.

The changes may impact the organization in a direct way (e.g., by adapting pricing policy or shifting sourcing patterns) as well as indirectly through learning (March, 1991) and experience (Tushman & Romanelli, 1985) by modifying the strength and the nature of the relationships between organizational and environmental variables (Forgues & Thietart, 1995). In our eyes, *environmental dynamism* leads to the two first types of uncertainty postulated by De Meyer *et al.* and highlighted in the introductory part of this dissertation (see section 1.2.2.), i.e. “variation” and “foreseen uncertainty”, respectively (De Meyer, Loch, & Pich, 2002).

Dynamic environments accelerate the obsolescence of products (Jansen, Van Den Bosch, & Volberda, 2005) and hence induce the need for organizations to innovate by developing new ones. Sidhu *et al.* (2004) found that environmental dynamism leads to expanded search for information in order to reduce managerial uncertainty, and Keller and Weibler (2014) showed that environmental dynamism is positively related to engagement in exploration. These empirical results tend to support the assertion that turbulent environments favor organizations forms that are quick at taking advantage from “new opportunities and the appearance of new habitats” (Hannan & Freeman, 1984, p.163). By experimenting with different types of

China and India); reverse brain drain (highly educated and skilled workers from countries like China and India going back to their homeland); next game changers (the N11, next big emerging markets after the BRIC countries: Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, Philippines, South Korea, Turkey and Vietnam); future outsourcing hotspots (not defined by labour cost or productivity but by specialization in niche areas like business analytics, software application development...); future Fortune Global 500 (an anticipated 30% increase in the number of Asian companies signaling a shift of economic power); new trade zones; satellite technology; virtual world; robotics; future consumer electronics; geo-socialization (next level of social networking); wireless intelligence; future broadband technologies; next emerging technologies (nanomaterials, flexible electronics, SMART materials...); global power generation; zero emission technologies; E-mobility; infrastructure development (emerging transporting corridors leading to mushrooming economic and technology clusters along these corridors); new business models (personalization, car sharing, “pay by the hour”...); and SMART factory (fully automated).

[http://www.bar-orijan.com/Portals/0/mega%20trands%20exec%20summary%20v3%20\(1\).pdf](http://www.bar-orijan.com/Portals/0/mega%20trands%20exec%20summary%20v3%20(1).pdf)

innovations, these organizations create a “catalogue of responses to different and, as yet, unknown demands from the competitive environment” (Forgues & Thietart, 1995, p.23).

In addition to promoting the engagement in exploration, environmental dynamism has been found to also impact the efficiency of the exploration initiatives by moderating positively the relationship between exploratory innovation and financial performance (Jansen et al., 2006). In other words, organizations pursuing exploration in dynamic environments see their financial performance improve, whereas organizations focusing predominantly on exploiting existing products, services and markets in such changing environmental conditions are likely to witness a decrease of their financial performances (Jansen et al., 2006). Refining this empirical observation with an agent-based simulation model, Kim and Rhee (Kim & Rhee, 2009) predict that “exploitative orientation would perform better when the environment changes with low frequency and small amplitude” (p. 15) and that “exploratory orientation would perform better when the environment changes either with low frequency and large amplitude or with high frequency and small amplitude” (p.16).

Thus, in peaceful times of relative stability, companies may either opt to exploit niche markets or to explore new lines of business (Lewin, Long, & Carroll, 1999) and benefit from adaptive learning (Cyert & March, 1963), but they should instil more exploration as environmental dynamism increases, and by doing so, strive for more balance between exploration and exploitation. The more dynamically competitive the environment, the more organizations may have to pursue both activities simultaneously and become more ambidextrous (Auh & Menguc, 2005; Jansen et al., 2006, 2005; Raisch & Birkinshaw, 2008).

Following the line of thinking and empirical results presented hereabove, we can expect that infrequent environmental changes with substantial amplitude (a situation that corresponds to Tushman and Anderson’s (1986) punctuated equilibrium), or even more chaotic situations owing to exogenous shocks, equally call for ambidextrous capabilities to be developed. This is the question that we address in the next section.

1.4.2. Exogenous shocks

Exogenous shocks cover most likely deregulation, technological breakthroughs (more disruptive or frame-breaking than simple changes) and crises (Meyer et al., 1990; Schmitt et al., 2010)(Table 4). They force organizations to move from one dynamic state to the other through

a discrete bifurcation process (Forgues & Thietart, 1995), consistent with the quantum change theory of Miller and Friesen (1984), Greiner's revolution stages of crisis (Greiner, 1972, 1998), and Mintzberg and Waters' researches (1985). *Exogenous shocks* generate the two last types of uncertainty postulated by De Meyer *et al.* and highlighted in the introductory part of this dissertation, i.e. "unforeseen uncertainty" and "chaos", respectively (De Meyer *et al.*, 2002). In addition to being causes of uncertainty, these sources of change are destabilizing, they are sources of instability and internal disorder as "they create demands which are not necessarily consistent with the planned objectives" (Forgues & Thietart, 1995, p.28). At the same time, "the forces of change favor, paradoxically, the emergence of a new form of order and stability. (...) Disorder gives an opportunity to explore new ways of doing and acting" (*opcit.*, p.28). As Schmitt and colleagues (2010, p.133) put it: "crisis conditions function as an amplifier of the existing trade-offs between the two orientations", exploration and exploitation.

The idea of organizational ambidexterity was initially conceptualized by Duncan (1976) as alternating sequences of organic and mechanistic structures. Mechanistic structures support routine operations, functionalization and formal duties (Lavie *et al.*, 2010), therefore being ideal to entail exploitation, whereas organic structures are much less rigid, hence facilitating search for new knowledge and exploration (Burns & Stalker, 1961). Such a temporal sequencing is probably well adapted to rather stable environmental conditions because organizations have time to manage the shifts and benefit from adaptive learning (Cyert & March, 1963), but this approach seems inappropriate under situations of swift and uncertain environmental change (Schmitt *et al.*, 2010).

According to Tushman and O'Reilly (Tushman & O'Reilly, 1996), an environmental context of punctuated discontinuities is best dealt with by separating spatially the exploration and exploitation activities (the concept of structural ambidexterity introduced in section 1.2.2. above). Conversely, Jansen *et al.* (2005) observed that organizations operating in highly dynamic competitive environments rely mostly on contextual ambidexterity instead of instating structural separation between units.

As observed by Raisch and Birkinshaw (2008), except these references, very few studies have formally considered environmental influence on the structural, contextual and leadership-related antecedents of organizational ambidexterity. Another exception comes though with Schmitt, Probst and Tushman (2010) who studied organizational behavior in times of economic crisis by discussing the case of Samsung Electronics, a company that experienced high growth

and successful diversification for many years before to be disrupted by the Asian economic crisis in November 1997. Contrary to other Korean companies which suffered dramatically from the turbulent economic conditions of the time, Samsung Electronics navigated the crisis successfully and even managed to become a global company during this period. Here again they noted the scarcity of literature on this subject and the contradictory empirical evidence of a positive relationship between ambidexterity and environmental hostility considering moreover that “whether and how exploitation and exploration emerge in an economic crisis have been inadequately addressed” (p.130). They however argued, on the basis of their analysis of the Samsung case, that structural separation has a positive impact on the the pursuit of exploration and exploitation activities during economic crises because separation “allows cross-fertilization between units and prevents cross-contamination” and “evades the impending threat of having to sacrifice efficiency for innovative activities and vice versa” (p.143). Conversely, Khanagha, Volberda and Oshri (2014) showed, in their longitudinal study of a large corporation’s transition to a new business model triggered by a major transformation in the ICT industry (i.e. the advent of Cloud computing), that there is “a need for recursive iterations between different modes of separated and integrated structures” (p.322) and hence that structural or spatial separation alone was not the optimal approach when facing such a “business model disruption” (p.324).

As a conclusion, changing environmental conditions call for pursuing organizational ambidexterity but the amplitude, the frequency and, most of all, the level of uncertainty of these variations impact the way organizational ambidexterity should be implemented. While the literature does reveal empirically a moderating effect of environmental factors on the ambidexterity-performance linkage (Raisch & Birkinshaw, 2008), we have still little knowledge on the organizational *mechanisms* by which those exploratory and exploitative practices ease or hinder organizational adaptation to environmental contingencies (Kim & Rhee, 2009).

This said, organizations are open systems, they evolve in environments which have their own dynamics and with which a continuous exchange of information, resources and energy takes place (Thompson, 1967). Consequently, they are not all equally affected by environmental changes. Moreover, disruptions have some idiosyncratic characteristics that pose unusual challenges for established firms (Khanagha et al., 2014). Some organizations may suffer more than others which have better capabilities to generate sufficient slack resources (financial and human) during the implementation of responses to discontinuities. We can therefore assume

that size matters in these circumstances. This is precisely the reason why we are particularly interested to look at the possibility for smaller players to put ambidexterity into practice. We focus on this part of the extant literature in the following chapter.

1.5. Organizational ambidexterity and medium-sized firms

As indicated in the introductory section of this dissertation, small and medium-sized enterprises (SMEs) represent a vital component for most economies. Despite this, they have been largely overlooked by management scholars, partially because data are not public and hence not readily available (Lubatkin et al., 2006). The extant literature on organizational ambidexterity has rather focused on larger firms which generally compete with different businesses in multiple markets.

Yet, medium-sized enterprises make ideal units of analysis in research on organizational ambidexterity because they allow for a “fine-grained examination of exploitation and exploration” (Voss & Voss, 2013, p.3). Like larger firms, they “generally face the kind of competitive pressures to jointly pursue exploitation and exploration” but they “lack the amount of slack resources and the kind of hierarchical administrative systems that can help or impede larger firms in managing their contradictory knowledge processes and, thus, affect the attainment of ambidexterity” (Lubatkin, Simsek, Ling, & Veiga, 2006, p.647). Large organizations can run multiple experiments without jeopardizing their survival, even in case of failure. When properly managed, they have the possibility to reproduce internally the variation-selection-retention processes of markets (Burgelman, 1991). They also often have financial resources allowing to eventually acquire new businesses and, by then, internalize new knowledge. Smaller organizations, conversely, have to place life-or-death bets on single or very few experiments (O’Reilly, Harreld, & Tushman, 2009) which makes them more fragile towards environmental changes and more exposed to the consequences of wrong strategic decisions.

The size of organizations may therefore provide a survival advantage, and it is important to study how firms which do not have the luxury of the size, i.e. the SMEs, can do to implement organizational ambidexterity in order to make them “better able to attain and sustain their advantages in the marketplace” and “more able to shield their future cash flows from external

selection pressures” (Lubatkin et al., 2006, p.653). Indeed, these authors’ empirical study of 139 North-American SMEs employing 20 to 500 individuals supports the hypothesis that the extent to which SMEs pursue an ambidextrous orientation is positively related with their subsequent relative performance measured by comparing the firm’s performance to that of their major competitors on profitability and growth. Digging further in the way SMEs put ambidexterity into practice, Cao *et al.* (2009) showed that balancing exploration and exploitation (our “Abel & Caïn” view described in section 1.3.2.) is more beneficial in terms of financial and commercial performance to resource-constrained firms, whereas a combination of the two dimensions of ambidexterity (our “Appollo & Dionysus view described in section 1.3.1.) is better for firms having greater access to internal and/or external resources.

Other voices however contented that small firms benefit more from a strategy focusing on either flexibility or efficiency, but not on an ambidextrous approach of both, and that none of these strategies outperform the other, implying that efficiency and flexibility strategies may be equally effective (Ebben & Johnson, 2005). These results have later been moderated by arguing that the effectiveness of these strategies may differ across different industry environments, i.e. stable or dynamic (Xie, 2012).

In addition to financial and slack resources, the quality of management, taken in its Penrosian sense (its ability to search for latent opportunities for a full utilization of production factors)(Penrose, 1959), is probably even more important in smaller firms than in larger ones for the implementation of organizational ambidexterity. Indeed, because SMEs have fewer hierarchical levels, their top managers “are much closer to the firm’s operating core” (Lubatkin et al., 2006, p.649), they “play both strategic and operational roles” (p.647), and hence they “experience the added dissonance of competing knowledge demands inherent in the pursuit of an ambidextrous orientation” (p.647). These managers are generally closer to the markets of their companies and therefore more aware of changing trends in customer demands. It has been showed that the level of behavioural integration of the top-management team, i.e. the collaborative behaviour, information exchange and joint decision making between team members, influences positively the extent to which SMEs pursue an ambidextrous orientation, which in turn, as we have seen, influences positively their relative performance (Lubatkin et al., 2006).

As a conclusion, even though several studies report a positive impact of implementing organizational ambidexterity in medium-sized companies, this statement does not yet make

unanimity among the academic community. And, moreover, there remains many open questions about how to orchestrate the allocation of resources between old and new business domains and how to manage the interface between exploration and exploitation (O'Reilly & Tushman, 2013). On the one hand, these questions are probably even more relevant in a context of limited resources characterizing SMEs, while on the other hand, SMEs appear obviously as an appropriate litmus test to study these questions (Lubatkin et al., 2006).

1.6. Summary of the literature review, theoretical gaps and avenues for our research

Research tells us that organizations, if they want to survive, should innovate and prepare for the future while improving efficiency of their current business at the same time. They can meet the challenge of increasingly complex competitive environments by combining exploitation and exploration. Exploitation refers to the leveraging of existing capabilities whereas exploration refers to the acquisition or the development of new ones. Although interrelated, these tasks require different underlying organizational processes, structures, strategies, and cultures. The ability of an organization to conduct both either simultaneously or sequentially is called organizational ambidexterity. Obvious as it may seem in principle, the task is particularly challenging in daily practice as an excess of exploitation may lead to a “success trap” by which the organization streamlines its operations to a point of oversimplification, overrationalization and inertia, whereas an excess of exploration leads to the “failure trap” of too many underdeveloped ideas eating up resources without delivering any outcome (Junni et al., 2013).

The paradox of an organizational ambidexterity potentially conflictual on the short term but allowing higher performance on the long run is a hypothesis generally well accepted (Lavie et al., 2010). It would let companies absorb more effectively the periods of heavy and unpredictable fluctuations in their environment. However, if its positive effect on performance (financial and commercial) and innovation has been shown empirically, it does not hold true for its impact on the longevity of organizations which is one of its founding assumptions.

Nevertheless, our analysis of academic literature allows us to draw some preliminary conclusions of practical interest for managers.

First, it appears that companies have an incentive to maximize as much as possible the two components of ambidexterity, namely the exploration and exploitation, provided they have the necessary financial and human resources ("Apollo & Dionysus"). Otherwise, it is necessary to arbitrate between these two dimensions ("Cain & Abel"). We can therefore consider that an organization is ambidextrous if it is either able to explore and exploit simultaneously, which requires a management able to reconcile the two trends and appease conflicts that may arise, or to oscillate between exploitative phases and exploratory phases, which requires intellectual flexibility and organizational plasticity.

The need to combine exploration and exploitation must however be reflected by decision-makers with regards to the exposure of their organization to the volatility of their environment. Some sectors are less exposed and some business environments are less volatile, they can afford higher emphasis on one dimension or the other (Jansen et al., 2006). Thus, in an environment stable by nature, companies can focus on operations: the risk of failure is low and the cost of ambidexterity is not justified (lower right quadrant of Figure 1.5). In a turbulent environment (volatile and uncertain), companies in sectors with little exposure to changes must open to the outside by exploring new technologies and new business models to prepare for the next disruption which, despite the low exposure, is not less likely to impact it sooner or later (upper left quadrant of Figure 1.5).

Conversely, businesses heavily exposed to a very uncertain environment (such as for example activities with high technological content operating in an international context) will benefit from the implementation of an ambidextrous strategy (upper right quadrant of Figure 1.5). In this case, it seems justified for these organizations to trade part of their short-term productivity against their long-term survival.

Then, it seems that the key to long-term survival in an increasingly changing environment is the ability of enterprises to dynamically adjust the balance between exploration and exploitation in response to contextual changes. To do this, companies have multiple means to operationalize organizational ambidexterity (structural, sequential and contextual measures) but the real world cannot remain complacent with static typologies described in academic literature. In practice, organizational ambidexterity is a complex and evolving process that must adapt dynamically to internal and external factors, most often through the implementation of a mix or a superposition of simultaneous measures, varying in intensity, at different levels of the company and by

regularly changing this mix in response to external stimuli and internal newly acquired capabilities.

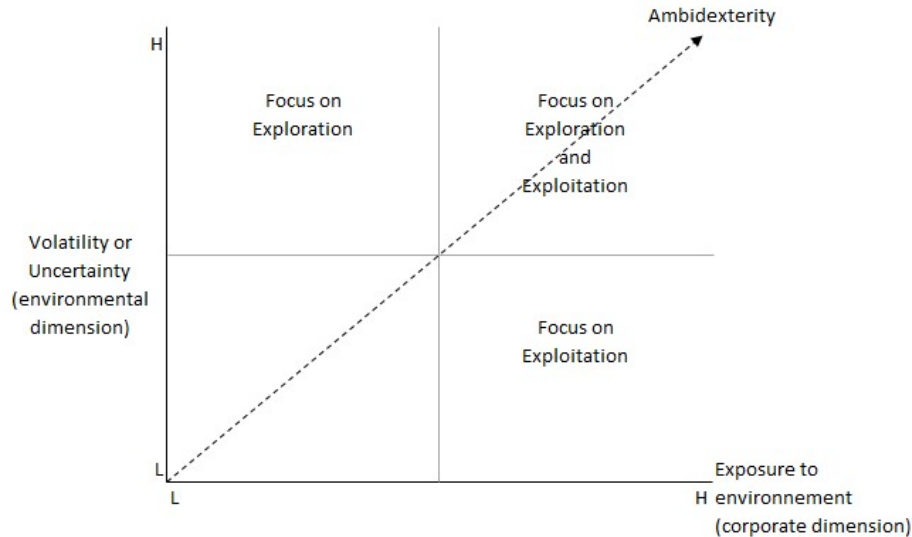


Figure 1.5: Influence of environmental volatility and company exposure to its environment on the Exploration-Exploitation strategy to implement

The question is therefore not only to determine whether organizational ambidexterity impacts favorably firms’ survival in dynamic environments but also, assuming it does, to elucidate *how* smaller firms can effectively implement an ambidextrous orientation. As pointed by Tushman and O’Reilly: “articulating *why* ambidexterity is important is not the same as *how* it is implemented” (Tushman & O’Reilly, 2011, p.18, emphasis is original). Obviously, devising a strategy is the easy part but strategic execution is much more difficult. The same authors explain (p.18) that “in the implementation of an ambidextrous design, execution appears to trump strategy”. Even when the management resolves to explore and exploit, strategic execution requires choices often hard to make to effectively balance these contradictory pressures. The authors claim that “while directionally correct, the research is not granular enough to be of much use to an operating manager (...). To be practically useful, what is needed is greater insight into the specific micromechanisms required for a manager to implement and operate an ambidextrous strategy” (opcit., p.8).

Furthermore, as opposed to research on corporate life cycles, the literature on organizational ambidexterity has generally taken a static approach while it has been shown that firms have to

dynamically adapt to environmental changes and variations in market demands (Tushman & Anderson, 1986). Raisch and Birkinshaw (2008) point the need for new research that investigates “how organizations adapt and develop ambidextrous structures, contexts, and leadership patterns over time to respond to varying boundary conditions” (p.401), and they claim that “such a process perspective requires a methodological shift in organizational ambidexterity research”. While observing that existing empirical studies mainly rely on cross-sectional surveys measuring ambidexterity and environmental conditions with data on manager’s perceptions, they propose (p.402) to “focus on the actual realization of ambidexterity by deploying archival data on exploitative and explorative moves that have been implemented” in order to contribute to the emergence of a process perspective of organizational ambidexterity. Hence, there is a relative consensus among prominent scholars to seek for more qualitative, in-depth studies with a dynamic perspective and following a longitudinal survey design as time helps separate noise from real meaning¹².

In addition, eventhough small and medium-sized enterprises represent a vital component for most economies, they have been largely overlooked by management scholars, partially because data are not public and therefore not readily available (Lubatkin et al., 2006). The extant literature on organizational ambidexterity has rather focused on larger firms which generally have access to more resources to compete with different businesses in multiple markets; there is therefore a need for in-depth researches centred specifically on SMEs.

Hence, if our study aims at providing an empirical verification of the positive effect of different measures on the survival of a medium-sized firm in the form of a testimony describing how this firm has gone through several crisis and challenges; it is our intention, beyond the confirmation of a causal link, to contribute a more detailed understanding of how measures have been practically implemented because the evolution of our economies (globalization, hyper-connectivity...) gradually makes environmental stability disappear and exposes companies to a context of ever greater volatility.

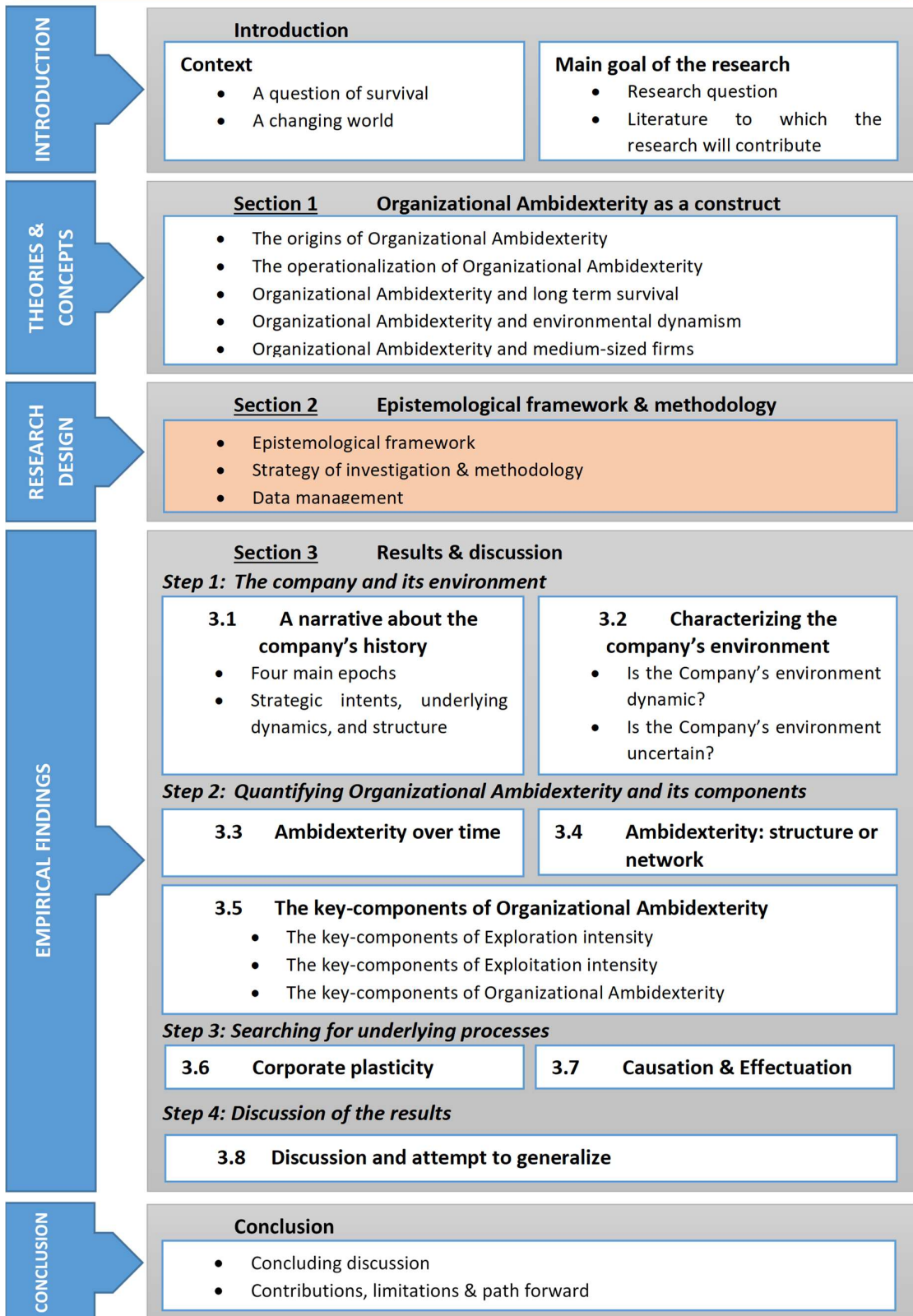
The following section details the design followed for our research before presenting and discussing the results.

¹² As pointed by Taleb (2007a), it explains why the news in the media is full of noise and why history is largely stripped of it.

Section 2. Research design

Thesis defended

Medium-sized companies can operate Organizational Ambidexterity to dynamically adapt to unanticipated environmental changes and hence improve their survival chances



2.1. Epistemological framework

“Much of the world with which we deal is essentially socially constructed. Studying social construction processes implies that we focus more on the means by which organization members go about constructing and understanding their experience and less on the number or frequency of measurable occurrences.”

(Gioia, Corley, & Hamilton, 2013, p.16)

Being practitioner, we want to contribute knowledge of academic value but particularly of practical relevance. Qualitative research is often presented as more favourable than quantitative research to this end (Pratt, 2009), hence the research design selected for our study for which we adopt a critical realist posture and combine both. Following Bhaskar (1978), we defend a realist ontological assumption that posits a world independent of human knowledge but, at the same time, we accept a socially and historically constructed epistemic relativism of knowledge (Mingers, 2002; Mingers, Mutch, & Willcocks, 2013).

Critical realism develops a stratified conception of the world: a real domain composed of generative mechanisms and structures independent from the observable patterns of events, an actual domain in which events occur, and an empirical domain which is the domain of individuals' feelings and interpretations of experienced events. Particularly interesting for our research on how to survive unexpected environmental changes is the conception that generative mechanisms and social structures have an emergent power which manifests or not precisely depending on the contextual conditions. This notion stems from Bashkar's idea that social sciences study objects evolving in open systems (Bhaskar, 1978) in which causal explanations is not about the deterministic association of patterns of events but the activation of causal tendencies under certain conditions (Tsoukas, 1989). Therefore, the “Humean” view of causality (“A implies B”) acknowledged by quantitative positivists is reworked by critical realists who express the causal powers of generative mechanisms as “A implies B in context C” (Walsh, 2015), but of course still in a Kantian logical framework (the cause A must logically precede the effect B).

Faithful to our epistemological posture, we are mainly interested in abductively finding explanations for the events observed in order to enrich the current view of the manner in which

the generative mechanisms are activated and the underlying processes put to work with regards to contextual conditions (Avenier & Thomas, 2015). Our study, mostly of abductive explanatory nature, will reflect iterations between theory and data, using the data to identify some new aspects of a dynamic perspective of organizational ambidexterity. The theoretical contribution expected will essentially consist in theory refinement, not to provide law-like rules but to offer heuristic propositions or “solidly-argued grounds upon which to make decisions for intervening in a situation, taking into account the role of the contexts in generative mechanisms’ activation” (opcit. p.89). Aiming at refining existing theory, we follow Glaser and Strauss who consider “theory as a process; that is, as an ever-developing entity, not as a perfected product” (Glaser & Strauss, 1967, p.32).

We acknowledge that the first part of our work is of empirical nature in that we transform nominal values about exploration and exploitation and about contextual events into numerical variables but we do not consider with this that the world can be reduced to these empirically observed and measured numerical data (a classical positivist view of the world). On the contrary, we use this first approach to try to detect similarities in the evolution of the internal (organizational) and external (contextual) parameters and then analyze these convergences in order to abductively derive, in a second analysis grounded in the company’s history, elements of understanding of plausible generative mechanisms or underlying processes supporting organizational ambidexterity. This combination of quantitative and qualitative methods echoes the recommendation of Mingers, Mutch and Willcocks (2013) who claim that critical realism supports mixed-method research strategy (i.e., a variety of methods in the same research study) on the ground that a particular object of research may well have different characteristics.

2.2. Strategy of investigation

2.2.1. Research setting

The research setting is the biotechnology industry, a science-based and market-driven industry. The United Nations in their Convention on Biological Diversity (art. 2)¹³ define biotechnology as "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use". The emergence of biotechnology can be interpreted as a radical process innovation that broke the barriers of entry

¹³ <https://www.cbd.int/convention/articles/default.shtml?a=cbd-02>

of other industries (Rothaermel & Deeds, 2004) such as the pharmaceutical industry (red biotech), the environment and agricultural industry (green biotech) and the chemical industry (white biotech also referred to as industrial biotech). Because it builds on different knowledge base (microbiology and molecular biology) than “conventional” chemical industries, biotechnology can be considered as a competence-destroying innovation (Powell, Koput, & Smith-doerr, 1996).

Although there is no clear official definition of “high technology”, the OECD showed that using research and development intensity¹⁴ as an industry classification indicator is possible¹⁵. Biotechnology is steadily ranking first on this basis since 1973¹⁶ (Table 2.1).

Industry name	Total R&D-intensity (1999, in %)
Biotechnology and Pharmaceuticals	10.46
Aircraft & spacecraft	10.29
Medical, precision & optical instruments	9.69
Radio, television & communication equipment	7.48
Office, accounting & computing machinery	7.21
Electrical machinery & apparatus	3.60
Motor vehicles, trailers & semi-trailers	3.51
Railroad & transport equipment	3.11
Chemical & chemical products	2.85
Machinery & equipment	2.20

Table 2.1: Classification of high technology industries on the basis of their R&D intensities (reproduced from OECD).

Our research is more specifically taking place in the field of industrial biotechnology which is defined as “the application of biotechnology for the industrial processing and production of chemicals, materials and fuels. It includes the practice of using microorganisms or components of micro-organisms like enzymes to generate industrially useful products, substances and chemical building blocks with specific capabilities that conventional petrochemical processes

¹⁴ R&D intensity is generally measured by dividing the R&D expenditures of a company by its sales.

¹⁵ The OECD does not only take the manufacturing but also the usage rate of technology into account.

¹⁶ Note that this classification is subject to an aggregation problem by combining biotechnology and pharmaceuticals as we have just seen that only a part of the biotechnology sector can be directly associated to the pharmaceutical industry (i.e., the red biotechnology).

cannot provide” (KET’s High-Level Expert Group, 2011). This industry is characterized by a large exposure to new (disruptive) technologies, a growing competition from far-eastern countries (China, India), an accelerating speed of development, high entry barriers because of capital intensiveness (large investments) and knowledge intensiveness, long development cycles with specific threats such as a relatively low success rate and a limited lifetime of intellectual property protection measures (patent cliff). Hence, this industry is highly expansive and exposed to a very competitive and dynamic environment.

2.2.2. *Unit of analysis*

The present research relates to medium-sized companies. The first question that arises in this matter is to define what is a *mid-size company*. To do so, we started from what is generally included in the broader category of *small and medium-sized enterprises* (SME) and we observed that there is actually no universally accepted definition of it. This situation reflects the relative nature of “small” and “medium” size classifications, which apply differently to companies in different sectors such as manufacturing, agricultural or services; as well as to companies in different countries or regions with varying economic structures. Indeed, a one thousand workforce company can be seen as relatively big to Western European or American standards while it is considered as relatively small or average in a country like China. Making direct statistical comparison between countries therefore involves many challenges among which the fact that these countries often use different definitions for “SME”. As an example, Table 2.2 compares the different criterias taken into consideration in defining and categorizing SMEs in the United States, the European Union, Australia, and Canada.

In Japan, criteria such as workforce and capital or total amount of investment are used to define SMEs, but even though the same criteria are used, thresholds that apply to each element vary by sector and also by criteria. To illustrate this point, let’s consider the criteria “workforce” and “capital/investment”: a firm in Japan will be considered as an SME if it employs less than 300 persons and has a capital of less than 300 million Yen in manufacturing, construction and transportation sectors, but these upper bounds fall to 100 persons and 100 million Yen in wholesale trade sector, 100 persons and 50 million Yen in services industry, and 50 persons and 50 million Yen in retail trade (United Nations, 2005).

All this shows the difficulty in defining clearly what an SME is and the lack of consensus resulting therefrom. Moreover, size expressed in number of employees, is relative as it results

from criteria such as local productivity but also from managerial choices (e.g. the level of process automation).

But, what makes medium-sized companies important units of analysis? SMEs represent a vital component of most economies as well as important players in the well-being of local and regional communities. In the US in 2006, they accounted for 99.7% of the 6.0 million firms defined as non-farm employers, they employed 50.2% of the 119.9 million nonfarm private sectors workers, and they contributed about 50% of the private non-agricultural GDP (USITC, 2010a). Besides employment and economic activity, SMEs provide another unique contribution to the economy by the role they play in innovation. A study released by SBA Advocacy (US SBA, 2009) demonstrates that small firms produce significantly more patents than large firms and that, according to patent impact metrics, their patents are more important technologically. What's more, SME's appear to be more profit- and cost-efficient than large enterprises in that they produce more innovations for a given amount of R&D expenditures (Vossen, 1998).

The relative importance of this category of enterprises is similar in the European Community with an overwhelming majority (99.8%) of SMEs - some 20.9 million – in the EU-27's non-financial business economy (European Commission, 2011; data of 2008). These companies account for two out of every three jobs (66.7%) and for 58.6% of total value added, with a particularly high relative importance in the southern Member States. The contribution to value added being lower than the contribution to employment suggests inherent characteristics of SMEs such as their inability to benefit from economies of scale and their relatively low level of capital intensity.

The Commission of the European Communities has acknowledged the decisive role of this class of companies for the future prosperity of the EU by placing their needs at the heart of the Lisbon Growth and Jobs Strategy in 2000 and by issuing a “Small Business Act for Europe” in 2008 (Commission of the European Communities, 2008) in which it is stated (p.2) that “In a globally changing landscape characterised by continuous structural changes and enhanced competitive pressures, the role of SMEs in our society has become even more important” and “Vibrant SMEs will make Europe more robust to stand against the uncertainty thrown up in the globalised world of today”.

Yet, despite their ubiquity and their impact on economic development, SMEs tend to be overlooked by management scholars. Instead, extant literature on organizational ambidexterity has tended to focus on larger firms, generally because data are more readily available since

most SMEs are private firms not subject to the disclosure requirements of publicly traded companies (Cao, Gedajlovic, & Zhang, 2009).

Country or Region	Definition				
United States		All manufacturing firms and non-exporting service firms ^a	Exporting service firms ^b		Farms
			Most	High value ^c	
	Number of employees	< 500	< 500	< 500	< 500 ^d
	Annual revenue	Not applicable	≤ \$7 million	≤ \$25 million	≤ \$250,000
European Union	Number of employees	< 250			
	Annual turnover ^e	≤ €50 million (\$61 million ^f)			
	OR Balance sheet total ^g	≤ €43 million (\$52 million ^f)			
Australia	SME (nonfarm) Number of employees	≤ 200 employees			
	SME (farm) Estimated value of operations	A\$22,500–A\$400,000 (\$18,866–\$335,400 ^h)			
Canada	Number of employees	< 250			
	Annual revenue	< C\$50 million (\$48 million ⁱ)			

Sources: USITC, *Small and Medium-sized Enterprises: Overview of Participation in U.S. Exports*, 2010, table 1.1, 1-3; EC, Directorate-General for Enterprise and Industry, *The New SME Definition: User Guide and Model Declaration*, undated, 14 and 16; Government of Australia, Australian Bureau of Statistics, "Definition of Small Business," April 3, 2009; Government of Canada, Industry Canada, "Small Business Quarterly," February 2010; IMF, "Representative Exchange Rates for Selected Currencies," June 1, 2010.

^a Includes exporting and nonexporting manufacturing firms and nonexporting services firms.

^b Selected by the Commission on the basis of size and export potential, and includes wholesale trade services; professional, scientific, and technical services; and finance and insurance services.

^c Computer services was the only sector in this category.

^d This threshold was imposed by USITC staff to partially harmonize definitions across sectors.

^e Annual turnover equals the firm's annual value of income from sales and services less rebates paid; does not include value-added tax or other indirect taxes paid.

^f Based on an exchange rate of US\$1.00 = €0.8227 (as of June 1, 2010).

^g Annual balance sheet total refers to the value of a firm's main assets.

^h Based on an exchange rate of US\$1.00 = A\$1.1926 (as of June 1, 2010).

ⁱ Based on an exchange rate of US\$1.00 = C\$1.0479 (as of June 1, 2010).

Table 2.2: Definitions of SME in the United States, the European Union, Australia, and Canada
(reproduced from USITC, 2010)

In this dissertation, the unit of analysis is a company in an intermediary size level that cannot be considered as a micro-enterprise (also referred to as non-employers enterprise) nor as a very large one. The firm regarded hereto is a company (Galactic SA) incorporated in Belgium and involved in industrial biotechnology which is complying with the European definition of mid-

size companies (less than 250 employees), at least for its local entities, and to the US definition (less than 500 employees) at a group level. It was founded in 1994 with 4 members, now employing about 400 people in 7 different locations on 3 continents, and selling about 100,000 tons of products in 65 different countries. Throughout its history, the company which is still to be considered as a medium-sized enterprise has been confronted with major changes in its environment and has had to survive turbulent times, re-inventing itself in order to develop into a group of companies that includes sole ventures as well as joint ventures with external foreign partners. Figure 2.1 shows the group structure as it was at the time this dissertation was written.

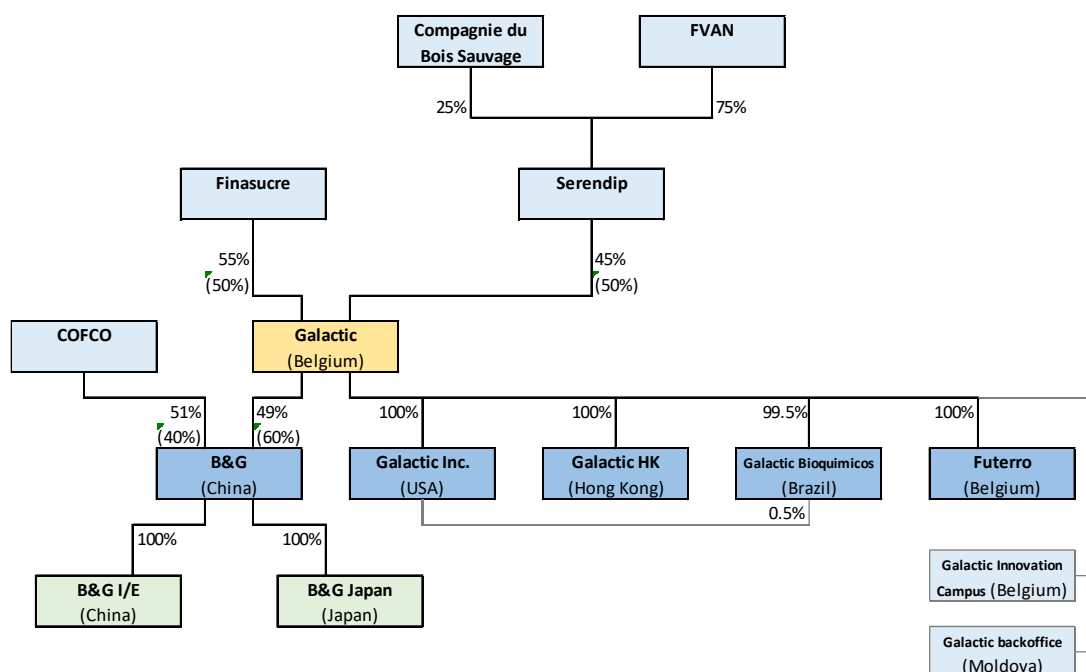


Figure 2.1: Group structure in 2015-2016
 (% of control in brackets; the dotted line rectangles are not fully-incorporated companies but other operational locations)

The chemistry of nature is what inspires Galactic to imagine a world in which chemistry meets nature. Today, this world opens up countless possibilities to replace expensive petrol based solutions with sophisticated alternatives. They are equal in performance to say the least, and far more superior in respect to the environment. Handed to us by nature, Galactic products are completely natural themselves. Therefore they hold a promise for future challenges.

Galactic activities can be divided in three main categories: Natural Solutions, Biopolymers, and Bioprocess Platform.

As a matter of facts, the company is the second largest producer of lactic acid and derivatives with manufacturing units in Europe (Belgium), Asia (joint venture in China) and America (US) and sales offices in Japan, Hong Kong and Brazil. Its products are used in human food, animal nutrition, polymers, pharmaceuticals, cosmetics, paints, inks, agrochemicals and many other applications. Lactic acid is made by fermentation of carbohydrates with the help of microorganisms; therefore part of what is generally referred to as industrial biotechnology or ‘white biotechnology’, a sector of great interest in the current context as it uses renewable (agricultural) resources instead of fossil ones as raw material. The company is therefore positioning itself as a provider of natural solutions to all industries it serves. In order to reduce its exposure to growing competition leading to a commoditization of lactic acid, the company is exploiting its core competencies in fermentation to develop beyond lactic acid with a wider range of natural solutions (proteins, starter cultures and fermentates).

Both the market of lactic acid and the one of natural food protection ingredients, in which Galactic is active, display firm growth thanks to strong drivers such as a growing need for food safety, for healthy and environmentally friendly solutions (in food and non-food segments), and for performing and low-cost-in-use alternatives to existing ingredients and chemicals.

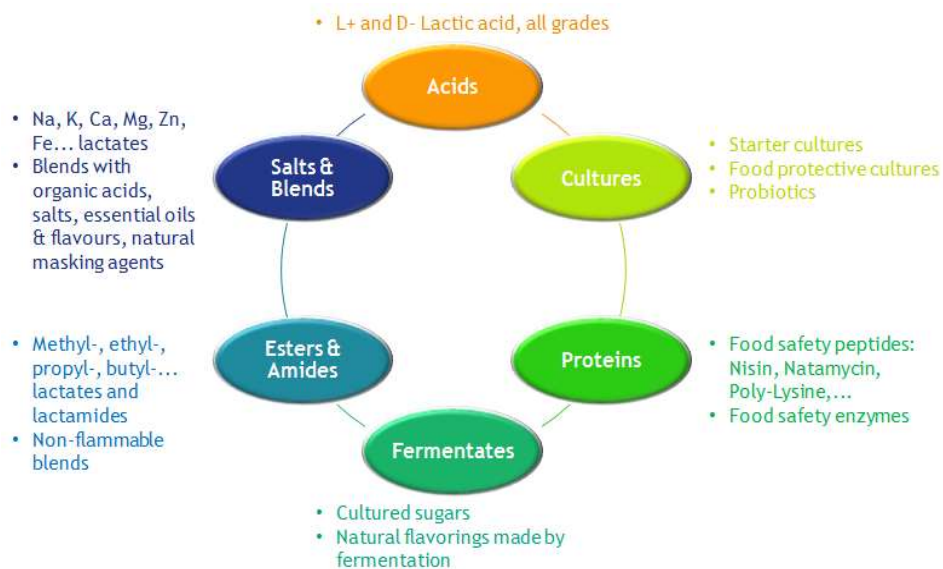


Figure 2.2: Galactic’s current product offering enables value-adding combinations for the food and non-food industries

Galactic also pioneered research and development on PLA (polylactic acid) almost 20 years ago. PLA is a bio-plastic produced from lactic acid. In 2007, Total Petrochemicals recognized the potential of Galactic's technology and the companies decided to enter into joint venture. Futero was set up with the mission to further develop PLA technology and make it robust enough to enable industrialization. Futero's mission is not to become a large scale PLA producer but to focus on R&D and licensing of its technologies. The market of bio-based plastics in general and of PLA in particular is estimated to grow in the coming years, therefore offering a nice opportunity to companies having efficient technologies in this field.

In addition to its production and sales activities, the company is also valuing its R&D by licensing patents and technologies and offering R&D services. Based on its 20 years of expertise in fermentation processes and thanks to a state-of-the-art R&D infrastructure, the company continues to develop a pipeline of technologies among which some are particularly interesting, i.e. bio-succinic acid, bio-propionic acid and bio-acrylic acid. Indeed those chemicals are currently derived from fossil resources, their respective markets are large and growing, and there is a real interest in the industry to have them produced from renewable resources. Since its inception in 1994, Galactic has filed for 34 patent families of which 17 have been licensed out. Besides R&D activities for its own account and licensing out some of its own technologies, the company also provides R&D services such as on-demand fermentation and/or purification campaigns for external companies and incubation of biotech start-ups in its innovation campus.

2.2.3. Longitudinal case study

The purpose of our research is not to determine whether organizational ambidexterity impacts favorably firms' survival in dynamic environments but, assuming it does, to elucidate *how* smaller firms can effectively implement an ambidextrous orientation. As explained before, "articulating *why* ambidexterity is important is not the same as *how* it is implemented" (Tushman & O'Reilly, 2011, p.18, emphasis is original). Our challenge here lies in the identification of generative mechanisms and underlying processes supporting the ambidextrous orientation of a company. According to Sarasvathy and Kotha (2001), that challenge is uniquely met by the case study methodology, and Yin (2009, p.1) tells us that "in general, case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within

some real-life context”. We therefore intend to use our personal position as director in this company since its inception to conduct a longitudinal in-depth case study covering the last 25 years of its existence.

We believe that the analysis over a relatively long period of time allows to highlight an evolutionary dynamic that the study of short time intervals does not allow. This approach should also make it possible to sort relevant information out of the noise information inherent to any human activity¹⁷.

Studying one single organization may limit the generalizability of our findings but, “by concentrating on one organization with 20 years of continuity in leadership, the research could access sources with intimate knowledge of the details of the firm’s evolution and could examine in depth how the organization had dealt with partial failure – and the threat of complete failure – at a critical point in its history” (Burgelman, 1991, p.242). The clear and non-negotiable timeframe of a DBA thesis will help us to overcome the risk of getting trapped in relentlessly developing local knowledge without taking time to carry out the scholarly activity of conceptual generalization (Avenier & Cajaiba, 2012). Moreover, “a longitudinal case study approach not only provides us with the opportunity to look at different stages (...), but also allows us to explore the sequence of events” (Khanagha, Volberda, & Oshri, 2014, p.324) which will be particularly valuable in our case to reflect on the dynamic aspect of the exploitative and exploratory moves that have been implemented by the company studied. We expect nonetheless that our findings will offer “heuristic generalization opportunities for refining our analytical understanding” of the phenomena at play (Tsoukas, 2011, p.295). We intend to extend upward the conceptual generality of the local contextualized knowledge that we will generate by connecting it to extant literature and “examining whether the reviewed literature offers insights that sufficiently illuminate the practical problem to then help practitioners design a promising way to deal with the problem” (Avenier & Cajaiba, 2012, p.203).

¹⁷ Taleb gives a clear example of that by comparing news and history. The news (by essence imbedded in the short term) is full of noise (useless information) whereas history is largely stripped of it (Taleb, 2007a).

2.3. Methodology

To answer our research question, we have adopted a four-steps approach as described hereunder.

Step 1: A narrative about the company history and an analysis of its environment

In line with the recommendations for longitudinal case studies (Thiétart, 2014; Yin, 2009), we started the analysis by reconstructing the timeline of events by writing a narrative tracing the company's history on the basis of various archival sources (see section 3.7. "Data-generation" and Appendix II "The history of Galactic"). In doing so, we follow Burgelman's ecological view of reality who believes that, in contrast to a reductionist approach that isolates variables and looks at relationships between these, historical methods adopt an ecological approach which "examines how individual components interact to become systems whose nature cannot be completely understood from looking only at the sum of the parts" (Burgelman, 2011, p.11).

But, why a narrative?

« Un récit idéal commence par une situation stable qu'une force quelconque vient perturber. Il en résulte un état de déséquilibre ; par l'action d'une force dirigée en sens inverse, l'équilibre est rétabli ; le second équilibre est bien semblable au premier, mais les deux ne sont jamais identiques. Il y a par conséquent deux types d'épisodes dans un récit : ceux qui décrivent un état (d'équilibre ou de déséquilibre) et ceux qui décrivent un passage d'un état à l'autre. »¹⁸

Tzvetan Todorov (1973), *Introduction à la littérature fantastique*, Paris, Seuil.

Dumez (2016, p.129) concludes from this extract that a narrative is the construction of a passage from one equilibrium to another. We have a slightly different reading and we take from the Todorov citation, stretching it a little, that if the description of stable situations may eventually require narratives, describing dynamic changes definitely imposes the use of narratives. The difference between descriptions and narratives lies precisely in the implied influence of time.

¹⁸ "An ideal narrative begins with a stable situation being disturbed by any force. This results in an unbalanced state; by the action of a force directed in opposite direction, the balance is restored; the second equilibrium is similar to the first, but the two are never identical. There are therefore two types of episodes in a narrative: those which describe a state (balanced or unbalanced) and those that describe the passage from one state to another."

Actions and interactions unfold over time and Dumez (2016, p.129, translation is ours) tells us that “the researcher who wants therefore to explain social dynamics, dynamics of interactions between individuals or of institutional development, must go through the narrative. (...) The narrative then has a status of knowledge production, of exploration, a tool to discuss theories”. Following Popper (1956), Dumez adds (2016, p.13, translation is ours) that “we must break with the idea that we should exclude the description and the narration as extra-scientific, literary and subjective forms: qualitative research must describe and tell, and the description and the narration should be considered as scientific and objectifying methods susceptible of criticism”.

In analyzing the key events of the company’s history, we identified four major periods characterized by different strategic intents (see Section 3.1.1 “The four main epochs of the company’s history”) as well as three exogenous variables heavily impacting the company’s day-to-day operations (see Section 3.2 “The company’s environment”). These variables are easily measurable and allow for an objective confirmation of the highly volatile and uncertain nature of the company’s environment even besides unexpected events of accidental nature.

Step 2: Quantifying different components of Organizational ambidexterity

The second step of our methodology was to list the main managerial decisions over a period of 25 years, from 1991 to 2015. To do so, we followed the event listing method prescribed by Miles and Huberman (1994) and also used for instance by Sarasvathy & Kotha (2001) in their study of effectuation in the management of Knightian uncertainty. A set of 410 decisions has been collected from various archival sources (see section 2.4.1 “Data generation”), dated, organized in chronological order and coded (see section 2.4.2 “Code-book design”) in order to measure the different dimensions of organizational ambidexterity. In total, 12 criterias have been identified and measured for each decision listed and 6 compounded indexes have been computed which lead to a first dataset of about 7,400 data covering the 25 year period under scrutiny (see section 2.4.3 “Data analysis”).

In a similar way, 277 contextual events have been recorded, dated and sorted in 8 different categories describing variations in the environment in which the company evolved during this same period of time. Another 3 compounded indexes have then been computed. Altogether, this formed a second dataset of about 3,050 data.

Step 3: Searching for underlying processes

“Not everything that can be counted counts, and not everything that counts can be counted.”

Albert Einstein

The objective of this third step in our approach is to abductively search the manner in which the generative mechanisms and underlying processes of organizational ambidexterity are activated with regards to contextual conditions by triangulating between data from the narrative, the various archival documents gathered and the measurements that emerged from the quantitative analysis of managerial decisions and contextual events.

A case study generally consists of a summary of the case itself (a literary presentation) without *a priori* model (an approach often used in sociology) followed by a largely inductive analysis. We add a systematic analysis of quantitative nature by the coding of documents using a code-book which is based on existing and clearly identified theories (organizational ambidexterity; exploration-exploitation; causation-effectuation). The juxtaposition of qualitative and quantitative modes of analysis intends to combine their discrete advantages, offset their inherent liabilities and, as a consequence, achieve a deeper understanding of how ambidexterity is operated in practice than either method could have produced alone (Meyer, 1982).

Step 4: Discussion and attempt to generalize

The fourth stage of our journey consists to discuss further our findings in order to identify the elements specific to our research unit and its own environment on the one side, and to draw generalizable elements on the other side.

2.4. Data

2.4.1. Data collection

Our research relied on various archival sources such as minutes of management meetings, minutes of board meetings, internal memos, press releases, announcements, communications to unions and staff members, e-mails etc... Table 2.3 presents an overview of these data sources.

Document type	Number of Documents
Information from competitors	342
Business notes, memos, presentations & reports	294
Management meetings (minutes & material)	185
Board meetings (minutes, decisions & material)	108
Periodic information to the Works Council (since 2012)	59
Press articles, press releases & announcements	59
Minutes of Works Council meetings (since 2012)	21
Information from shareholders	18
Licensing agreements, joint-venture agreements	16
Conferences material, general presentations	11
Grant files & reports	5
Total number of documents	1118

Table 2.3: The archival sources of data used in our research

A list of 410 major actions or decisions taken by the company all along its 25 years of history has been established on the basis of the analysis of the various documents listed above. Figure 2.3 shows the evolution of the number of observations (actions, decisions) recorded for each year of the period covered by the study¹⁹.

The exponential growth of actions/decisions per year reflects the development of the company and its transformation from a very small entity with a few employees to an international organization with about 400 staff members in six locations on three continents. We could however also argue that our data set is richer in the last years and poorer in the earlier years of the period covered because older documents were harder to retrieve. To circumvent this problem and to be able to compare data from different years, we averaged the measures for each year (see section 3.9 “Data analysis” for more details).

¹⁹ The year 2010 was apparently particularly rich in documents mainly because of a high number of patents filed this year.

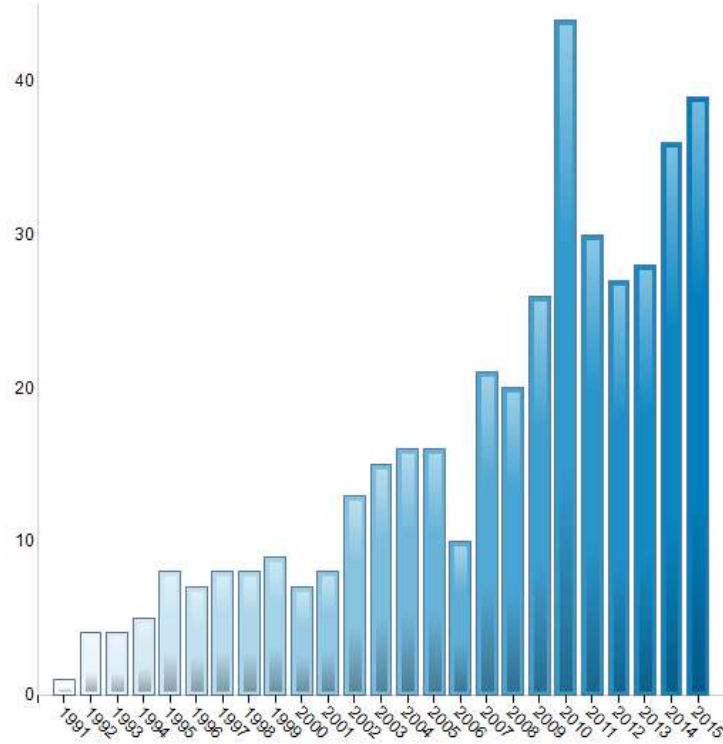


Figure 2.3: Number of observations (actions or decisions taken by the company) in each year from 1991 to 2015 (mean = 17.70; median = 19.00; standard deviation = 6.05)

In parallel to the listing of decisions taken by the management over the years, we have recorded 277 contextual events that characterized the company's environment over the same period of time. These context events include external environmental incidents that occurred beyond the control of the organization (Cheng & Van de Ven, 1996) but which were likely to influence positively or negatively its development. To search for these events, we analysed the archival sources specific to the company as mentioned hereabove (memos, meeting minutes, communications etc...) and other sources external to the company such as databases (IMF²⁰ database for feedstock and utility prices, OANDA²¹ database for foreign exchange rates) as well as press releases, financial statements and reports from financial analysts about competitors. All the recorded events were dated and sorted along the following categories, most of which were mentioned already in Table 1.4.

²⁰ International Monetary Fund Commodities Data (www.imf.org/external/np/res/commod/External_Data.xls).

²¹ Oanda database on historical rates (www.oanda.com/lang/fr/currency/historical-rates/).

- Competitive intensity has been proposed as a key environmental moderator of ambidexterity and firm performance. Competitive intensity, also referred to as Environmental Competitiveness, reflects the degree of competition, i.e. the number of competitors or the number of areas in which there is competition (Jansen et al., 2005). More specifically, competitive intensity reflects the extent to which organizations succeed in maintaining zero-sum relations with the others as they compete for the same pool of limited resources (Barnett, 1997). Jansen et al. (2006) found that competitiveness increases the need to pursue exploration and exploitation simultaneously but Levinthal & March (1993) claimed that outcomes of exploration tend to rapidly diffuse among competitors in competitive environments. New entrants benefit more from exploitation when competitive intensity decreases whereas defenders benefit more from exploration when it increases (Auh & Menguc, 2005).
- Market trend must be taken here in its marketing acceptance, based on offer and demand, and not in regards to financial nomenclature, i.e. a perceived tendency of financial markets to move in a particular direction over time. We refer to market trends in our study for variations in customers preferences and/or suppliers propositions. As an example, in 2005, the specter of inflation resurfaced with the constant increase of crude oil prices, but, at the same time, supported a growing interest for new energy sources and non-fossil technologies.
- Resource availability: we refer to resources here as *external* economic factors required by the company to accomplish its activity (feedstocks, raw materials, utilities and eventually labour force). The analysis of the archival sources indicated periods of scarcity for some of these external resources disrupting supply chain and leading to shortages. Excluded from this section are the *internal* aspects generally considered in resource-based view approach of corporate strategy which emphasizes leveraging firm competences to create competitive advantage (Brown & Eisenhardt, 1997).
- Crises: Schmitt and colleagues (2010, p.130) define a crisis as “an ambiguous situation that poses a major threat to organizational survival (...), whose causes and effects are unknown (...), to which there is little time to respond (...), and which requires decisions or judgments that will result in a change for the better or the worse (...)”. Therefore, a crisis disrupts the activities of an organization and, at best, provides an opportunity to reorganize itself to be more efficient in the future. In other less favorable cases, or if inevitable crises are not properly managed, they can jeopardize the very existence of the

organization. We include in this category the economic and financial crisis, political events, natural catastrophes, technological disasters and firm-level crises such as labor strikes out of the control of the company but which have had a direct impact on the course of its development. An example of crisis that impacted the company came in 2009 with the credit crunch that resulted from the global financial crisis and its aftershocks and that posed existential threats to leading global financial firms while capital-intensive sectors such as life sciences and biotech were under pressure from a tighter credit environment, or in 2014 with the financial crisis in Russia which resulted from the collapse of the Russian ruble triggered by the falling oil prices, a major export of Russia, and international economic sanctions imposed on Russia following Russia's annexation of Crimea and the Russian military intervention in Ukraine. This situation impacted Galactic sales in this region directly but also indirectly by affecting meat producers in Western Europe who are exporting their products to Russia. But, as said, crisis can also offer opportunities for faster development such as in 2012 when the lactic acid production plant of a Japanese competitor was stopped for months because of Fukushima nuclear disaster the year before and that B&G Japan took this opportunity to fill the empty space and increase its market share.

- Cost fluctuations obviously influence the company's competitiveness, especially when they are not resented with the same intensity by the different economic actors. Again, we consider here only macro-economic fluctuations in market forces which result in moves of feedstock prices, raw materials or utilities, eventually amplified by speculation and decisions at political level. The surge of sugar price in 2009 offers a good example of such volatility when the New York #11 index increased by 45.8% over the previous year (yearly average).
- Currencies and exchange rates fall obviously beyond the control of a company, even if it eventually uses hedging tools, i.e. forward contracts, swaps, options, futures and other derivative products.
- Regulatory framework: changes of normative environment promote or hinder the development of entire fields of activity and local governments may institute policies that influence organizations' predisposition toward either exploration or exploitation (Lavie et al., 2010, p.145). For instance, when in 2013 the European Commission receives green light to authorize the use of lactic acid to reduce microbial surface contamination in beef carcasses, a new market opens up to lactic acid producers. The same happened in 2006 when the European Union decided to ban the use of antibiotics

as growth promoters in animal feed or in 2003 when the public health agency within the USDA (FSIS) issued a new regulation by which meat processors must take actions to protect Ready-to-Eat Meat and Poultry products against the growth of a foodborne pathogen called *Listeria monocytogenes*. On a more negative note, difficulties arose in 2008 when China Marine Bureau declared lactic acid a « hazardous material » whereas it was not listed as hazmat by the United Nations nor by any other country, or the year before when the Chinese Export Tax refund was suddenly reduced from 13% to 5% which implied an immediate and unexpected drop of 8% in sales margin for all exports from the company's Chinese facility. Furthermore, normative rules are not only based on laws and regulations but they also include cultural norms, ethics, and administrative principles (Burgelman, 2015).

- Disruptive technology as proposed by Christensen (1997) echoes Schumpeter's creative destruction (Schumpeter, 1934). It is "a technology that changes the bases of competition by changing the performance metrics along which firms compete" (Danneels, 2004, p.149). Whereas one usually think of disruptive technologies for major advances "that will transform life, business, and the global economy"²², we refer to it more modestly for technological innovations which have the potential to change the rationale of the industry in which our unit of analysis is evolving and hence put its future development at risk.

As can be seen from the distribution of contextual events (Figure 2.4), the company was primarily exposed to changes in competitive environment, variations in currencies, and costs fluctuations. These three categories of events account for 80% of the environmental events recorded.

²² The McKinsey Global Institute lists for instance: the mobile Internet, automation of knowledge work, internet of things, Cloud, advanced robotics, autonomous and near-autonomous vehicles, next-generation genomics, energy storage, 3-D printing, advanced materials, advanced oil and gas exploration and recovery, and renewable energy.

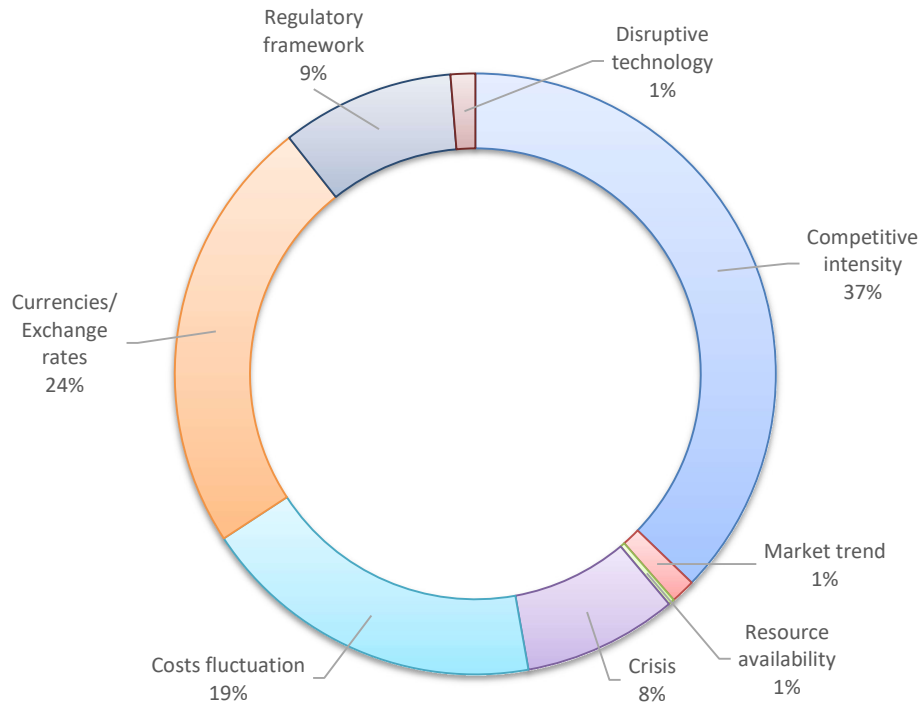


Figure 2.4: Distribution of contextual events by category (277 records in total)

Other antecedents of change raised in Table 1.4 such as ‘globalization and interconnectedness’ (Friedman, 2005) and ‘change of capitalistic paradigm’ which indicates a shift of power from executives to shareholders (Cannella, 1995) are not contemplated here. Lavie and colleagues (2010) pointed that trends for globalization entail greater attention to socio-environmental antecedents of exploration–exploitation but such kind of tidal waves are part of much longer cycles, incremental by nature, for which clear inflections cannot be detected in a study like ours. What is more, the greater shareholder power progressively gained in the second half of the twentieth century by institutional investors and in the beginning of the twenty-first century by hedge-funds and activist shareholders (Wells, 2016) was more a subject for large public corporations where managers wielded the real power than for small or medium sized companies such as our unit of analysis.

Following Cheng & Van de Ven (1996), events were coded as per the estimated impact they may have had on the development of the company. Hence, five levels have been defined and impact values attributed: extremely positive (+2), positive (+1), neutral (0), negative (-1), or extremely negative (-2). It is worth insisting that this analysis was performed from the

perspective of the company which means that an event might be considered positive (for the company) even though it might have adverse effect on other economic agents. An example illustrates this point: Fukushima Daiichi nuclear disaster in 2011 was a terrible accident that harmed populations and hit dramatically the Japanese economy. To this extent it was rated as negative (-1) because it hindered B&G Japan's growth by way of consequence. However, this unfortunate event led in the next year to another fact which was rated as positive (+1) in terms of competitive intensity when the company's main competitor in Japan located close to Daiichi prefecture had to cease production for several months, a situation that offered an opportunity for B&G Japan to fill the space and rapidly grow its market share.

2.4.2. Code-book design

Pure coding, directly from the material itself as in "*grounded theory*" approaches, may not be applicable to refining an existing theory. The grounded theory methodology operates almost in a reverse fashion from social science research in the positivist tradition (Glaser & Strauss, 1967). In this approach, no theoretical assumption should be used *ex ante*: the theory emerges from the material itself (Dumez, 2016). Conversely, our case aims at refining an existing theory. We therefore adopt a *theoretical coding* as described by Bohm (2000). In this way, the material is encoded from categories coming straight from the theory. Dumez (2016, p.73) opposes to this method the obvious risk of circularity and wonders how this approach can bring forth surprises, unexpected results, and changes of point of view from the retained material. However, in addition to the measures taken to avoid or lessen the risk of circularity (see section 2.3.2 hereinabove), we believe that Dumez' questioning applies to researches aiming at finding new theories but not to our case which, again, seeks to refine, confirm or invalidate an existing theory (organizational ambidexterity) in a clearly defined context (see sections 2.2.1. "Research setting" and 2.2.2. "Unit of analysis").

Our study could not be subjected to an independent double coding due to the limited time allowed for a DBA but also because the material analyzed, largely made of internal company documents, resorts to a specific jargon difficult to apprehend for external researchers. A deep understanding of the company, its culture and products, as well as the impediments and extraneous influences was also deemed necessary to be able to proceed to an objective, appropriate, relevant and fruitful coding.

Dumez (2016, p.77), inspired by Aristotelian scholasticism, teaches us that the core of the coding work is to mount in generality but not too much, that is to say, to look for the nearest generality by working on the specific difference. This forms the basis of our methodology in designing our code-book inspired from Gioia's "systematic inductive approach to concept development" (Gioia et al., 2013) that we applied to the questionnaires used in 20 different researches on organizational ambidexterity published in literature. As per Burgelman (2011), finding the right balance between "particular generalization" and "general particularization" is precisely the role of longitudinal qualitative research. Indeed, in his attempt to bridge history and reductionism, Burgelman explains that "historians make sense out of extensive narratives by giving them some limited general applicability (they generalize the particular)", to "show how past processes have produced present structures", whereas "social scientists use limited narratives to illustrate presumably general theories (they particularize the general)" (Burgelman, 2011, p.17-18). Our longitudinal case study, and especially the methodology we have adopted to analyse the data with the help of a strictly-structured coding, exactly targets this goal of being positioned between the historian's particular generalization and the reductionist's general particularization in order to avoid the shortcomings of these two extremes (i.e. the general, abstract, non-experiential, statistical aspects of reductionism on the one hand; the particular, concrete, experiential aspects of the historian's approach on the other hand).

Organizational ambidexterity can be considered as a construct in that it can be measured and that "its primary purpose is to delineate a domain of attributes that can be operationalized and preferably quantified as variables" (Gioia et al., 2013, p.16). As indicated in Section 1, many different methods have been used to operationalize organizational ambidexterity but none of them seemed appropriate to capture the different dimensions of the construct in a way that allowed its measure although the 25 years of history of our unit of analysis. The literature on organizational ambidexterity has generally taken a static approach by mainly relying on cross-sectional surveys and much of the work to date has consisted in empirical studies using financial performance (profitability, earnings, sales over assets, cash flows), sales performance (sales growth, market share growth) or eventually knowledge and innovation (patents, Tobin Q's) as dependent variables. In order to be able to measure ambidexterity each and every year of the company's history in a reliable and comparable way, we had to identify its components and design a method to evaluate each of these components. To do so, we developed a methodology inspired from Gioia's method for grounded theorizing (Gioia et al., 2013) which enabled us to identify 1st-order concepts from the 20 recent empirical papers mentioned above. These papers,

listed in Table 2.4, were predominantly selected for the level of details in describing their methodologies. The 1st-order concepts coalesced into 2nd-order themes which were then grouped into aggregate dimensions forming the basis of our code-book. Figure 2.5 summarizes this logical process.

Reference	Year
Rothaermel & Deeds, 2004	2004
Kyriakopoulos & Moorman, 2004	2004
Gibson & Birkinshaw, 2004	2004
He & Wong, 2004	2004
Sidhu, Volberda & Commandeur, 2004	2004
Atuahene-Gima, 2005	2005
Lavie & Rosenkopf, 2006	2006
Lubatkin, Simsek, Lin & Veiga, 2006	2006
Jansen, Van den Bosch & Volberda, 2006	2006
Bierly & Daly, 2007	2007
Lin, Yang & Demirkan, 2007	2007
Morgan & Berthon, 2008	2008
Brion, Mothe & Sabatier, 2008	2008
Mom, Van den Bosch & Volberda, 2009	2009
Cao, Gedajlovic & Zhang, 2009	2009
Brion, Mothe & Sabatier, 2010	2010
Voss & Voss, 2012	2012
Patel, Messersmith & Lepak, 2013	2013
Cummings, 2013	2013
Ming, 2014	2014

Table 2.4: List of research papers used to isolate concepts, themes and aggregate dimensions as basis for our code-book

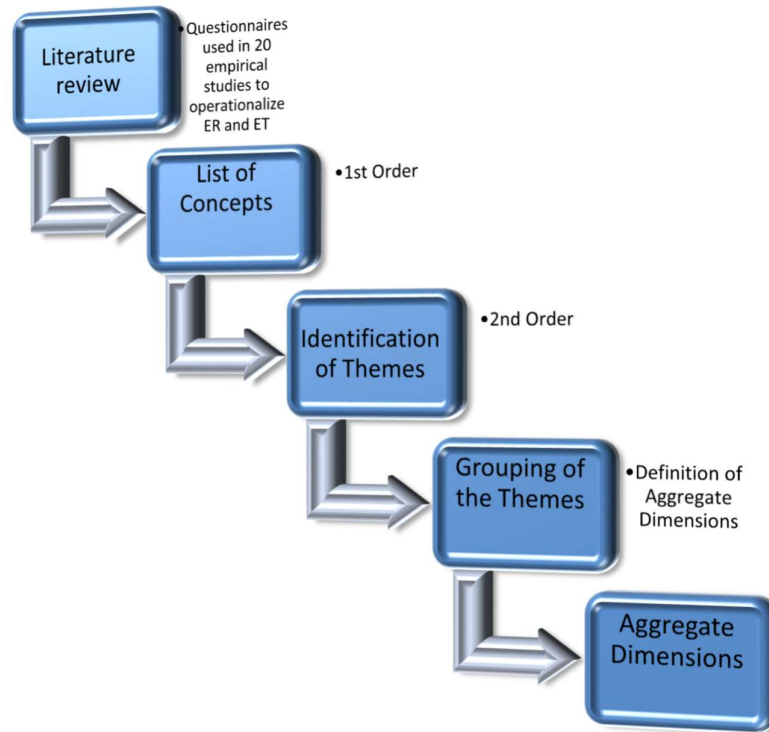


Figure 2.5: Logical process followed to identify aggregate dimensions for the code-book

Next, Gioia recommends to build a “data structure” which provides a graphic representation of the progression from raw data (the questionnaires from 20 empirical studies) to selected themes. Figure 2.6 shows a partial example of such a data structure; the complete data structure with all the concepts and themes for both exploration and exploitation appears in Appendix IV.

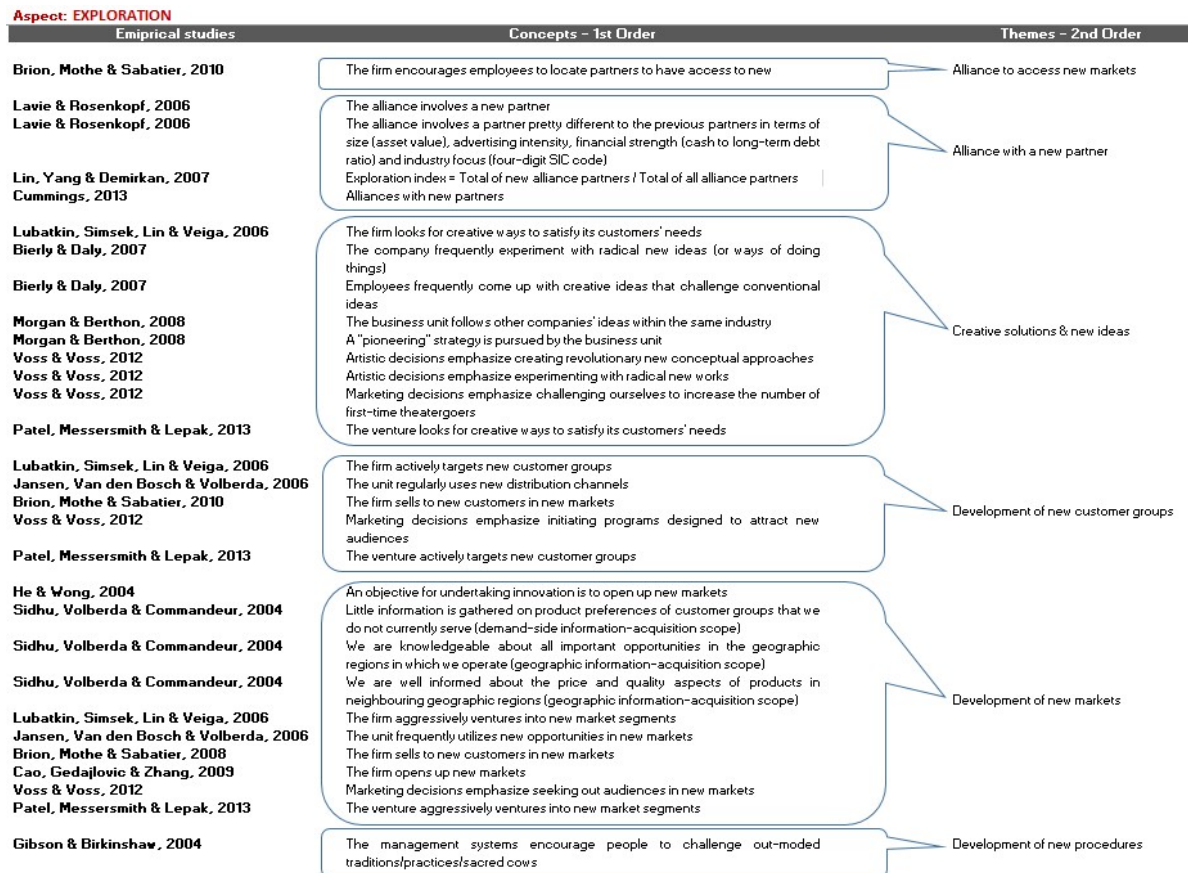


Figure 2.6: Example of “data structure” for Exploration (partial)

In the process of clustering the concepts into main themes, we found out that some concepts existed for one aspect (exploration for instance) but did not emerge for the other aspect (exploitation in this case). We therefore created themes not substantiated in the literature but necessary to mirror the ones that came out for the other aspect. They are highlighted in italic in Table 2.5. which presents the aggregated dimensions that we have identified for each aspect of organizational ambidexterity as defined earlier, i.e. exploration and exploitation. For some themes however, it was not possible to proceed with this “mirroring”. The opposite for “Economy of scale” for instance would make no real sense and would therefore never be selected during the analysis of our data. This was also the case of “Reduction of costs and consumptions”. We resolved to keep those two themes on the exploitation side only without counterparts for exploration.

Aggregate dimensions	Aspects	
	EXPLOITATION	EXPLORATION
Type of alliance	Alliance with an old partner <i>Alliance to penetrate existing markets</i> Exploitative alliance (focus on downstream activities)	Alliance with a new partner Alliance to access new markets Exploratory alliance (focus on upstream activities)
Organizational actions	Improvement of efficiency Improvement of existing activities Improvement of existing procedures Improvement of existing skills or knowledge <i>Plannification - Predictable consequences of actions</i> Economy of scale Reduction of costs or consumptions	Flexibility to changes Development of new activities Development of new procedures Development of new skills or knowledge Unknown future - Unknown consequences of actions
Supply-side actions	Improvement of existing technologies Improvement of production processes Improvement of existing products	Development of new technologies <i>Development of new production processes</i> Development of new products
Demand-side actions	<i>Expansion of market shares in existing markets</i> Deeper penetration of existing customer groups	Development of new markets Development of new customer groups
Experience vs. Creativity	Building on accumulated experience Providing existing solutions to customers	Creative solutions & new ideas <i>Providing new solutions to customers</i>
Timeframe	Short-term goals	Long-term goals
Intellectual Property (IP)	Exploiting existing IP (licensing-out)	Development of new IP (patenting) Acquiring new IP (licensing-in)

Table 2.5: Aggregate dimensions identified for Exploration and Exploitation after a first round of clustering

(In italic, the themes that did not come directly from the material but were created to mirror the ones identified in the other aspect. The aggregate dimension "Intellectual Property " has been added.)

This logical and systematic approach left us with six aggregate dimensions, i.e. type of alliance, organizational actions, supply-side actions, demand-side actions, experience versus creativity, and timeframe. Yet, looking at the company's activities and the extant literature on organizational ambidexterity, we came to believe that one dimension of interest was missing and was not covered by any other dimension: the intellectual property (IP).

IP did not show up in our analysis because the 20 empirical studies our analysis was based on were using questionnaires (the very reason why they were selected) whereas patent-related researches are mostly based on recording and processing numerical data such as number of patent owned, number of patent applications, number of patent awarded etc... (Andriopoulos & Lewis, 2009; Benner & Tushman, 2002; Katila & Ahuja, 2002). The role of intellectual

property seems obvious on the exploration side of the ambidexterity spectrum as new ideas, creations, processes, technologies and other intangible assets must be protected (patenting) and measures must be taken to be in a position to prove by way of evidence priority and pre-emptive rights (notarial deeds, i-depot²³). Acquiring licenses from other companies or research centers (licensing-in) is also a way to explore new directions. Likewise, IP is affecting the other side of the spectrum, exploitation, as granting licenses to other organizations can be seen as an alternative approach to extract value from new developments, hence to exploit the results of exploration activities. Moreover, beyond the intellectual property strategies enacted by the companies, the IP regulatory environment has also an impact on the propensity to explore or exploit: Lavie and his colleagues (2010) for instance claim that the value of exploration is reduced and firms may withhold their investments in exploration and focus more on exploitation in the case of insufficient government protection of intellectual rights.

When taking IP into account we were however confronted with one theme on the exploration side for which we found no exact counterpart in the exploitation side, i.e. “Acquiring new IP (licensing-in)”. Here again we decided to keep it anyway as we thought it would be worse not to consider it at all than to add it without counterpart.

After this first round of structuring exercise, we ended up with 7 aggregate dimensions covering 19 themes describing exploitation and 18 themes characterizing exploration. However, soon after we started to use our newly-built code-book to analyse our data-set made of managerial decision or actions taken by the company during its 25 years of existence, we realized that more aggregation could be effected in order to gain in clarity and simplicity without losing in accuracy and precision, i.e. to mount in generality as recommended by Dumez (2016, p.77).

- In the aggregate dimension “Organizational actions”: the themes “Improvement//development of existing//new activities”, “Improvement//development of existing//new procedures” and “Improvement//development of existing//new skill or knowledge” have been merged in a more general “Improvement//development of existing//new activities, procedures and knowledge”. Similarly, the themes “Economy of scale” and “Reduction of costs or consumptions” have been condensed in one single theme.

²³ The i-DEPOT is a legal means of evidence that issues a date stamp on a given idea or creation. It proves the rightful ownership of a specific creation at a specific date. The i-DEPOT is organized by the Benelux Office for Intellectual Property and is equivalent to the “enveloppe soleau” in France.

- In the aggregate dimension “Supply-side actions”: the three themes have been merged into one “Improvement/development of existing//new technologies, processes and products”.
- In the aggregate dimension “Demand-side actions”: the two themes have coalesced into one “Expansion in//development of existing//new markets and customer groups”.
- In the aggregate dimension “Experience vs. Creativity”: the themes “Building on accumulated experience//Creative solutions & new ideas” and “Providing existing//new solutions to customers” have been merged into a simpler “Accumulated experience, existing solutions//Creative (new) solutions, new ideas”.
- In the aggregate dimension “Intellectual property”: the themes have been condensed into one “Exploiting existing IP (licensing-out)//new IP: development (patenting) or acquisition (licensing-in)”.

The second round of clustering for which we kept our 7 aggregate dimensions narrowed down the number of themes to 12 and 11, respectively for exploitation and exploration aspects (Table 2.6).

Aggregate dimensions	Aspects	
	EXPLOITATION	EXPLORATION
<u>Type of alliance</u>	Alliance with an old partner Alliance to penetrate existing markets Exploitative alliance (focus on downstream activities)	Alliance with a new partner Alliance to access new markets Exploratory alliance (focus on upstream activities)
<u>Organizational actions</u>	Improvement of efficiency Improvement of existing activities, procedures or knowledge Plannification - Predictable consequences of actions Economy of scale, reduction of costs, improvement of yield	Flexibility to changes Development of new activities, procedures or knowledge Unknown future - Unknown consequences of actions
<u>Supply-side actions</u>	Improvement of existing technologies, processes or products	Development of new technologies, processes or products
<u>Demand-side actions</u>	Expansion in existing markets or existing customer groups	Development of new markets or customer groups
<u>Experience vs. Creativity</u>	Building on accumulated experience, providing existing solutions	Creative solutions & new ideas
<u>Timeframe</u>	Short-term goals	Long-term goals
<u>Intellectual Property (IP)</u>	Exploiting existing IP (licensing-out)	Development (patenting) or acquisition (licensing-in) of new IP

Table 2.6: Aggregate dimensions identified for Exploration and Exploitation after a second round of clustering

Then came the question of measuring the weight of each theme by transforming nominal values about exploration and exploitation into numerical variables which forms the core of the next section describing the method pursued to analyse our data-set with the help of the coding grid now available.

2.4.3. Data analysis

The 410 managerial actions and decisions listed as explained in section 2.4.1 have been rated in Excel in regards to all selected themes to allow a first layer of analysis. In order to provide a deeper analysis with the help of more sophisticated statistic tools, the Excel dataset has also been uploaded in Sphinx iQ2, a software developed by the French company *Le Sphinx Développement*.

The main purpose of coding and then rating in Excel was to transform nominal values about exploration and exploitation, i.e. our themes, into numerical variables. To do so, we attributed arbitrarily a value of +1 to each exploration-related theme and a value of -1 to each exploitation-related theme²⁴ (Figure 2.7). Themes that were not applicable to a given managerial action or decision were ticked as “nihil” and attributed a value of zero. Figure 2.8 shows an extract of the coding file that has been constructed for the purpose of this research and which contains the 410 managerial actions or decisions (“observations”) mentioned earlier.

²⁴ With one exception, Exploratory Alliance vs. Exploitative Alliance, for which we attributed values of +2 and -2, respectively, to avoid skewness with the two other components of the aggregate dimension “Type of Alliance”, i.e. “Alliance with old/new partner” and “Alliance to penetrate existing/new market”, which were kept with values of +1/-1. Example: with weights of +1/-1 for the theme Exploratory/Exploitative Alliance, an exploratory alliance with an old partner to penetrate existing market would have resulted in a compounded score for the aggregate dimension of +1-1-1 = -1, indicating an excess of exploitation over exploration and missing the exploratory intension of this type of alliance. Using a weight of +2/-2 leads us to a compounded score of +2-1-1 = 0 which better reflects the balance between the exploratory intension and the exploitative implementation of this exemplative endeavor.

Partnership		Value
Old partner		-1
Nihil		0
New partner		1
Existing market		-1
Nihil		0
New market		1
Exploitative alliance		-2
Nihil		0
Exploratory alliance		2

Supply-side Actions		Value
Improvement of existing technologies, processes, products		-1
Nihil		0
Development of new technologies, processes, products		1

Demand-side Actions		Value
Expansion in existing markets, customer groups		-1
Nihil		0
Development of new markets, customer groups		1

Experience vs. Creativity		Value
Accumulated experience, existing solutions		-1
Nihil		0
Creative (new) solutions, new ideas		1

Timeframe		Value
Short term goals		-1
Nihil		0
Long-term goals		1

Intellectual property		Value
Exploiting existing IP (licensing-out)		-1
Nihil		0
New IP: development (patenting) or acquisition (licensing-in)		1

Org. Actions		Value
Improvement of efficiency		-1
Nihil		0
Development of flexibility		1
Improvement of existing activities, procedures, knowledge		-1
Nihil		0
Development of new activities, procedures, knowledge		1
Plannification (predictability)		-1
Nihil		0
Intuition (unknown future)		1
Economy of scale, reduction of costs, improvement of yield		-1
Nihil		0

Figure 2.7: Rating grid for the 7 aggregate dimensions and their themes.

(Positive values attributed to themes of exploratory nature, negative values attributed to themes of exploitative nature, zero values for themes that do not apply or to which no clear exploratory or exploitative nature could be attributed. The wording of some themes has been shortened or summarized for clarity and ease of use.)

Observation n°	Year	Main actions & events (organizational level)	Old/new partner	Existing/new market	Exploitative/Exploratory alliance	Efficiency
267	2011	Galactic enters an evaluation program with a Danish company to evaluate the possibility to ferment a cellulosic feedstock to make lactic acid. Here again, the results are not bad but the company prefers to park the project after a few months of research.	New partner 1	Nihil 0	Exploratory alliance 2	Development
268	2011	The project with Materia Nova and Politecnico di Torino to establish a new environmental assessment tool related to the chemical recycling of PLA and other end-of-life options is in progress.	New partner 1	Nihil	Exploitative alliance Nihil Exploratory alliance	Development
269	2011	Galactic files for a patent on the separation of the two isomers of lactic acid in the	Nihil 0	Nihil 0	Nihil 0	Development

Figure 2.8: Extract of the coding file in Excel.

(Number 1 shows the selection of the aspect for the theme “Exploitative/Exploratory alliance” in the aggregate dimension “Partnership” from a rolling menu in the case of the observation n°267. Number 2 shows the rating linked to the selection that appears automatically according to the grid displayed in Figure 2.7)

The sum of positive scores for a given managerial action or decision therefore reflects its exploration intensity. Similarly, the absolute value of the sum of negative scores reflects the exploitation intensity of the managerial action or decision considered. The use of the absolute value is only there to convert negative values into positive ones to avoid a value judgement by

which we would infer that Exploitation is by essence negative for an organization as we have clearly indicated in the previous sections that exploitation is absolutely necessary to firms who wants to escape from the well-known “failure trap” (underdeveloped new ideas)(Junni et al., 2013). Consequently, the net result of summing all negative and positive scores shows whether this managerial action or decision is more of exploratory or exploitative nature. And, logically, perfect organizational ambidexterity is approached when the score reaches zero.

At this point, we see emerging a method to quantify numerical indexes such as “Exploration Intensity” (the sum of all positive rating scores), “Exploitation Intensity” (the absolute value of the sum of all negative rating scores), and an “Ambidexterity Score” (sum of all positive and negative rating scores) for each decision taken or action implemented by the company. Table 2.7 shows some selected examples (3 examples of exploratory nature, 3 examples of exploitative nature, and 1 example of ambidextrous balance of both).

In accordance with the foregoing, we define:

- **Exploration Intensity** ($ER_{Intensity}$) as:

$$ER_{Intensity} = \sum_{x \in \mathbb{R}_{>0}} x_i$$

$$\text{with } \mathbb{R}_{>0} = \{x \in \mathbb{R} \mid x > 0\}$$

$$\text{and } x_i = \text{rating score of the } i^{\text{th}} \text{ theme}$$

(Equation 2.1)

- **Exploitation Intensity** ($ET_{Intensity}$) as:

$$ET_{Intensity} = \left| \sum_{x \in \mathbb{R}_{<0}} x_i \right|$$

$$\text{with } \mathbb{R}_{<0} = \{x \in \mathbb{R} \mid x < 0\}$$

$$\text{and } x_i = \text{rating score of the } i^{\text{th}} \text{ theme}$$

(Equation 2.2)

- **Ambidexterity Score (A_{mbS}) as:**

$$A_{mbS} = \sum_{x \in \mathbb{R}_{>0}} x_i + \sum_{x \in \mathbb{R}_{<0}} x_i = \sum_{x \in \mathbb{R}} x_i$$

(Equation 2.3)

Observation n°	Year	Actions & decisions	Themes											Ambidexterity score		
			Old/New partner	Existing/new market	Exploitative/Exploratory alliance	Efficiency vs. Flexibility	Activities, procedures, knowledge	Plannification vs. Intuition	Technologies, processes, products	Markets, Customer groups	Experience vs. Creativity	Timeframe	Costs, consumptions & yields		IP	
81	2002	B&G, a joint-venture between Galactic and BBKA Biochemicals, is created in China. The JV will license Galactic's existing technologies to produce lactic acid and derivatives. The Chinese shareholder has 51% of the shares but Galactic retains the control of the operations (60% of voting rights). The newly-formed company will produce and sell its products in the whole Asia-Pacific region.	1	1	-2	-1	1	-1	0	1	0	1	0	0	-1	0
140	2007	Creation of Futero (50:50 JV with Total Petrochemicals) to continue the development of Galactic's PLA technology (access to expertise in polymers' application development)	1	1	2	1	1	1	1	0	1	1	0	0	0	10
283	2012	Galactic sells a license to Total on its technology for L-lactic acid, D-lactic acid and PLA recycling (Loopla®). According to the licensing contract and thanks to a preliminary ruling agreement with the tax authorities, the total amount of those licenses received in cash in 2012 is viewed as the present value of future annual licensing fees which is therefore booked in the balance sheet as deferred revenue that will be amortized in the following 8 years (non-cash). The resulting improvement of the cash position allowed the company to bring back its long-term debt-to-equity ratio to a healthier level.	-1	-1	-2	-1	-1	-1	0	-1	-1	-1	0	-1	-11	
307	2012	The situation in China was further deteriorating. The global demand for lactic acid was declining as a result of the global economic meltdown. In the first quarter of 2012 for instance the total exports of lactic acid from China declined by 51% compared to the same period of the previous year and the competition was fierce since all lactic acid producers were trying to maintain their sales volumes. The directors of the B&G board then decided to launch a profit recovery initiative and the management resolved to implement the same product promotion strategy based of customer-centric marketing approach as the one Galactic was executing in Europe to enhance the promotion of higher-value specialties.	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-8	
363	2014	Galactic supports a PhD thesis at the Catholic University of Louvain which purpose is to isolate and characterize new strains of bacteriocins-producing microorganisms directed specifically against Gram negative pathogens.	-1	0	2	1	1	1	1	0	1	1	0	0	7	
372	2015	Galactic signs a MOU with a major dairy producer, to evaluate the possibility to produce lactic acid out of one of its dairy byproducts that will be piling up with the sharp increase in milk production expected following the cancellation of EU milk quotas. The two companies start lab scale tests in order to develop a process adapted to this new raw material and reaching the quality standards required by the market.	1	-1	2	1	1	1	1	0	1	1	0	0	8	
383	2015	Galactic implements a new Customer Relationship Management system (CRM) which allows to improve its market prospection activities with the help of clearly defined workflows and better sales follow-up procedures. The system is deployed in Europe and North America. Asia and Latin America will follow later.	-1	-1	-2	-1	-1	-1	-1	0	-1	-1	0	0	-10	

Table 2.7: Themes' rating and Ambidexterity Scores for selected examples of managerial decisions or actions.

The first observation (n°81) in Table 2.6 depicts the creation in 2002 of a joint-venture (an alliance) between Galactic, our unit of analysis, and a Chinese partner (new partner: +1). The purpose of this partnership was to build and operate (exploitative alliance: -2) a new production factory for lactic acid and some derivatives to be sold in the Asia-Pacific region (new market: +1; new customer group: +1). It was the first time Galactic entered in such kind of venture (new activity, procedures, knowledge: +1). Of course such an investment of about USD 50 million was well thought out and thoroughly planned (plannification: -1) as a part of a long-term strategic move (timeframe: +1) with the intension to pursue its growth in a sustainable and efficient manner by coming operationally closer to some far-away markets (efficiency: -1). Besides capital instalments, Galactic contributed its existing technologies in the frame of a licensing agreement (IP licensing-out: -1). Granting a license on existing technologies does not help improving them and hence the “Technologies, processes, products” is kept at 0. The sum of all ratings brings an Ambidexterity Score of 0 for this decision which indicates a good balance between the exploration of new possibilities (new partner, new market, new customers, new activity) and the exploitation of existing assets (exploitative alliance with licensing of existing technologies to produce existing products with foreseeable returns).

The example above contrasts with another joint-venture (observation n°140) created in 2007 by Galactic together with Total Petrochemicals with the aim to continue Galactic’s development initiated already in 1992 of a brand-new technology to manufacture a biopolymer of lactic acid (PLA, polylactic acid). The purpose for Galactic to enter into this joint-venture named Futerro, a “première” for Galactic (new activity: +1) was to access Total’s expertise in developing applications for polymers (new partner: +1; new market: +1; exploratory alliance: +2). As a matter of fact, Total is a major player in the polyolefines industry worldwide and, therefore, represented a partner of choice in the development of a new polymer (new technologies, processes, products: +1). Although the PLA is intended to be used for clearly identified markets such as packaging films, textile fibers and rigid plastics, the subject of the joint venture was at this stage very upstream and still not very customer oriented (demand-side actions: 0). It is well known in this industry that the development of a new plastic is part of a long, multi-year cycle (timeframe: +1), for which the chances of success remain very uncertain (unknown future, intuition: +1). If successful, this project of magnitude would add to Galactic a string to its bow by giving access to an entirely new market and thereby reducing its exposure to the traditional market of lactic acid (flexibility:+1). Such type of strategic move is obviously in favor of exploration and leads therefore to an Ambidexterity Score of +10.

The following example (observation n°283) differs strongly from the previous one by placing it at the other end of the ambidexterity continuum with a largely exploitation-oriented Ambidexterity Score of -11. Indeed, in 2012, Galactic and Total Petrochemicals, its partner since 5 years (old partner: -1), reached an agreement by which Galactic was to grant a license (IP licensing-out: -1) on its existing technologies (without improving them further though, hence the 0 rating for “Technologies, processes, products”) by essence related to the company’s accumulated experience (Experience vs. Creativity: -1). The payment of this license in one single cash instalment by the licensee had an immediate (timeframe: -1) positive impact on Galactic’s cash position (efficiency: -1).

Observation 307 pictures a different situation in which the management of B&G (Galactic’s Chinese subsidiary) had to react to a sharp deterioration of its working environment triggered by a global economic meltdown and heightened competition. The decisions taken involved drastic savings on production and administrative costs (costs, consumptions, yields: -1; improvement of processes: -1) as well as a deep change of marketing approach inspired by the one Galactic was implementing in Europe (expansion in existing markets: -1) for short-term results (timeframe: -1). Such type of managerial decision is obviously very much in favor of exploitation with an Ambidexterity Score of -8.

The next observation (n°363) is a classical example of exploratory alliance (+2) with a university with whom the company worked before (old partner= -1) to support a PhD research on new products and processes (+1) for a new activity (+1) with far-reached (timeframe: +1) unsure results (unknown future: +1). If experience is obviously necessary, the very nature of such research is to appeal to the creativity of the researcher and the university department to generate innovative approaches and new ideas (Experience vs. Creativity: +1), a clearly exploratory process which leads to an Ambidexterity Score of +7.

Another exploitation-minded partnership (ambidexterity score: +8) comes with observation n°372 when Galactic signed a memorandum of understanding with a major dairy company (new partner: +1; exploratory alliance: +2) to investigate the possibility to produce lactic acid aimed at traditional markets (existing market: -1) from a new raw material (flexibility: +1). This collaboration targets the development of new knowledge (+1) and new technologies and processes (+1) by building on both teams’ creativity (+1) for a possible joint-investment in a production plant in the future (unknown future: +1; timeframe: +1).

A final example comes with observation n°383 which shows a typical exploitative type of managerial decision linked to the implementation of a new computer system for improved sales operations (efficiency: -1; existing markets: -1) in partnership with a business consultant (exploitative alliance: -2) with whom Galactic used to work before (old partner: -1). A well planned project (plannification: -1) with a tight implementation schedule (timeframe: -1) which leads not surprisingly to an ambidexterity score of -10.

The examples stressed out hereabove show how an ambidexterity score could be determined for each and every of the 410 managerial decisions or actions recorded in our data-set. To highlight how the company was able to divide its efforts between Exploration and Exploitation over time, we had then to define a score for each year. To do this, we have opted for the use of arithmetic means of the set of scores obtained each year in order to allow the comparison between years. Indeed, a simple addition of the scores for each year would have led to bias due to the variable number of observations each year.

Hence, we define:

- **Average Exploration Intensity** ($\overline{ER}^y_{\text{Intensity}}$) for year y :

$$\overline{ER}^y_{\text{Intensity}} = \frac{1}{n} \sum_i ER_{\text{Intensity}_i}$$

with $ER_{\text{Intensity}_i}$ = Exploration Intensity score of observation i

and n = number of observations in year y

(Equation 2.4)

- **Average Exploitation Intensity** ($\overline{ET}^y_{\text{Intensity}}$) for year y :

$$\overline{ET}^y_{\text{Intensity}} = \frac{1}{n} \sum_i ET_{\text{Intensity}_i}$$

with $ET_{\text{Intensity}_i}$ = Exploitation Intensity score of observation i

and $n =$ number of observations in year y

(Equation 2.5)

- **Average Ambidexterity Score** (A_{mbS}) for year y :

$$\overline{A_{mbS}}^y = \frac{1}{n} \left[\sum_i ER_{Intensity_i} + \sum_i ET_{Intensity_i} \right]$$

(Equation 2.6)

Table 2.8a and 2.8b give the data for year 2014 as an example of computation of those three indexes for this year.

Observation n°	Year	Actions & decisions	Old/New partner	Existing/new market	Exploitative/Exploratory alliance	Efficiency vs. Flexibility	Activities, procedures, knowledge	Plannification vs. Intuition	Technologies, processes, products	Markets, Customer groups	Experience vs. Creativity	Timeframe	Costs, consumptions & yields	IP	Exploration intensity	Exploitation intensity	Ambidexterity score
336	2014	The company decides to sell out the customer base of the PLA recycling activity it had initiated in 2010 and all related tangible assets.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
337	2014	Galactic invests in a computer-based Warehouse Managing System (WMS) with QR-codes to improve internal logistics.	0	0	0	-1	-1	-1	-1	0	-1	-1	0	0		-6	-6
338	2014	Once again, the aggressiveness of competition drives prices down significantly, especially in lactates and blends. Galactic reacts by promoting new "Low Cost In Use" solutions which, more efficient, allow a lower dosage and hence savings to the customers even at higher unit prices. A "win-win" approach. Galactic was then primarily targeting the competition's customers as well as those of its customers that were felt at risk. This new "XT" product range was made possible thanks to some of the company's recent researches.	0	0	0	-1	-1	-1	-1	-1	1	-1	0	0		-5	-5
339	2014	The price pressure was also beginning to be felt on some specialty products such as calcium lactate whose price fell by about 20% at some specific Asian accounts. Galactic preferred to reduce its production throughput to focus on higher-end markets instead of fueling a downward price trend.	0	0	0	-1	0	-1	0	-1	-1	-1	0	0		-5	-5
340	2014	The implementation of a new market strategy and business model to focus on providing specialties and tailor-made solutions continues.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
341	2014	Galactic increases the intensity of co-developments with its prospects and customers in the frame of the GIC-based TSR procedure. 53 projects are conducted in the lab this year.	-1	-1	2	-1	1	1	1	-1	1	-1	0	0	1		1
342	2014	Galactic works at kicking off the operations with Galactic Italia.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
343	2014	Galactic works at kicking off the operations with Galactic Deutschland.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
344	2014	The research program on the transformation of lactic acid into acrylic acid together with the universities of Liège and Louvain (Project nicknamed "NOVOVAL") comes to an end.	1	1	2	1	1	1	1	0	1	1	0	0	10		10
345	2014	The R&D project with the Meurice Institute for the development of a new range of bacteriocins-containing fermentates is in progress.	-1	0	2	1	1	1	1	0	1	1	0	0	7		7
346	2014	Galactic and Purac, who joined forces to attack Jungbunzlauer in court for patent infringement lose the case. They decide not to appeal the court's decision.	-1	-1	-2	-1	-1	-1	0	0	-1	-1	0	-1		-10	-10
347	2014	The ECLIPSE project on algae to PLA is in progress.	1	0	2	1	1	1	1	0	1	1	0	0	9		9
348	2014	Galactic and Naturex continue their collaboration on the bioconversion of vegetable juices by fermentation. Tests are conducted at industrial scale.	1	-1	2	1	1	1	1	0	1	1	0	0	8		8
349	2014	Galactic and Naturex continue their collaboration on DUOCOOL and DUOFRESH.	1	-1	2	1	1	1	1	0	1	1	0	0	8		8
350	2014	The sales team has been greatly expanded from previous years and the current team is deemed sufficient to revive sales according to the new customer-centric strategy. All sales forces (including our application engineers) is on the road to meet with customers and prospects, discover their needs and offer new solutions. Some of the company's latest innovations such as the Adagio range of products, for which new applications were found, began to take off in the market, about three years after their first introduction.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
351	2014	The company starts a new production line for ultra-pure lactic acid dedicated to very demanding segments such as personal care industry. These new products were successfully introduced at an international exhibition in Hamburg, Germany.	0	0	0	1	1	-1	1	1	1	-1	0	0	3		3
352	2014	Galactic starts producing butyl lactate in Belgium.	0	0	0	-1	1	-1	1	-1	-1	-1	-1	0		-4	-4

Table 2.8a: Themes' rating and average intensity and ambidexterity scores for the year 2014 (part A).

Observation n°	Year	Actions & decisions	Old/New partner	Existing/new market	Exploitative/Exploratory alliance	Efficiency vs. Flexibility	Activities, procedures, knowledge	Plannification vs. intuition	Technologies, processes, products	Markets, Customer groups	Experience vs. Creativity	Timeframe	Costs, consumptions & yields	IP	Exploration intensity	Exploitation intensity	Ambidexterity score
353	2014	Galactic tests an alternative technology to improve the biomass removal step in its lactic acid process.	0	0	0	-1	1	1	1	0	1	1	-1	0	3		3
354	2014	Galactic resumes its work on the development of an innovative process to manufacture sodium lactate in powder form. This time the project will be brought to the end and an industrial production will be put in place in 2015.	0	0	0	1	1	1	1	0	1	1	0	0	6		6
355	2014	Galactic and B&G R&D teams continue to work on eradicating a fermentation impurity that causes carbon losses.	0	0	0	-1	-1	-1	-1	0	-1	-1	0	0		-6	-6
356	2014	Production and R&D teams continue to work together on improving carbon yield at the fermentation level.	1	0	2	-1	-1	-1	-1	0	1	1	-1	0			0
357	2014	The erection of a GMP-certified production unit for sodium lactate solutions targeting the pharmaceutical industry continues with the independent expert.	1	1	-2	1	1	-1	-1	0	-1	-1	0	0		-2	-2
358	2014	Futero files for a patent on a process and apparatus for purification of a stream containing a cyclic ester of an alpha-hydroxycarboxylic acid (PCT/EP2014/052154).	0	0	0	1	1	1	1	0	1	1	0	1	7		7
359	2014	Futero files for a patent on a process for recovering and improving production of meso-lactide from a crude lactide containing stream (PCT/EP2014/059220 - WO2014180836).	0	0	0	1	1	1	1	0	1	1	0	1	7		7
360	2014	Futero files for a patent on how to use PLA in skinplate application (PCT/EP2014/063310 - WO2014206996).	0	0	0	1	1	1	1	0	1	1	0	1	7		7
361	2014	Futero files for a patent on increasing the efficiency of a PLA production unit by recycling of internal residues (PCT/EP2014/077076 - WO201586613).	0	0	0	1	1	1	1	0	1	1	0	1	7		7
362	2014	Futero files for a patent on the production of meso-lactide, D-lactide and L-lactide by back-biting of PLA (PCT/EP2014/077077 - WO201586614).	0	0	0	1	1	1	1	0	1	1	0	1	7		7
363	2014	Galactic supports a PhD thesis at the Catholic University of Louvain which purpose is to isolate and characterize new strains of bacteriocins-producing microorganisms directed specifically against Gram negative pathogens.	-1	0	2	1	1	1	1	0	1	1	0	0	7		7
364	2014	Galactic supports a 2-years R&D project with the Meurice Institute for the development of propionic-based antifungal products for the food industry.	-1	0	2	1	1	1	1	0	1	1	0	0	7		7
365	2014	Galactic works on the synthesis of special heavy esters for a large German agrochemical company.	0	0	0	1	1	1	1	1	1	1	0	0	7		7
366	2014	Galactic launches GALATEA® in partnership with Taradon Laboratory. GALATEA® is a new concept for the beauty industry based on a combination of three enzymes with anti-ageing properties aiming to protect the body against oxidative stress. Taradon is a small belgian biotech company renting offices and lab space in the GIC.	1	1	-2	-1	1	-1	1	1	1	-1	0	0	1		1
367	2014	B&G starts producing calcium lactate for the animal feed industry. Galactic is interested since it had to pull out of this market a couple of years before because of a lack of raw material (lactic acid-containing byproduct from USA). However, B&G is unable to satisfy Galactic needs and Galactic decides ultimately to stop importing this product, pulling out again from this market he just re-entered a few months before.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
368	2014	The downward trend of the Euro versus the US dollar enhanced Europe's competitiveness on the international scene, and by that improved the situation of Galactic's Belgian site. This coupled with a gradual appreciation of the Chinese Renminbi and an increase of freight cost from China to Latin America prompted Galactic to shift the sourcing for the East coast of this region from B&G to Galactic Belgium. Several thousand tons of different products and numerous customers were concerned. This change further helped the sales team in Europe to focus on specialties and enrich the product-mix without caring too much about filling the plant with volumes. As a consequence, several commodity customers were left to the competition when Galactic decided to cut off the downward spiraling price trend.	0	0	0	-1	-1	-1	0	-1	-1	-1	-1	0		-7	-7
369	2014	Despite the negative impact of the substantial volume shift from China to Belgium and competitive pressure from international competitors due to high raw material cost in China as well as due to exchange rate disadvantages, B&G performed rather well all through the year, especially thanks to strong momentum on the domestic market. The development of the sales of newly launched products was positive and contributed to the profitability of the company, especially after the successful expansion of the capacity to manufacture Ultra-Pure Lactic Acid and the focus to sell additional volumes for Feed Acidifiers and lactic acid in the feed industry in China. The financial position of B&G was solid, stock levels of finished products were low and the free cash-flow was positive which convinced the board of directors to increase the leasing and technology license fees paid to the shareholders.	0	0	0	-1	-1	-1	0	-1	-1	-1	0	0		-6	-6
370	2014	Galactic Inc. implements a new remuneration system for its sales team based on KPI's and bonuses to support its sales strategy.	0	0	0	-1	-1	-1	0	0	-1	-1	0	0		-5	-5
Averages :			0,06	-0,03	0,33	-0,08	0,17	-0,08	0,39	-0,25	0,14	-0,08	-0,11	0,11	6,22	-5,75	0,57

Table 2.8b: Themes' rating, average intensity and ambidexterity scores for the year 2014 (part B).

We can see in the example of Table 2.8 (a, b) that the company succeeded to balance relatively well its exploration and exploitation efforts while keeping comparatively high intensities of both with however a slightly higher focus on exploration (average exploration intensity of 6.22; average exploitation intensity of 5.75) which resulted in an Ambidexterity Score of 0.57 for this year. We refer the reader to Section 3.4 for a discussion on the evolution of these indexes over the 25 years of history of the company.

We also averaged the rating scores of each individual themes every year; an information that revealed precious when looking at the relative impact of these themes on the way the company became and remained ambidextrous. This will help us identify which theme companies should predominantly pay attention to in their quest for ambidexterity; and it will provide us matter to substantiate our managerial recommendations in the concluding section of this dissertation.

In order to go further in understanding how organizational ambidexterity could be developed and implemented by a company, or at least to know how Galactic did, we resolved to add two different lenses to our analysis. First, from a perspective internal to the firm, we measured **structural ambidexterity**. Second, from a perspective external to the firm, we measured **network ambidexterity**.

As we recall from our literature review, it was Duncan (1976) who first advocated for companies to put in place “dual structures” requiring different time perspectives and management capabilities to accommodate simultaneously the conflicting alignments needed for efficiency and innovation. Two decades later, Tushman and O’Reilly (1996) picked up on the concept and emphasized structural separation between activities aiming at managing evolutionary (incremental) change and revolutionary (discontinuous) change in simultaneous fashion. The idea here is therefore to design a measure that reflects whether the decisions taken by the management of Galactic over its 25 years of existence called for a separation between departments (or at least involved only one single department) or incited collaboration (applying to two or more departments)(Figure 2.9). Crossing this type of information with the evolution of ambidexterity over time will provide insights about how ambidexterity can be executed from an internal/organizational perspective.

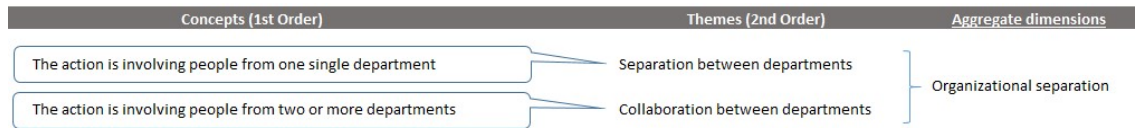


Figure 2.9: Concepts and themes for structural ambidexterity.

So, we went through all 410 decisions or actions recorded in our data-set and attributed numerical values of +1 and -1, respectively for the ones involving only one department and for the ones concerning two or more²⁵, and 0 when it did not apply (Figure 2.10).

Structural Ambidexterity	Value
Action involving only one department (separation)	1
Nihil	0
Action involving two or more departments (collaboration)	-1

Figure 2.10: Rating grid for structural ambidexterity.

Here too, averaging the rating scores obtained for all observations on a given year leads to an indication of the propensity of the company to favor separation or collaboration between its departments during this same year.

We also define:

- **Partnership Intensity** of a single observation as 0 if the observation indicates no partnership or alliance outside the organization²⁶, and 1 if the observation reveals such a partnership. Therefore, the Partnership Intensity of a given year is logically the sum of all the partnership decisions taken over this year.

²⁵ Note that the attribution of +1 and -1 values here is not correlated in any way to the attribution of +1 and -1 values to exploratory and exploitative aspects when computing ambidexterity scores. In other words, a value of -1 given to one observation for measuring structural ambidexterity does not suggest that this observation is of exploitative nature. The rating of themes for measuring ambidexterity scores and the rating of structural ambidexterity have been conducted independently from each other.

²⁶ We here refer to “the organization” as the whole Galactic group. A project conducted by Galactic SA together with one of its subsidiaries is not considered as a partnership or an alliance except when the decision is about Galactic collaborating for the first time with an external entity to form a joint-venture company.

For network ambidexterity, the task was easier as all the ingredients for its measure were already available from the rating exercise made before to determine exploration/exploitation intensities and the resulting ambidexterity scores. Extant literature (Grant & Baden-Fuller, 2004; Lin et al., 2007; Park et al., 2002; Rothaermel & Deeds, 2004) tells us that the formation of alliances or partnerships can be seen as a form of exploration and exploitation as much as exploratory alliances provide opportunities to access new knowledge and investigate new market and technologies whereas exploitative alliances can be used to benefit from complementary resources and to leverage existing competencies across organizational boundaries.

We therefore define:

- **Network Ambidexterity Score** as the sum of the ratings attributed to the themes “Old//New partner”, “Existing//New market” and “Exploitative//Exploratory alliance”.
- **Average Network Ambidexterity Score** for a given year as the arithmetic mean of all Network Ambidexterity Scores recorded that year.

In Table 2.10, we take again the same examples of managerial decisions as before but this time with the results related to partnership intensity and network ambidexterity.

In these examples, several actions decided by the management were involving different departments in the organization at the same time (rating -1). The sale of licenses for instance (observation n°283) engages different teams in the due diligence process during which the potential licensee evaluates the technology of interest as its superiority must be demonstrated in practical terms (technical feasibility), financial terms (cost competitiveness), intellectual property terms (freedom to operate) etc... In a similar way, dealing swiftly with fast deteriorating economic conditions (observation n°307) requires that actions be taken simultaneously and collaboratively by different services such as production (a profit recovery initiative aimed at implementing cost savings) and sales departments (new marketing approach). Conversely, pure R&D projects can be conducted by a single team (rating +1), in this case the R&D department, eventually in partnership with external institutional (observation n°363) or private (observation n°372) organizations. Interestingly, the rating for structural ambidexterity is less contrasted when joint-ventures are concerned because their activities may either associate several departments such as in the set up of a fullblown production and sales

joint-company (rating -1 for observation n°81), or it may involve only one team as in the case of a pure R&D joint-company (rating +1 for observation n°140)²⁷.

Here again, averaging the ratings of all observations of a given year gives the value of the index for this year. The use of averages allows for a direct comparison between years even if they are made of a different number of observations. Correspondingly, compounded averages of several years allow for a direct comparison between epochs as shown in Table 2.9²⁸.

On the margins of a vision of ambidexterity at the level of the organization (structural ambidexterity) and its direct entourage (network ambidexterity), our review of the extant literature had highlighted a dimension on the scale of the individual called **contextual ambidexterity**. However, the very nature of most documents constituting the corpus of our archival sources (see Section 2.4.1 Data generation) did not permit a clear enough identification of stretch, discipline, support and trust; i.e. the attributes describing organizational context as per Ghoshal and Bartlett (1994) brought forward by Birkinshaw and Gibson (2004) as the cornerstones of contextual ambidexterity. This can be explained by the fact that our archival sources contain essentially documents made by managers and intended to managers (minutes of management meetings, minutes of board meetings, internal memos etc...) whereas contextual ambidexterity precisely displaces the decision process from a centralized management team to decentralized sub-units or even to the individual employees themselves. Consequently, in spite of an attempt to structure a coding grid using the same Gioia's type of systematic approach as previously adopted to analyze the other aspects of organizational ambidexterity (Figure 2.11), we had to resolve to leave the analysis of individual context on the side. This, however, could be the subject of a forthcoming study.

²⁷ The contribution of support departments such as legal, HR, accounting and financial teams, as important as they are in the process of starting a new company, is not considered here as we focus the concept of ambidexterity on either activities of exploitative nature (engineering, production, sales) or exploratory nature (business development, research and development).

²⁸ Table 2.9 is shown here only to illustrate our point about the use of averages to compare the years between them as well as periods covering several years (epochs) between them. The meaning of each epoch and the interpretation of these results are further discussed in Section 3.

	Year	Structural Ambidexterity
ANTIQUITUS	AO1991	1,00
	AO1992	1,00
	AO1993	1,00
FEODALIS	AO1994	1,00
	AO1995	-0,13
	AO1996	-0,14
	AO1997	0,38
	AO1998	0,14
	AO1999	0,00
	AO2000	0,14
	AO2001	0,29
MODERNITAS	AO2002	-0,23
	AO2003	0,00
	AO2004	0,06
	AO2005	-0,06
	AO2006	-0,33
	AO2007	0,25
	AO2008	0,50
	AO2009	0,38
	AO2010	0,43
	AO2011	0,23
CONTEMPORALIS	AO2012	0,19
	AO2013	0,26
	AO2014	0,20
	AO2015	-0,13

Average for ANTIQUITUS	1,00
Average for FEODALIS	0,21
Average for MODERNITAS	0,12
Average for CONTEMPORALIS	0,13

Table 2.9: Example of average ratings (here the structural ambidexterity score) for each year from 1991 and 2015 and for each major epoch of the company's history.

Observation n°	Year	Actions & decisions	Structural Ambidexterity score	Old/New partner	Existing/new market	Exploitative/Exploratory alliance	Partnership intensity	Network Ambidexterity score
81	2002	B&G, a joint-venture between Galactic and BBKA Biochemicals, is created in China. The JV will license Galactic's existing technologies to produce lactic acid and derivatives. The Chinese shareholder has 51% of the shares but Galactic retains the control of the operations (60% of voting rights). The newly-formed company will produce and sell its products in the whole Asia-Pacific region.	-1	1	1	-2	1	0
140	2007	Creation of Futerro (50:50 JV with Total Petrochemicals) to continue the development of Galactic's PLA technology (access to expertise in polymers' application development)	1	1	1	2	1	4
283	2012	Galactic sells a license to Total on its technology for L-lactic acid, D-lactic acid and PLA recycling (Loopla®). According to the licensing contract and thanks to a preliminary ruling agreement with the tax authorities, the total amount of those licenses received in cash in 2012 is viewed as the present value of future annual licensing fees which is therefore booked in the balance sheet as deferred revenue that will be amortized in the following 8 years (non-cash). The resulting improvement of the cash position allowed the company to bring back its long-term debt-to-equity ratio to a healthier level.	-1	-1	-1	-2	1	-4
307	2012	The situation in China was further deteriorating. The global demand for lactic acid was declining as a result of the global economic meltdown. In the first quarter of 2012 for instance the total exports of lactic acid from China declined by 51% compared to the same period of the previous year and the competition was fierce since all lactic acid producers were trying to maintain their sales volumes. The directors of the B&G board then decided to launch a profit recovery initiative and the management resolved to implement the same product promotion strategy based of customer-centric marketing approach as the one Galactic was executing in Europe to enhance the promotion of higher-value specialties.	-1	0	0	0	0	0
363	2014	Galactic supports a PhD thesis at the Catholic University of Louvain which purpose is to isolate and characterize new strains of bacteriocins-producing microorganisms directed specifically against Gram negative pathogens.	1	-1	0	2	1	1
372	2015	Galactic signs a MOU with a major dairy producer, to evaluate the possibility to produce lactic acid out of one of its dairy byproducts that will be piling up with the sharp increase in milk production expected following the cancellation of EU milk quotas. The two companies start lab scale tests in order to develop a process adapted to this new raw material and reaching the quality standards required by the market.	1	1	-1	2	1	2
383	2015	Galactic implements a new Customer Relationship Management system (CRM) which allows to improve its market prospection activities with the help of clearly defined workflows and better sales follow-up procedures. The system is deployed in Europe and North America. Asia and Latin America will follow later.	-1	-1	-1	-2	1	-4

Table 2.10: Example of ratings to measure structural ambidexterity, partnership intensity and network ambidexterity.

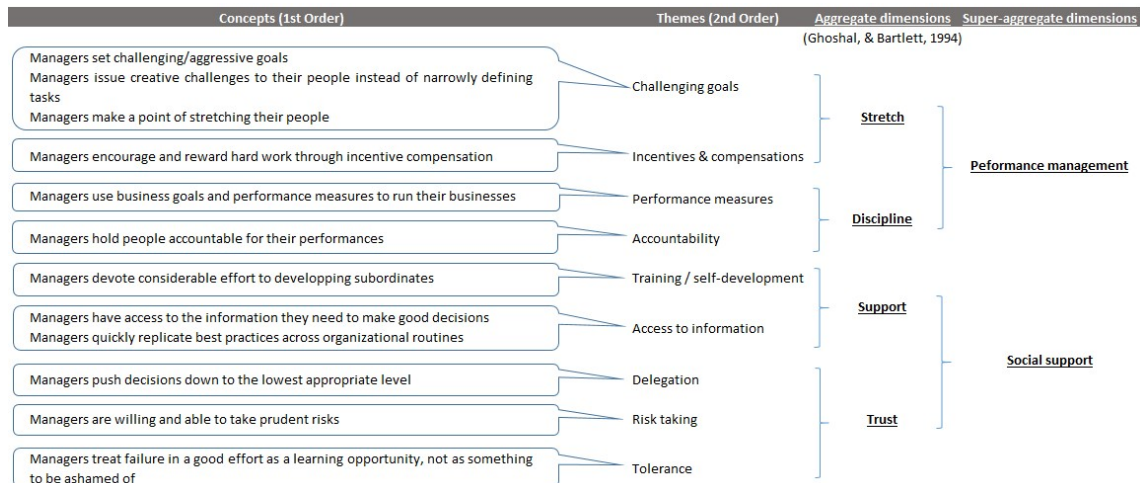


Figure 2.11: Concepts, themes and aggregate dimensions of contextual ambidexterity
(references: Birkinshaw & Gibson, 2004; Gibson & Birkinshaw, 2004).

Another line of thought somewhat connected to organizational ambidexterity refers to the principles of **Causation and Effectuation**. In this regard, it is worth mentioning that we came across these notions in a rather inductive manner after we finished writing our literature review, when we were drawing up our narrative about the history of our unit of analysis. Indeed, it was when we came to describe one of the major strategic inflections in the history of the company that, returning to the corpus of theories in management science, we discovered these principles initially posited by Sarasvathy in 2001 (Sarasvathy, 2001). As a reminder, causation processes focus on selecting among available means to create a given effect²⁹ whereas effectuation processes focus on selecting among possible effects that can be created with a given set of means; and we recall the metaphor of the chef cooking a dinner (Sarasvathy, 2001) who can either start from the menu and select ingredients and utensils (a causation process of exploitative nature), or he can start from available ingredients to design a possible menu (an effectual approach of exploratory nature).

In a similar way as previously described, we have applied Gioia's systematic methodology to cluster first-order concepts into second-order themes to lead ultimately to aggregate dimensions (Table 2.11). The concepts and themes as well as the bibliographic sources are detailed in Appendix V.

²⁹ Sarasvathy defines an effect as the operationalization of an abstract human aspiration (Sarasvathy, 2001, p.245).

Aggregate dimensions	Aspects	
	CAUSATION	EFFECTUATION
Type of analysis	Definition of targets (market surveys) Selection of resources needed Analysis to provide expected return ("gain more")	Definition of resources available Choice of possible targets Assessment of affordable loss / acceptable risk ("lose less")
Organizational actions	Design of strategy - Plannification Deployment of defined business model - Control to reach target Prediction of an uncertain future	Seizing opportunities - Exploiting contingencies Development of new business models Control of an unpredictable future
Supply-side actions	Improvement of existing products Exploitation of preexisting knowledge	Development of new product
Demand-side actions		Alliance - Partnership Seeking pre-commitments from customers

Table 2.11: Aggregate dimensions and their constitutive themes for Causation and Effectuation.

For the sake of practicability, we further condense the themes in order to end up with the rating grid of Figure 2.12.

Org. Actions	Value
Design of strategy. Plannification. Deployment of defined business model	-1
Nihil	0
Seizing opportunities. Exploiting contingencies. Development of new business model	1

Supply-side Actions	Value
Improvement of existing technologies, processes, products	-1
Nihil	0
Development of new technologies, processes, products	1

Demand-side Actions	Value
Nihil	0
Seeking pre-commitments from customers	1

Type of analysis	Value
Analysis to provide expected return ("gain more")	-1
Nihil	0
Affordable loss/acceptable risk ("lose less")	1

Figure 2.12: Rating grid for Causation versus Effectuation (-1 for causation; +1 for effectuation).

Not surprisingly, our 4 aggregate dimensions are rather well aligned with Sarasvathy's 4 main principles of the Effectuation process (Sarasvathy, 2001, p.252):

- Our dimension "organizational actions" corresponds to the principle of "controlling an unpredictable future (effectuation) rather than predicting an uncertain one (causation)" (opcit.). The logic behind the causation process is "to the extent that we can predict the

future, we can control it” (opcit.) which is what companies aim at when designing their strategies, planning their operations and deploying their predefined business models. Conversely, the rationale supporting the effectuation process is “to the extent that we can control the future, we do not need to predict it” (opcit.) which is a situation that can be achieved when companies are flexible enough to be able to seize opportunities, exploit contingencies and adapt their business models. As a matter of fact, this dimension covers the same themes as the one we named “plannification versus intuition” when coding for exploration intensity, exploitation intensity and ambidexterity score. It shows the proximity of the two theoretical frameworks, i.e. organizational ambidexterity and causation/effectuation, although the former is presented as an organizational paradox potentially present in all types of companies (Brown & Eisenhardt, 1997) whereas the latter is seen more in a processual way among entrepreneurial ventures essentially³⁰ (Farjoun, 2007; Jacquemin & Lesage, 2016; Sarasvathy, 2001a, 2001b; Sarasvathy & Kotha, 2001; Sarrouy-Watkins & Hernandez, 2015).

- Our dimension “supply-side actions”, which opposes the exploitation of existing products or knowledge to the development of new ones, echoes Sarasvathy’s “exploitation of contingencies rather than exploitation of preexisting knowledge”, the former being of effectual nature whereas the latter is of causal nature. Here too, the dimension covers the same themes as used to measure ambidexterity score, i.e. “technologies, processes, and products”.
- The “demand-side actions” which seeks to include prospects and potential customers very early in the business development cycle through alliances, partnerships and/or pre-commitments “as a way to reduce and/or eliminate uncertainty and to erect entry barriers” (opcit.) resorts from an effectual logic. In this case, we decided not to include the partnership-related themes used to characterize the ambidexterity score because the underlying idea of this aspect of the effectual process is to integrate potential customers into the development cycle of new products or services and not merely to engage in operational alliances or even in pure research partnerships. We paid attention to really keep the “demand-side” aspect of this process in mind when rating for this dimension.

³⁰ Some authors including Sarasvathy herself claim that effectuation theory may not be restricted to the domain of entrepreneurship and that it may not be limited to small start-up firms (Wittbank & Sarasvathy, 2010).

- Our dimension about “type of analysis” contains the elements put forward by Sarasvathy in her principle about “affordable loss rather than expected return” that she justifies as follows (opcit.): “Causation models focus on maximizing the potential returns for a decision by selecting optimal strategies. Effectuation predetermines how much loss is affordable and focuses on experimenting with as many strategies as possible with the given limited means. The effectuator prefers options that create more options in the future over those that maximize returns in the present”. This dimension is related to the theme “economy of scale, reduction of costs, improvement of yields” defined for the ambidexterity score.

Table 2.12 gives the ratings obtained to measure causation versus effectuation intensity for the same examples of managerial actions and decisions as before.

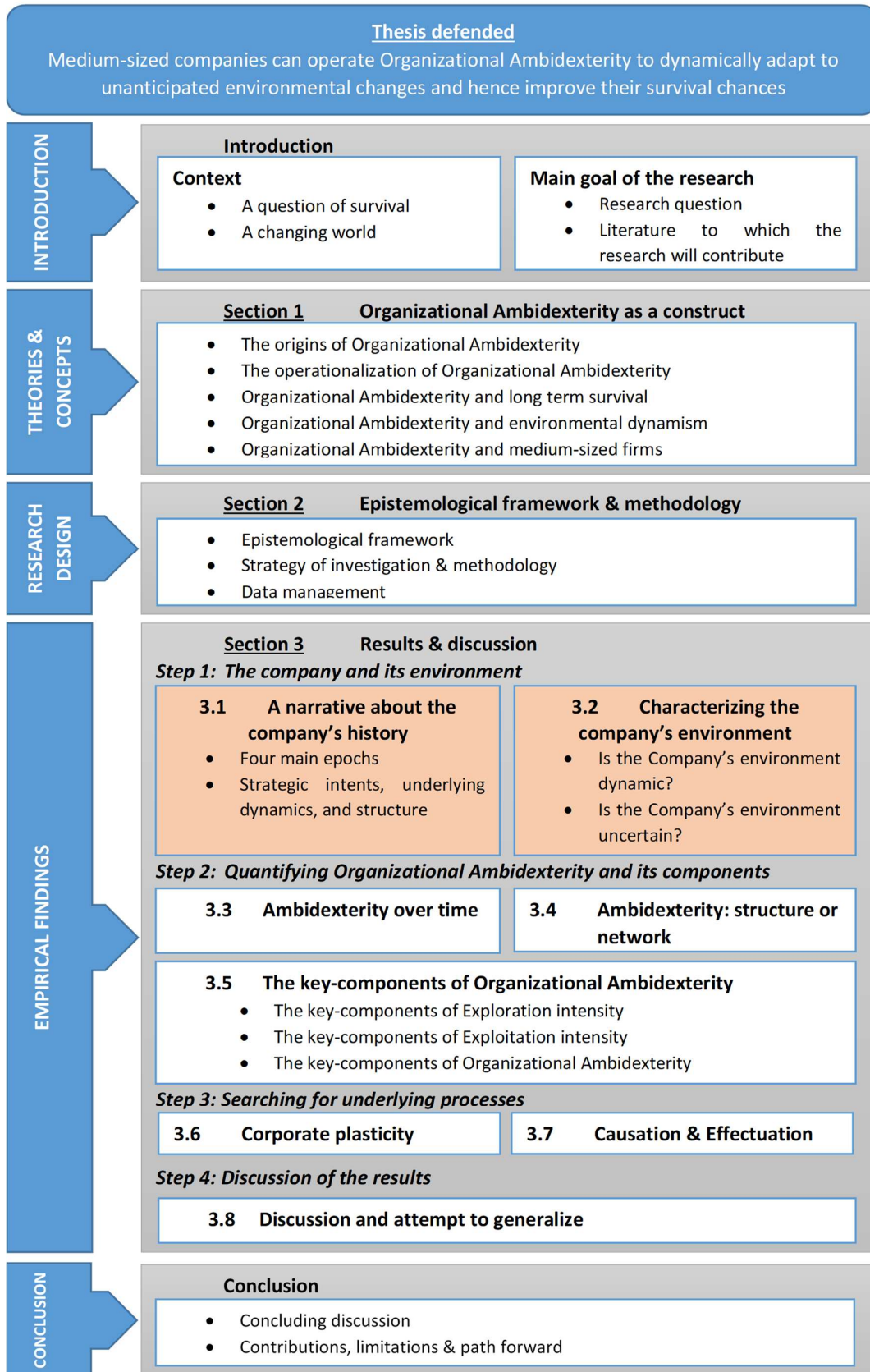
Observation n°	Year	Actions & decisions	Causation vs. Effectuation			
			Organizational actions	Supply-side actions	Demand-side actions	Type of analysis
81	2002	B&G, a joint-venture between Galactic and BBKA Biochemicals, is created in China. The JV will license Galactic's existing technologies to produce lactic acid and derivatives. The Chinese shareholder has 51% of the shares but Galactic retains the control of the operations (60% of voting rights). The newly-formed company will produce and sell its products in the whole Asia-Pacific region.	-1	0	0	-1
140	2007	Creation of Futero (50:50 JV with Total Petrochemicals) to continue the development of Galactic's PLA technology (access to expertise in polymers' application development)	1	1	0	2
283	2012	Galactic sells a license to Total on its technology for L-lactic acid, D-lactic acid and PLA recycling (Loopla®). According to the licensing contract and thanks to a preliminary ruling agreement with the tax authorities, the total amount of those licenses received in cash in 2012 is viewed as the present value of future annual licensing fees which is therefore booked in the balance sheet as deferred revenue that will be amortized in the following 8 years (non-cash). The resulting improvement of the cash position allowed the company to bring back its long-term debt-to-equity ratio to a healthier level.	-1	0	0	-1
307	2012	The situation in China was further deteriorating. The global demand for lactic acid was declining as a result of the global economic meltdown. In the first quarter of 2012 for instance the total exports of lactic acid from China declined by 51% compared to the same period of the previous year and the competition was fierce since all lactic acid producers were trying to maintain their sales volumes. The directors of the B&G board then decided to launch a profit recovery initiative and the management resolved to implement the same product promotion strategy based of customer-centric marketing approach as the one Galactic was executing in Europe to enhance the promotion of higher-value specialties.	-1	-1	0	-3
363	2014	Galactic supports a PhD thesis at the Catholic University of Louvain which purpose is to isolate and characterize new strains of bacteriocins-producing microorganisms directed specifically against Gram negative pathogens.	1	1	0	2
372	2015	Galactic signs a MOU with a major dairy producer, to evaluate the possibility to produce lactic acid out of one of its dairy byproducts that will be piling up with the sharp increase in milk production expected following the cancellation of EU milk quotas. The two companies start lab scale tests in order to develop a process adapted to this new raw material and reaching the quality standards required by the market.	1	1	0	2
383	2015	Galactic implements a new Customer Relationship Management system (CRM) which allows to improve its market prospection activities with the help of clearly defined workflows and better sales follow-up procedures. The system is deployed in Europe and North America. Asia and Latin America will follow later.	-1	-1	1	-1

Table 2.12: Example of ratings to measure causation versus effectuation intensities of managerial decisions or actions.

Armed now with a fairly comprehensive dataset covering the 25 years of the history of the company and a quite detailed code-book that allowed to rate and quantify the components of various aspects of organizational ambidexterity, we will devote the next section to the analysis of their evolution over time and to the identification of their interactions. Then, after this analysis of quantitative nature, we will try to put our findings into perspective in view of the events that have marked the history of the company and of the strategic inflections that have resulted therefrom in order to better understand how generative mechanisms and underlying processes of organizational ambidexterity are activated with regards to contextual conditions.

Section 3. Results and Discussion

Step 1: The company and its environment



3.1. A narrative about the company's history

History entails the lining up of events in an orderly sequence of cause and effect. Throughout human history we have found it meaningful to think of events as somehow interconnected (de Rond & Thiétart, 2004). Understanding the causation of events is a condition of our capacity to understand what is going on around us (Carr, 1961). The categorization of the past into discrete and quantified named blocks is called “periodization”.

Some scholars, focusing on strategic change, have documented major epochs (Mintzberg, 1978), periods of quantum changes (Danny Miller & Friesen, 1984b), reorientations (Tushman & Romanelli, 1985) in strategy making (Burgelman, 1991), and many have adopted the metaphor of organic growth, such as in life-cycle theory, as a heuristic device to explain development in an organizational entity from its inception to its termination. Life-cycle models depict the process of change in an organization as progressing through a necessary sequence of stages whose content is prescribed by an institutional, natural or logical program (Van de Ven & Poole, 1995). Miller & Friesen (1984a) for instance have described and tested five common stages of corporate life-cycle: birth, growth, maturity, revival, and decline.

In our attempt to narrate the history of Galactic, we decided not to follow this rather classical and somewhat reductionist view, but to ‘periodize’ the company’s history in phases, or epochs (Mintzberg, 1978), that better fit its own development over time. We believe this approach will help shedding light on the various aspects of organizational ambidexterity that have been operationalized by the company throughout its life.

3.1.1. *The four main epochs of the company's history*

We align the main phases of the company’s history to the main periods of human History as they both describe, one at a micro-level and the other at a macro-level, a journey towards more complexity and they show some similarities. In a nutshell, these major epochs are:

Antiquitus. This Latin word means ‘prior’ or ‘ancient’. In our timeline, it designs the period that precedes the official inception of the company but which is of importance in understanding the intentions and cultural elements that lead to its incorporation. This period ends with the creation of the company in 1994.

Feodalis which starts when the company was created. In human History the Middle Ages, also referred to as the Postclassical Era or the Medieval period, were considered as a period of darkness and ignorance separating the Classical period of learning and culture from the humanist ideals of the Renaissance. This is not the meaning that we want to stress out here. As a matter of fact, the Feudal period provided the foundation for the transformations of the humanists' own Renaissance. It was a period, especially the High Middle Ages, during which the population of Europe increased greatly as technological innovations allowed trade to flourish (the growth of the company' sales was then organic and focused on its exports). It was also a period in which a political structure emerged whereby knights and lower-status nobles owed service to their overlords in return for privileges (a situation quite close to the hierarchical organization of a growing entrepreneurial company centered on its CEO and founder). And, it was a period where travels like Marco Polo's and the setting up of trading posts in some far-away countries pushed the boundaries of the society. In short, the Middle Ages were not that much of a dark period of illiteracy and blindness but rather times where cultural and technological developments transformed the European society, leading it to the early modern period. For Galactic, this period of growth, structuration and development started in 1994 and lasted until 2001.

Modernitas. The Modern Period in human History began with the voyage of Christopher Columbus in 1492 and more generally covers the establishment of a global network with, at about the same time, the opening of a maritime route to the East. In Europe, it comprised, among other episodes, the European Renaissance (14th – 16th century), the Age of Discovery (15th – 17th century) and the Age of Enlightenment (18th century). For Galactic, this age started in 2001 with the desire to expand geographically, not only by setting up sales relationships with customers and distributors in many countries sourced from Galactic's Belgium-based only factory as was done before, but with the idea to erect and operate production facilities on other continents. This period that ended in 2011 was characterized by a rapid growth (both in terms of company activities and in terms of population, i.e. company staff), many organizational and structural changes (similar to the Industrial Revolution in the human History), and by environmental challenges (e.g. episodes of heightened competition and price wars, like the Napoleonic campaigns have been in human History – relatively speaking; and the

global crisis in 2008 that can be paralleled with the Long Depression that lasted from 1873 to 1896).

Contemporalis. We consider that the Contemporary Period began for the company with the acquisition of a new research center end of 2011. This acquisition ignited a revolution³¹ in the company's way to approach its markets and develop new products. This is the time when the company progressively transformed from being a mere producer of lactic acid and a few derivatives into becoming a provider of a much wider portfolio of natural solutions. To support this transition, the company decided to merge its corporate R&D and European sales/marketing departments, both in management terms (same leadership) and in organizational terms (same building infrastructure). The intention was to reduce the distance between the company scientists and the market and hence improve the time-to-market for its new developments. In human History, it is generally accepted to consider that the Contemporary Period started with World War I³² and lasts until now. Fortunately enough, this period did not start with a real war for the company but it was nevertheless the strategic response to a global trend by which lactic acid was evolving more and more towards a commodity status. This change in the company's business model somewhat mirrors the evolution of human History throughout the 20th century, and even more so during the 21st century, that has put the human individual (here: the customer) at the center of all activities as the focal point and the dynamic force (Friedman, 2005). The point is no longer to define what the company has to offer but to better understand what the customer wants to buy. It seems trivial but it is not, in a capital-intensive industry with long development cycles and low success rate such as the one in which Galactic evolves.

Figure 3.1 compares the main phases in the company's history with the major time periods of the human History and highlights their similarities.

³¹ The term "revolution" is here used in a "Tushmanian" sense which considers changes at the firm level (Romanelli & Tushman, 1994; Tushman & O'Reilly, 1996), as opposed to Meyer who uses this word specifically for the industry level and prefers the term "metamorphosis" to depict changes at the level of the company (Meyer et al., 1990).

³² This is an anglosaxon perspective. French historians prefer to consider 1789, the French revolution, as the turning point between the modern era and the contemporary period.

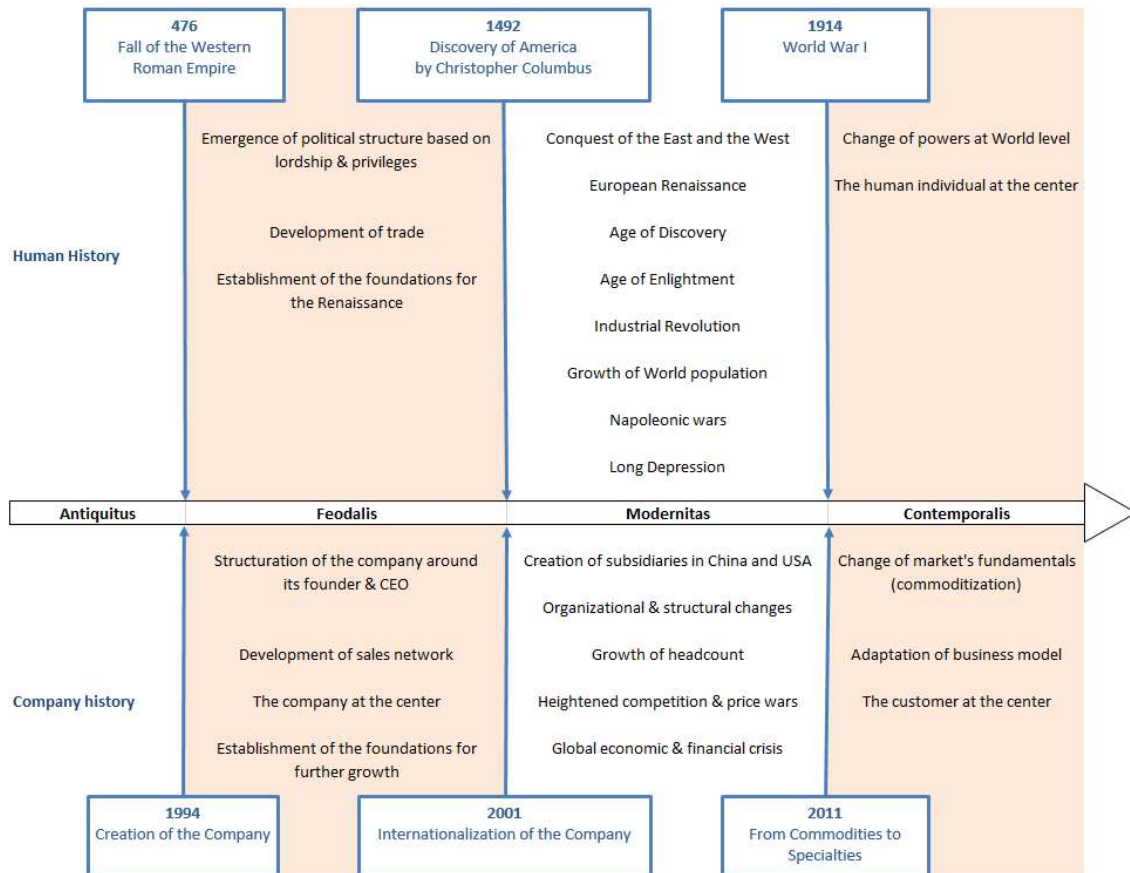


Figure 3.1: Comparison of the company's major epochs with the major time periods of the human History.

Appendix II narrates each of these major phases with some level of detail in order to reconstruct the company's history and identify the internal and external changes that have paved its evolution until now. To provide the reader with a better understanding of the environmental context in which the company evolved, we include here and there short vignettes describing the external factors and main events that have shaped the company's direct environment. In that we follow the recommendation of Dumez (2016, p.131) when he says that "Timelines (chronologies) should be multiple. Different dimensions must be taken into account to understand the dynamics of action or interaction: technology, political environment, regulatory decisions, organizational changes etc. Causal mechanisms can intervene between events belonging to different dimensions and these mechanisms can be isolated only if the order of succession of events is determined with sufficient accuracy".

In the next chapter we present some characteristics of the three main epochs that emerged from our analysis of the various documents consulted during the writing of the narrative of the company's history.

3.1.2. *Strategic intents, underlying dynamics, and structures*

“Whether initial success is the result of competence or luck, top management's role is to articulate an organizational strategy that will help secure continued survival.”

(Burgelman, 1991, p.283)

If we exclude the period prior to the creation of the business, three main epochs emerge which were characterized by profoundly distinct strategic intents. We define a “strategic intent” as the intention, openly acknowledged or not, which underlies and motivates the strategic actions implemented by an organization. With this definition we go further than the generally accepted meaning often reduced to a mere motivational statement of the means by which the top-management wants the organization to achieve its mission³³. During the Feodalis period (1994-2001), the intent revolved essentially around structuring the company at all levels of the organization and gaining a reputation as second producer worldwide. The next period, Modernitas (2001-2011), saw the company internationalizing its activities by opening subsidiaries in the Far East first and then to the West. Later, during Contemporalis (as from 2011), the firm had to undergo a profound change to survive increased competition and commoditization³⁴ of its main products by implementing a strategy based on specialization³⁵.

³³ Hamel and Prahalad (1989) define Strategic Intent as "an ambitious and compelling dream that energises and that provides the emotional and intellectual energy for the journey to the future". Strategic Intent as a concept was born in Post-World war II Japan when it emerged as world leader in economy. Hamel and Prahalad observed that Western companies were adjusting their ambitions to the resources available whereas Japanese corporations leveraged resources by accelerating the pace of organizational learning and fostering the desire to succeed among their employees to attain seemingly impossible goals.

³⁴ In business literature, commoditization is defined as the process by which goods that have economic value and are distinguishable in terms of attributes (uniqueness or brand) end up becoming simple commodities in the eyes of the market actors. The key effect of commoditization is that the pricing power of the manufacturer or brand owner is weakened: when products become more similar from the customers' point of view, they will tend to buy the cheapest (<https://en.wikipedia.org/wiki/Commoditization>).

³⁵ We don't use the word “specialization” as opposed to “generalization” (when businesses try to encompass as many features and capabilities as possible, also sometimes referred to as “diversification”) but to indicate that the company moved its focus from commodity to specialty products. Specialty products have unique characteristics for which enough customers are willing to make a special purchasing effort, they are not easily substituted by other

The interfaces between epochs look like turning points which Burgelman calls “strategic inflection points” to describe “the giving way of one type of industry dynamics to another; the change of one winning strategy into another; the replacement of an existing technological regime by a new one” (Burgelman & Grove, 1996, p.10). In our case, the first turning point, when the company was created in 1994, is not really an inflection point but more accurately a starting point. It complies however relatively well with Burgelman’s replacement of technological regimes since the firm was actually incepted to exploit a new purification technology initially developed by its founder and which would revolutionize the lactic acid industry. Twenty years later, about 80% of the worldwide production relies on this technology or close variants of it. Ironically, it is precisely the cost efficiency of this new technology that will later be responsible of a move from differentiated to undifferentiated price competition and from monopolistic to (almost) perfect competition. This commoditization effect will be at the core of another inflection point in the company’s strategic development in 2011.

In fact, the two strategic inflection points in the history of the company, respectively around 2001 and 2011, find their origin in fundamentally different environmental factors even if they were both perfectly intentional. In 2000, Galactic’s management started to perceive a profound mutation in the market structure. Indeed, thanks to the expansion of the processed food industry consecutive to the urbanization of the world population, to changing eating diets in developing countries towards the rising consumption of meat and dairy products, and to the spreading of new applications for lactic acid and lactates, demand was growing exponentially and the offer would need to follow with ever larger production units. In addition to size, lowering production costs was calling for the integration of lactic production units to existing massive crop-processing sites. A comprehensive strategic analysis was launched that concluded on the need to settle down closer to fast-growing foreign markets (Asia, United States) and reduce dependency to beet sugar as single raw material. The decision to start this geographical expansion with Asia was supported by the growth potential in this area, particularly pulled by China’s rocketing development, and by the competitive environment in this region of the world. This was at this time the only continent where Purac, the world leader, did not have a factory. In Japan, another producer was suffering from extremely high production costs therefore limiting the company to a few niche markets, whereas the dozen of Chinese producers were

products or products from other suppliers. The uniqueness of specialty products perceived by customers supports market strategies based on differentiation (Porter, 1980). Conversely, commodity products are the same as other products of the same type offered by other producers or manufacturers, they are easily interchangeable. Market strategies based on commodities generally require low cost positions or cost leadership (opcit.).

manufacturing low quality products which were also poorly marketed. China looked also attractive because the Central Government had decided to list lactic acid production among the priorities of its newly adopted five-year plan. As a result of this strategic repositioning, Galactic opened a joint-venture company in China in 2002, a fully-owned subsidiary in the US in 2005 and a sales office in Japan in 2009. As we can see, the inflection of the company' strategy was then primarily triggered by new opportunities in the market place. We will see later in this study that other environmental conditions such as feedstock prices and foreign currencies were also forming a positive context at this moment in time supporting a global expansion of the company's activities. In structural terms, the internationalization phase that followed the 2001 strategic reorientation was accompanied by decentralization of the company's decision-making structures.

Environmental conditions were much less supportive in 2011 with a gloomy macroeconomic context and extremely expensive feedstocks and rocketing oil prices in addition to a heightened competition intensity and the slow but relentless commoditization of its flagship products already depicted. As its structure and size did not allow Galactic to become a low cost champion, coping easily with raw materials volatility and defeating competition directly³⁶, the company needed to respond and adapt quickly to the new environmental situation by focussing on specialties and turning attention to its customers³⁷. In short, the management decided to turn the company from being a "me-too" commodity seller for the main part in the food industry to being a reliable innovative solution provider in food, feed and industrial segments. To achieve that, the company resolved to re-centralize the decision-making processes and merge the sales, marketing and R&D departments with the view to reduce the distance between its scientists and the market in order to better anticipate customers needs and reduce the "time-to-market" for its innovations. An ambitious program called "Competing for Growth: a new shape for a sustainable future" was designed around three pillars: exploiting the company's core competencies in product and process development; enhancing the company's market and application knowledge through market-driven initiatives and through partnering with customers; and improving the company's image and notoriety through increased market presence and enhanced communication. In concrete terms, the first action was to improve what

³⁶ Burgelman & Grove (2007, p.969) explain that "Forces driving toward commoditization (...) may change the rules (e.g. lead customers to expect lower price and higher quality) so that manufacturing process rather than product innovation becomes the new basis of competition".

³⁷ Small businesses that can not take the lead on their competitors by doing better can choose to turn to their customers and offer more specialized products or services that the customers will value better (Xie, 2012), and competition will then become "irrelevant" (Kim & Mauborgne, 2004).

the company called “customer reach”, i.e. targeting and satisfying customers’ needs, by focusing on key-segments and prioritizing markets. Hence, it was decided to increase the sales force, to split them in two teams, i.e. food and non-food, to increase technical resources, and to align those on the sales teams in two teams as well. At the same time, a priority was to restructure the distribution network, not only following a geographical segmentation as it was the case formerly, but by selecting specialists of each market segment instead of generalists “one-stop-shop” type of distributors. A second action was to enhance operational agility by accelerating the speed of response and promoting collaboration. For the former, the speed of response, a point of attention was brought to better anticipate and plan the sales *ex-ante* (before orders are coming in) so that a better execution *ex-post* by logistic departments would be possible. A system of key-performance indicators (KPI’s) was also put in place to raise the team members’ awareness towards the main business drivers and success factors. For the latter, promoting collaboration, the management was hoping that the freshly acquired Galactic Innovation Campus would help breaking the boundaries between the teams (hence improving internal communication) but also that these new facilities would allow to organize product and application demonstrations, trainings of customers and distributors, and co-developments with them. The management restored also a marketing department worthy of the name and reinforced this team as well.

Therefore, if the inflection of the company’ strategy in 2001 was primarily prompted by the emergence of new opportunities in the marketplace and a positive environmental context, it was caused 10 years later by serious threats and negative environmental circumstances likely to jeopardize the vital prognosis of the company.

Figure 3.1 summarizes the key-features of the three main epochs of the company’s history in terms of strategic intent, underlying dynamic and structure.

	Feodalis	Modernitas	Contemporalis
Strategic intent	Structuration	Internationalization	Specialization
Underlying dynamic	From Products to Customers	From Products to Customers	From Customers to Products
Structure	Centralized (Key-people in Belgium) (Departments organized in silos)	Decentralized (Key-people in China & USA) (Departments organized in silos)	Recentralized (Key-people in Belgium) (Sales & Bus. Dev./R&D merged)

Table 3.1: Comparison of the company’s major epochs in terms of strategic intent, underlying dynamic and structure.

The implementation of the different sequences of strategic intent that followed each inflection point was accompanied by a change in the organizational structure of the company. Clearly, the first years of the company's life (Feodalis) were organized centrally around a limited management team based in Belgium. As a consequence of the company's decision to expand abroad from 2001 onwards (Modernitas), it became necessary to review this organization in order to send overseas members of its management team. Indeed, a medium-sized structure such as Galactic has neither human resources nor sufficient financial resources to duplicate the management teams. The same people have thus had to manage different teams on different continents and commute on a regular basis between those different locations. This way of doing allowed a fast transfer of knowledge between the head office and the newly created entities as well as the rapid establishment of a corporate culture and a sense of belonging among the latter to the former. However, the distance separating the different entities both culturally and geographically, as well as the autonomy of management given to the leaders sent to these local entities have gradually led to a certain decentralization of the decision-making bodies³⁸; a trend reinforced by the involvement of middle-managers primarily made of natives from the countries in which the local entities were implemented and the growth in size of these local teams. This may have had an important impact on the inflection of organizational ambidexterity pattern between Feodalis and Modernitas that will be discussed later (Section 3.3.1.) as some studies have shown positive association between exploration and decentralization (Jansen et al., 2006) arguing that “exploration entails non-routine problem solving and search for new knowledge that may make information processing inefficient under centralized decision making” (Lavie et al., 2010, p.122). The second strategic inflection, around 2011 (Contemporalis), saw the reverse movement taking place gradually, that is to say a movement of recentralization³⁹ of the decision-making structures with the return to the Belgian headquarters of the members of the top-management team (first from China and later from USA). As said, Galactic had decided at that time to reorient its overall strategy to react to the slow but relentless commoditization of its flagship products and turn the company from being a “me-too” commodity seller essentially in the food industry to being a reliable innovative solution provider in food, feed and industrial

³⁸ “An organizational structure is called “decentralized” when decision making has been disaggregated into a number of subunits, or divisions, each making its own decisions” (Siggelkow & Levinthal, 2003, p.651).

³⁹ Interestingly, Siggelkow and Levinthal (2003) found out with the help of an agent-based simulation model that temporarily decentralized firms that later reintegrate can display higher performance than pure forms of permanently centralized or decentralized structures. They claim that temporary decentralization has the ability to dislodge a firm from a given set of practices in such a way that it escapes its developmental trajectory. They however warn that such a radical organizational change can be detrimental for minor environmental variations, but that it can have a long-term benefit in case of larger environmental shocks.

segments. The company deemed that such a Copernician revolution implying a change of underlying dynamic (from product-focused to customer-centred) had to be coordinated from the headquarter with the reinforcement of product development teams, market development teams, sales teams and marketing teams on the one hand but also, at the same time, with a strengthening of operational efficiency. We will see in Section 3.3.1. that it had, here again, an effect on the organizational ambidexterity pattern followed by the company.

But let us look at the company's environment before investigating further the way organizational ambidexterity develops over time.

3.2. The company's environment

“Leaders cannot create the context in which they operate. Their distinctive contribution consists in operating at the limit of what the given situation permits. If they exceed these limits, they crash; if they fall short of what is necessary, their policies stagnate.”

On China,
Henry A. Kissinger

The title of the present dissertation hypothesizes a world of growing uncertainty. Similarly, our research question postulates that companies have to dynamically adapt to *unanticipated* environmental changes. Therefore, prior to studying how our unit of analysis (the company Galactic) eventually did to achieve this, we believe scientific rigor imposes to verify if its environment is indeed dynamic and unpredictable.

3.2.1. Is the company's environment dynamic?

The rate of change and the degree of instability of the environment, often referred to as “environmental dynamism”, encompasses multiple facets. In order to characterize the company's environment and quantify its dynamism, a set of data has been constituted with the various external events that affected the company's development. Each and every of these events has been rated in terms of impact (positive or negative) and amplitude, and sorted in regards of the category it belongs to, i.e. competitive intensity, market trend, resource availability, crisis, costs fluctuation, currencies and exchange rates, regulatory framework, and disruptive technology (see Section 2.4.1 for more details).

Figure 3.2 shows the combination of all these elements and helps capture the evolution of the environmental dynamism that surrounded the company throughout its 25 years of existence. As we can see the company evolved in a **largely negative context almost all the time** with a negative intensity⁴⁰ exceeding by far the positive intensity every year since the year 2000. The company obviously succeeded to grow and expand despite this long lasting awkward predicament. In addition to being negative, the firm's environment was obviously worsening

⁴⁰ As a reminder, the negative (positive) intensity measured for a given year is the result of the addition of all negative (positive) contextual events that happened this year weighted by the extend of their impact on the company (Section 2.4.1).

with time (Figure 3.3), at least until the year 2008 when the downward trend stabilized before to start improving slightly in 2014 (mainly, as we will see further, thanks to a modest upgrade of the competitive landscape).

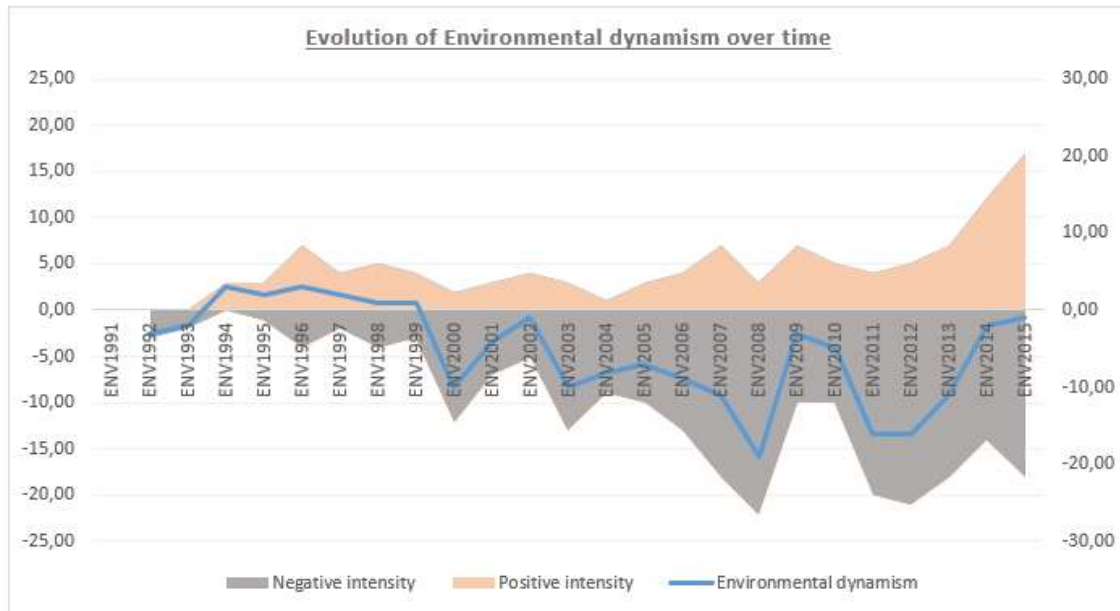


Figure 3.2: Evolution of environmental context over time: negative and positive intensities (left axis), environmental dynamism (right axis)

What is also worth a comment is that the amplitude of cumulated changes, i.e. the difference between the absolute values of positive and negative intensity scores, increased over the years which is an indication of a **growing volatility surrounding the company**. This is not only due to the environment itself but also to the expansion of the firm in new domains, i.e. new geographic areas and new markets, which increases its exposure to new environmental components (as we factored in these new components only when they started to impact the company⁴¹).

⁴¹ As an example, we included the effect of the fluctuation of the Japanese Yen only when the company started to operate in Japan.

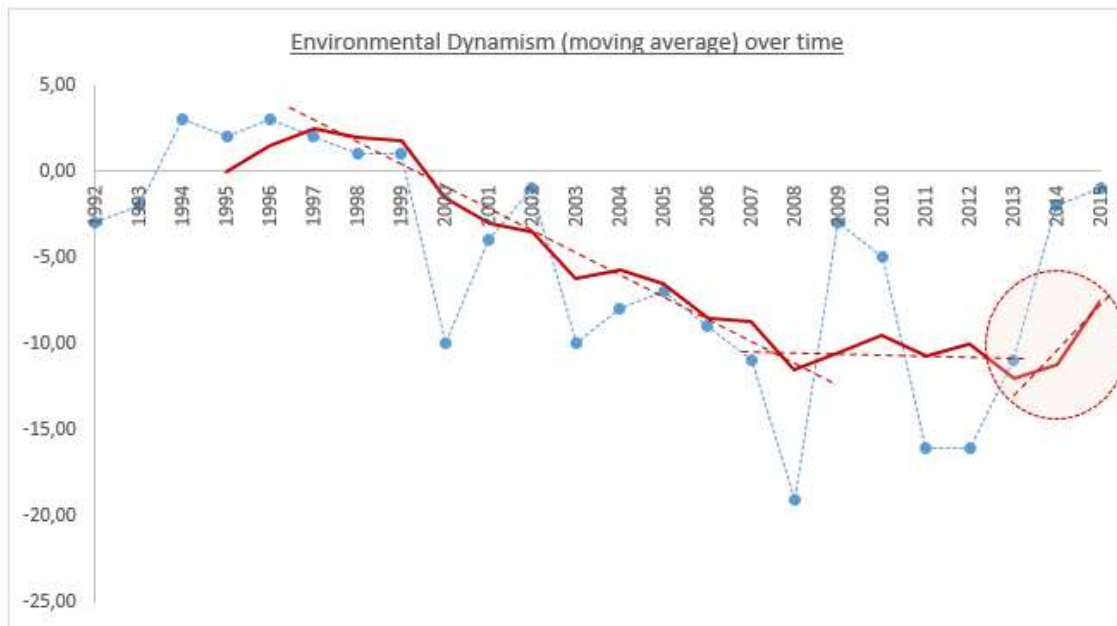


Figure 3.3: Evolution of environmental context over time (with moving average, in red, to dampen the data volatility from one year to the other in order to better capture the real trend behind the data distribution)

Analyzing the evolution of each environmental component⁴² reveals different profiles: incremental evolution for competitive intensity and costs fluctuations (Figure 3.4.a), more erratic patterns (exogenous shocks) for others such as crisis, currencies and exchange rates, and regulatory framework (Figure 3.4.b). It demonstrates the **complexity in which the firm must navigate** and how difficult it is for managers to read such an environment and anticipate the multiple changes.

⁴² We focus here on the five main components and discard disruptive technology, resource availability and market trend which account only for 3% of the number of events recorded in our dataset as shown earlier (Figure 2.4). The 8 parameters are however taken into account when looking at the environmental dynamism as a whole (Figure 3.2 and 3.3).

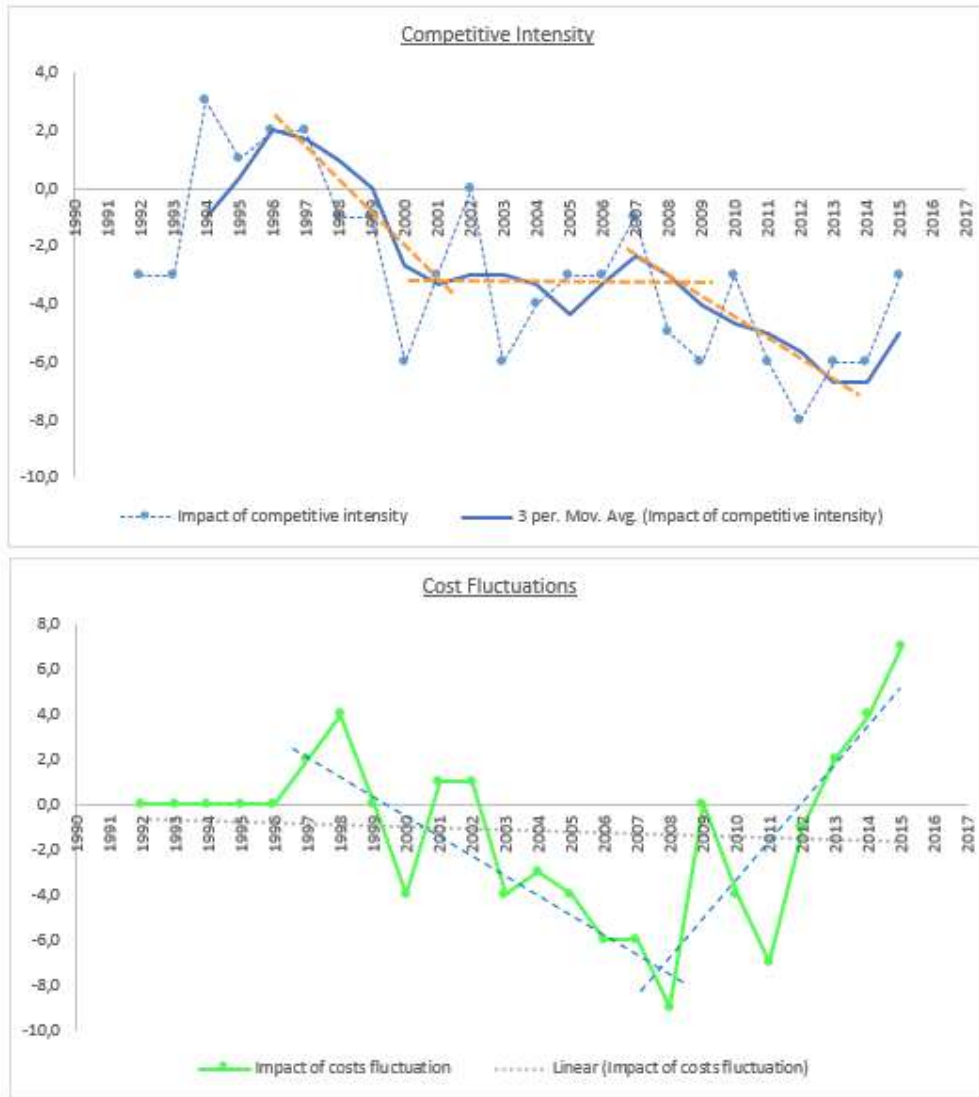


Figure 3.4.a: Components of environmental context which display a predominantly incremental (slow) evolution.

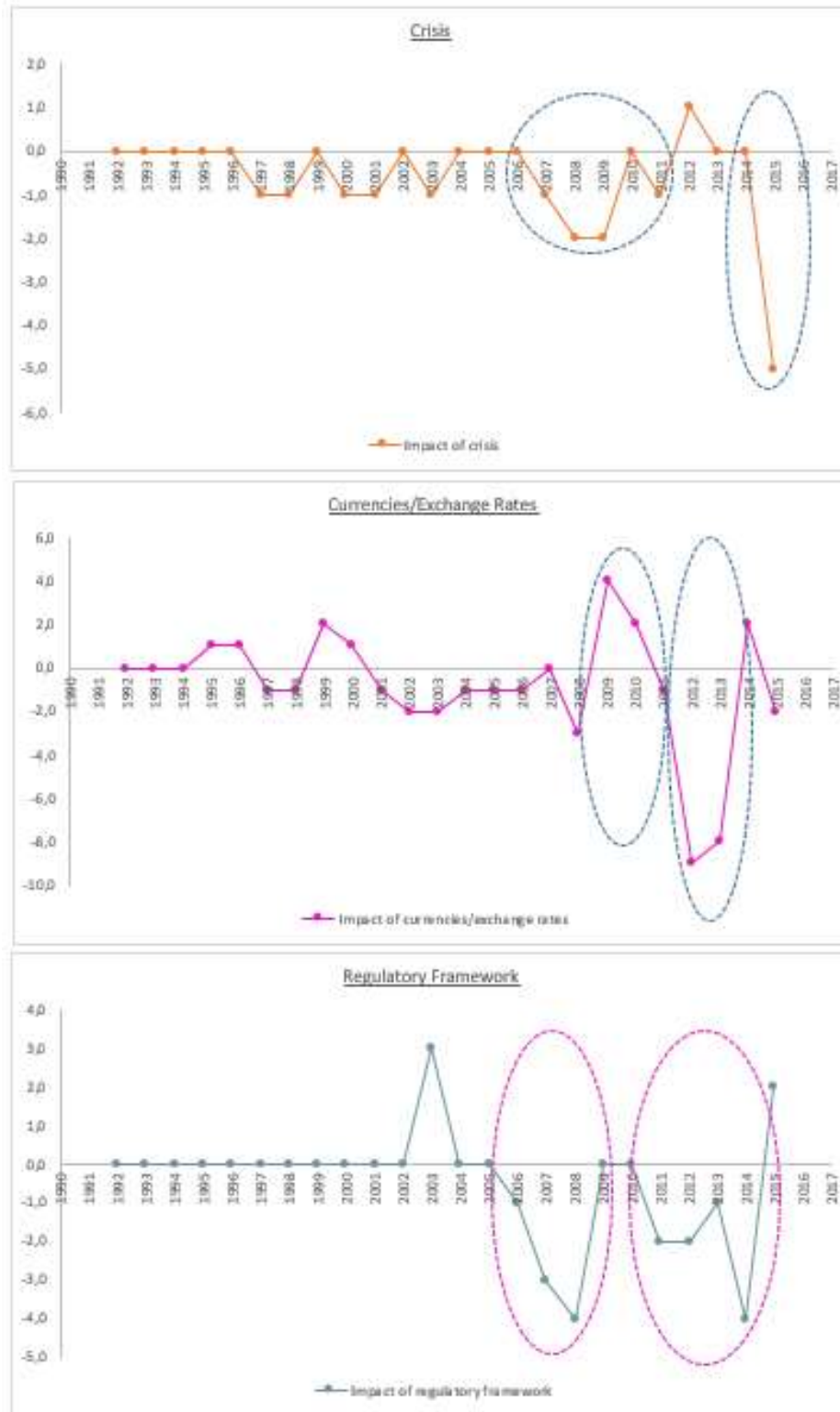


Figure 3.4.b: Components of environmental context which display a an erratic evolution sprinkled with exogenous shocks.

The elements presented above allow us to infer with confidence that **the company is indeed evolving in a dynamic environment and that the level of dynamism is growing** as a result of external factors (e.g. growth of competitive intensity) but also because of its own development which leads to a larger exposure to contextual changes (internationalization and diversification of its activities). In other words, **the more a company expands in a dynamic environment, the more it becomes exposed to the effects (positive or negative) of this uncertain environment**. Some environmental changes cumulate their effects which increase the level of uncertainty⁴³ affecting the company's operations but others, impacting the company in opposite directions, neutralize or mitigate their effects which tends to reduce the volatility surrounding the company.

Yet, we don't only postulate in our research question that the company evolves in a *dynamic* environment but also that this environment is *uncertain* and *unpredictable*. Dynamism and uncertainty are different things. For instance, some industries are considered cyclical by nature (e.g. consumer discretionary goods⁴⁴, luxury goods, the airline industry or – to some extent – the car industry) and others, such as the electric power industry, are strongly regulated⁴⁵; they are less prone to unforeseen variations. Therefore, if environmental dynamism is a necessary condition for uncertainty, it is not a sufficient one which leads to the next question to be answered: is the company evolving in an uncertain, unpredictable context as induced by our research question?

⁴³ We consider here the Knightian uncertainty, sometimes called “true uncertainty”, which consists of a future whose distribution is unknown and unknowable, hence unpredictable by essence, as opposed to the notion of “risk” for which the future responds to a known distribution and can therefore be estimated with statistical tools (Knight, 1921).

⁴⁴ Consumer discretionary goods is a sector focused on products and services that consumers purchase with discretionary income. It is highly sensitive to the business cycle as discretionary expenses are easier to cut from a consumer's budget during hard times than essential costs.

⁴⁵ A regulated industry is an industry closely controlled by the government.

3.2.2. Is the company's environment uncertain?

As schematically presented in the Figure 3.5.a/b, environmental behaviour can take different forms over time (Cheng & Van de Ven, 1996):

- i. the system quickly levels off to a state of equilibrium and the system is said stable
- ii. the system settles to periodic or cyclical behaviour
- iii. the system never settles down to a repeating pattern, in which case the system can be:
 - Chaotic (also called deterministic with nonlinear dependencies)
 - Purely random (also called stochastic).

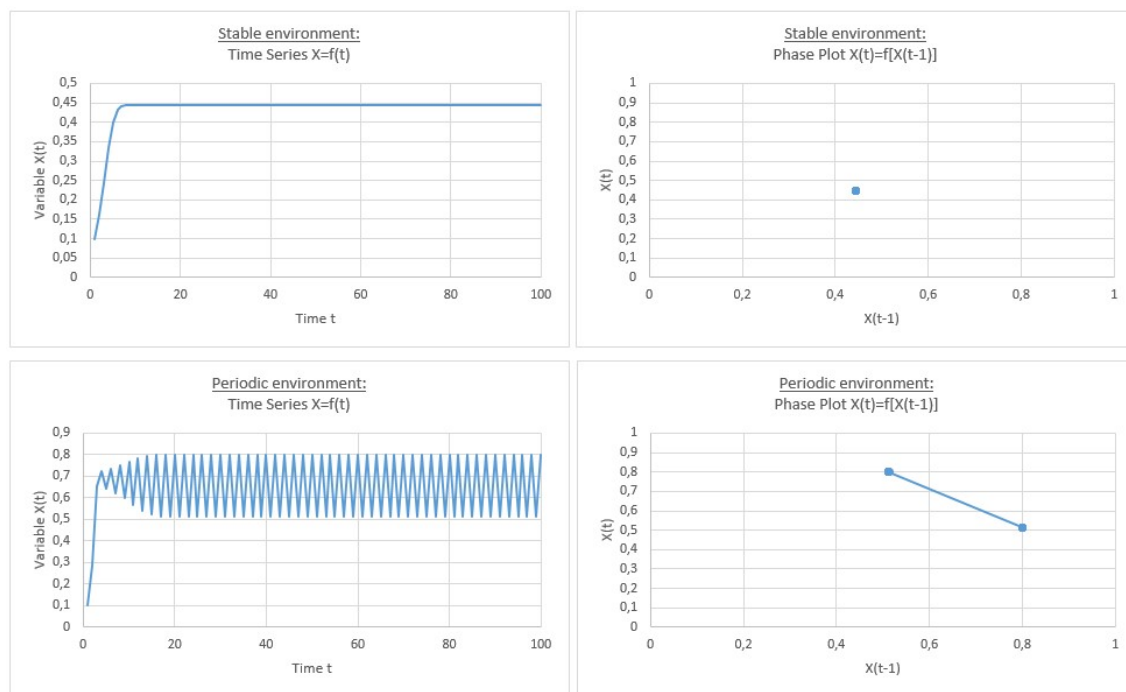


Figure 3.5.a: Time series and phase plots showing stable and periodic behaviors

(The stable and periodic graphs have been obtained with a logistic map of the form $X_t = k \cdot X_{t-1} \cdot (1 - X_{t-1})$ with X being a descriptive variable of the environment and k , a constant governing the degree of nonlinearity, being equal to 1,8 and 3,2 for stable and periodic systems, respectively)(adapted from Cheng & Van de Ven, 1996; Koput, 1992)

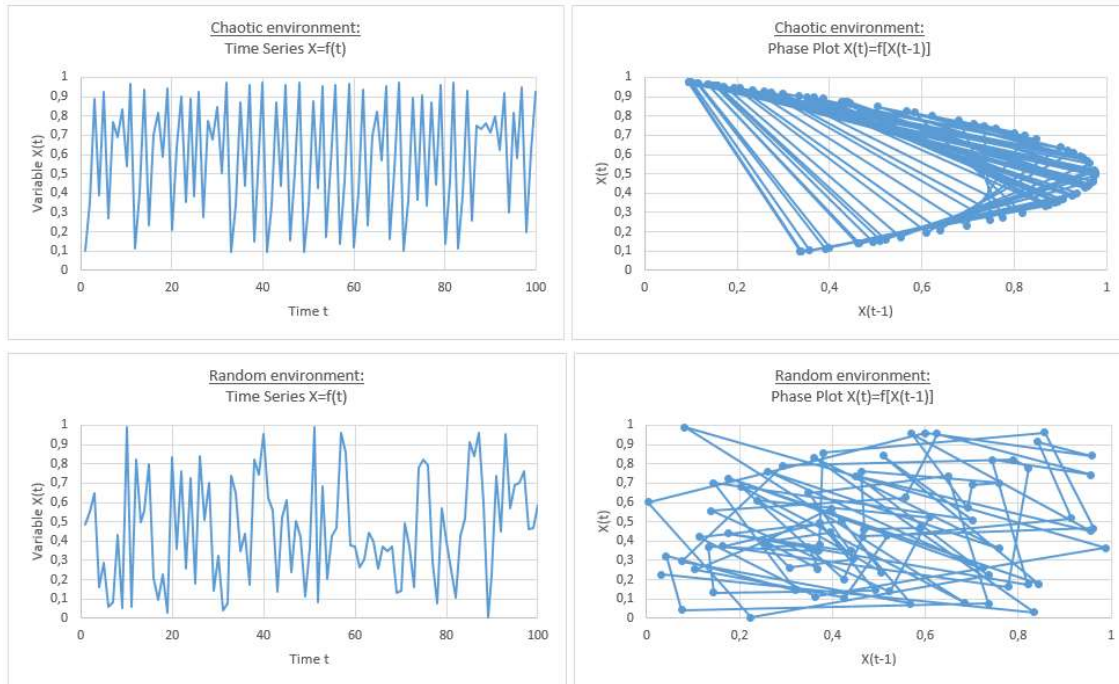


Figure 3.5.b: Time series and phase plots showing chaotic and random behaviors

(The chaotic graphs have been obtained with a logistic map of the form

$X_t = k \cdot X_{t-1} \cdot (1 - X_{t-1})$ *with X being a descriptive variable of the environment and k , a constant governing the degree of nonlinearity, being equal to 3,9)(adapted from Cheng & Van de Ven, 1996; Koput, 1992)(The random graphs have been obtained by using the RAND() function in Excel)*

Stable and cyclical behaviours can be analysed by linear methods through linear correlations, i.e. linear stochastic models such as autoregressive (AR) and moving average (MA) models, and yet they are predictable to a certain degree. The intrinsic dynamics of the system are governed by the linear paradigm that small causes lead to small effects (Kantz & Schreiber, 2004).

Conversely, the irregular behaviour of a system can be attributed either to some random external input, or to dynamic nonlinear chaotic input to the system (Kantz & Schreiber, 2004). “**Dynamic** means that the values a variable takes on at a given time are a function (at least in part) of the values of that same variable at an earlier time. **Nonlinearity** implies that the dynamic feedback loops vary in strength (loose or tight coupling) and direction (positive or negative) over time” (Cheng & Van de Ven, 1996, p.607, emphasis is ours). Another characteristic property of a chaotic system is its **sensitivity to initial conditions** by which “small initial differences or fluctuations in variables may grow over time into large differences, and as they move further from equilibrium they bifurcate or branch out into numerous possible

pathways” (Cheng & Van de Ven, 1996, p.608). In this nonlinear world, small causes lead to big effects – Lorenz’ famous metaphor of the flap of a butterfly's wing which creates, a few months later, a storm. Another way to put it is that, in a chaotic system, similar causes don’t lead to similar effects. The pathways that are taken in the branchings cannot be predicted (Cheng & Van de Ven, 1996) since “a forecast based on imprecise information will be inaccurate, and the magnitude of inaccuracy (...) will increase exponentially as the time period covered by the forecast increases” (Brockman & Chowdhury, 1997, p.500). It is an exponential instability (Forgues & Thietart, 1995).

Ultimately, “the most striking feature of chaos is the unpredictability of the future despite a deterministic time evolution” (Kantz & Schreiber, 2004, p.65). Indeed, as a matter of fact, determinism does not preclude the possibility of chaos. Determinism and predictability are not equivalent. Moreover, chaos and order can be observed in juxtaposition within the same system (an interesting discussion on this subject can be found in Peitgen, Jürgens, & Saupe, 1992, pp.9-14).

So, if chaos or randomness are detected in the company’s environment, we can conclude to the instability and the unpredictability of this environment, and we can start looking at how the company has done to cope with this situation.

Detection of chaos and randomness

The goal of time-series analysis is to learn about the dynamics behind some observed time-ordered data. It consists mainly in compressing a large sample of data into a few characteristic numbers which help enhancing our knowledge about the underlying system provided that we can interpret these characteristic numbers properly. Bradley & Kantz (2015) give an illustrative example with the computation of the mean and the variance: if the observed data are a sample from a Gaussian distribution, these numbers characterize it completely; if, on the other hand, the data stem from a bimodal distribution, the mean value is very atypical and the variance is not meaningful.

Several methods have been developed to detect chaos in time series. The calculation of correlation dimension gives an estimate of the system complexity whereas the determination of Kolmogorov entropy and Lyapunov characteristic exponents quantify the level of chaos in the system (Rosenstein, Collins, & Luca, 1993). The Grassberger-Procaccia algorithm

(Grassberger & Procaccia, 1983) which determines the correlation dimension is probably the most popular method used to quantify chaos but Rosenstein and colleagues (1993, p.117) as well as Brooks (1998) tell us that it is very sensitive to variations of its calculation parameters and it is usually applicable only to long, noise-free time series. The Kolmogorov-Sinai entropy, which is actually a measure of the loss of information due to unpredictability (Kantz & Schreiber, 2004), is the sum of the positive Lyapunov exponents. It is difficult to put in practice since spurious exponents are hard to identify and can be positive as well⁴⁶ (Bradley & Kantz, 2015). We therefore follow Rosenstein et al. (1993) who consider sufficient to calculate only the largest Lyapunov exponent (λ_1) to provide a useful characterization of a chaotic system.

In the previous section, we have referred to an exponential instability linked to a chaotic system being sensitive upon initial conditions. In such a system, initial values of a time series that are close together separate exponentially as time passes. If d_0 describes the distance between these two values at t_0 , the distance between them after n periods of time (d_n) can be described by:

$$d_n = d_0 \cdot e^{\lambda n} \quad (\text{equation 3.1})$$

In this relation, the Lyapunov exponent, λ , measures the rate of separation of the trajectories of the two values over time. Therefore,

- If λ is positive, nearby trajectories diverge exponentially, the system is sensitive to initial conditions. It is chaotic. This is actually true for λ between 0 and ∞ , as $\lambda = \infty$ characterizes random noise.
- If $\lambda = 0$, nearby trajectories do not diverge, the distance between them remains constant, the system is not sensitive to initial conditions and is therefore called *marginally stable*.
- If λ is negative, nearby trajectories converge to a stable fixed point. Such a system exhibit asymptotic stability. The more negative the Lyapunov exponent, the faster the system reaches a stable fixed point and the greater its stability. $\lambda = -\infty$ describes superstable fixed points.

Equation 3.1 can be transformed by taking the logarithms in order to isolate λ :

$$\lambda = \frac{1}{n} \cdot \ln \frac{d_n}{d_0} \quad (\text{equation 3.2})$$

⁴⁶ Spurious Lyapunov exponents are exponents in the reconstructed state space that are not defined in the true state space.

Theoretically, the Lyapunov exponent is a measure of this rate of separation after infinite time (to the limit for $t \rightarrow \infty$), and equation 3.2 becomes equation 3.3.

$$\lambda = \lim_{t \rightarrow \infty} \frac{1}{t-t_0} \cdot \ln \frac{d_t}{d_0} \quad (\text{equation 3.3})$$

However, in practice we cannot afford the luxury of infinitely long integrations and we calculate instead the instantaneous largest Lyapunov exponent with enough integrations to settle to approximately its asymptotic value. Equation 3.3 is then transformed into equation 3.4 which stands if the number of iterations N (or replacement steps in the algorithm that we used – see below) is large enough.

$$\lambda = \frac{1}{N} \cdot \sum_{n=1}^N \log_2 \frac{dx_{n+1}}{dx_n} \quad (\text{equation 3.4})$$

To analyse our data, we use the algorithm developed by Wolf, Swift, Swinney, & Vastano (1985). We have slightly modified the program⁴⁷ to make it “user-friendlier” and to have the Lyapunov exponent calculated for each time step (EVOLV in the Fortran program). It then allows to plot the whole evolution of the Lyapunov exponent over the period under scrutiny in order to see the temporal convergence to its asymptotic value and conclude on the presence or the absence of chaos (with some reserves discussed in section 3.2.5). The modified program is showed in Appendix V. The reader can find a short and clear description of the calculation methodology followed by Wolf and colleagues in Cheng & Van de Ven, 1996.

This algorithm is sometimes contested because it does not test for the presence of exponential divergence but it only assumes its existence and thus it is said to yield a finite exponent for stochastic data also (where the true exponent is actually infinite)(Kantz & Schreiber, 2004, p.69). This is not much of a problem in our case since our purpose is to detect either chaos or randomness to confirm the unpredictability of the environment in which the company is evolving. As discriminating deterministic chaos from pure stochastic volatility is not at the core of our work, we are satisfied with Wolf’s assumptions but we nevertheless discuss this point further hereunder where we confirm that Wolf’s algorithm delivers indeed a positive and not infinite Lyapunov exponent for pure random time series.

⁴⁷ The author thanks Prof. Emeritus Robert Brasseur of the Center for Numerical Molecular Biophysics, University of Liège, Belgium, for helping with the programmation.

The Figure 3.6 below shows typical convergence patterns obtained with Wolf's program for the time series presented as examples of different forms of environmental behaviors in Figure 3.5.a/b.

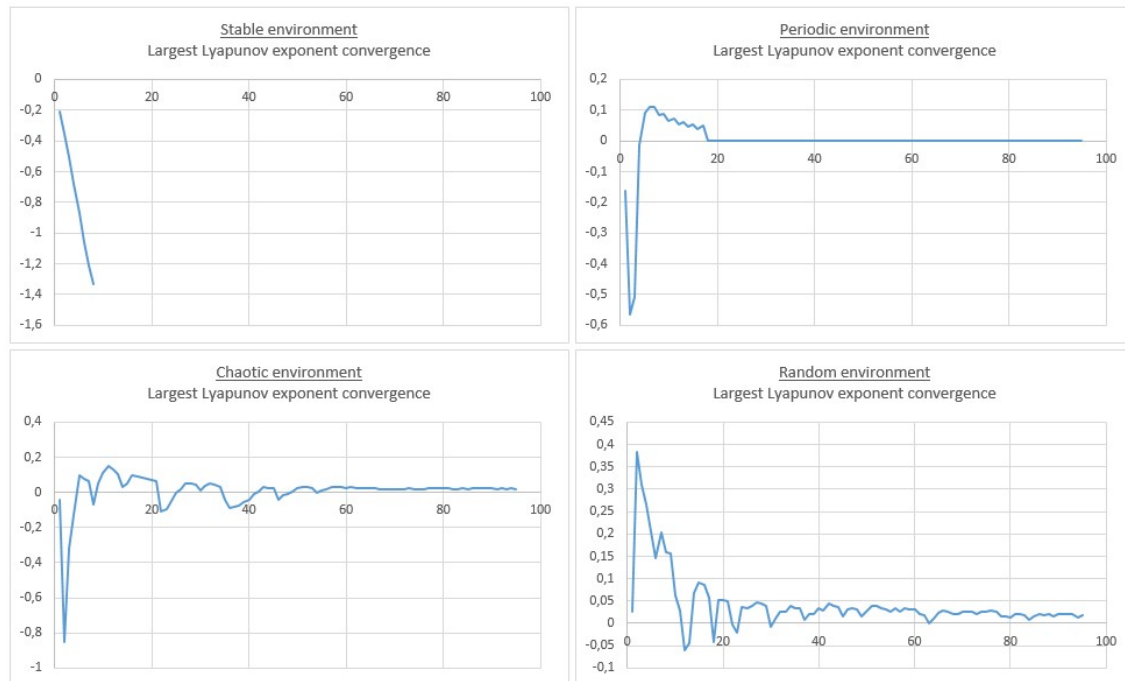


Figure 3.6: Largest Lyapunov exponent convergence plots for different environmental behaviors (The corresponding time series and phase plots are the ones showed in Figure 5.1a and 5.1.b. The input parameters used are: DIM = 3; TAU = 1; dt = 1; SCALMX = 1E-4; SCALMN = 0,3; EVOLV = 1 – see below for further explanations. The Largest Lyapunov exponent could not be accurately calculated for the stable environment, it should logically be $-\infty$. Similarly, the program did not deliver a calculated value for the periodic environment, it should logically be 0. The largest Lyapunov exponent was 1.96E-2 and 1.84E-2 for chaotic and random environments, respectively)

As explained, the Lyapunov exponents measure the amount of uncertainty of the system or, said differently, the rate at which the system loses information. The exponents are then expressed in bits of information per unit of time or in bits per iteration for discrete systems such as experimental time series.

Environmental variables tested

As indicated in the narrative about the company's history, our experience on the field tells us that, beside unexpected events of accidental nature, the company is highly impacted in its day-to-day operations by (at least) three exogenous factors: sugar prices, crude oil prices, and EUR-

USD exchange rates. Our analysis of the different components of environmental dynamism (Section 3.2.1) showed indeed the predominance of costs variations and foreign exchange fluctuations in the events recorded throughout the company's history (they account together for 43% of the events in our environmental dataset). A third variable, competitive intensity, also appeared predominant but, as opposed to currencies and costs factors such as sugar or oil prices, there is no official index recording fine-grained data about the competitors that the company is facing on the marketplace; and our dataset reports only 113 competition-related events which is not enough to allow for accurate detection of chaos or randomness.

We therefore decided to focus on three **highly impacting exogenous factors**, i.e. sugar prices, crude oil prices, and EUR-USD exchange rates, and not to study all possible variables to test the company's environment. This decision is justified by the obvious impossibility to observe a complex dynamic system in its globality (Durieux & Vandangeon-Derumez, 1996). Yet, Thiétart and Forgues (1995) tell us that it is not necessary to identify and measure the whole set of variables to study complex system dynamics. Indeed, in a phase space reconstructed from the measurement of a single variable, this variable displays the same properties as the underlying system even if it is only a partial representation of it because "many important properties of dynamical systems are invariant under diffeomorphism, this means that conclusions drawn about the reconstructed dynamics also hold for the true dynamics of the system" (Bradley & Kantz, 2015, p.2). As a matter of fact, if one variable observed in its phase space is chaotic, we can conclude that the whole system is chaotic. The only risk relies to type II error in statistical hypothesis testing, i.e. rejecting a true hypothesis as incorrect or, stated otherwise, failing to detect an effect that is present⁴⁸. Hence, if we detect chaos with one single variable, we can conclude that the system is chaotic but if we fail to detect it, we cannot conclude that chaos is absent. We nevertheless resolved to analyse three environmental variables instead of one.

- i. **EUR-USD exchange rates** affect the company because of dual transactions (the company sells its products on credit and receives payment in USD after a delay) and translation effects (the company has operations overseas and needs to translate the foreign currency values of each of these assets and liabilities into its home currency to consolidate its financial accounts).

⁴⁸ With this statement, we diverge from Durieux & Vandangeon-Derumez (1996) who claim that the risk encountered is a type I error.

- ii. **Crude oil** prices impact the company because of their direct effect on energy prices in general (as many industrial processes, Galactic technologies consume relatively high amounts of energy) but also because of their indirect influence on the markets of biosourced products which are competing with oil-based chemicals. There exist several indexes for oil prices (WTI, Brent...) but we use here crude oil (petroleum) index displayed by the International Monetary Fund. It consists in a simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh, that we are using as a proxy for energy prices in general. To which extend oil prices influence other energy sources such as natural gas is still subject to debate but there is little discussion about the fact that there is a connection. Economic theory suggests that natural gas and crude oil prices should be related because natural gas and crude oil are substitutes in consumption and also complements, as well as rivals, in production. In general, the observed pattern of crude oil and natural gas prices tend to support this theory (Villar & Joutz, 2006).
- iii. **White sugar** is Galactic's prime feedstock in Belgium and therefore the first component of lactic acid production variable cost. The price actually paid every year by the company depends on various factors such as the world sugar price, the negotiation process with the suppliers and the situation of the European Sugar Regime that is regularly reformed. Yet, sugar being a commodity and Galactic being not a super-large purchaser, there is little room for negotiation. Refined white sugar is traded in USD/metric ton in London at the London Futures Exchange (LIFFE) with a contract known as N°5 contract. Raw sugar is traded in US cents per pound in New York at the IntercontinentalExchange (ICE) with a contract known as the N°11 contract. Both trades are moving similarly with the former being always more expensive than the latter. The difference between the two corresponds to a margin for refiners who transform raw sugar into white sugar. We here use the New York N°11 as proxy of the world sugar price.

Another property of chaotic systems is to be isomorphic in time (Durieux & Vandangeon-Derumez, 1996). If chaos is found in a monthly time series for instance, then the system will be chaotic for a shorter time period. Of course, the detection of chaos require enough granularity in the data, i.e. enough values in the time series. As Thiétart & Forgues (1997, p.127) point out: "The search for chaos is a tricky endeavour, especially when dealing with a finite time series. As the available statistical techniques are based on asymptotic estimates, the reliability of the

results is dependent on the size of the series”. The risk with too few data would be to fail to detect chaos when it actually exists, here again a type II error in statistical hypothesis testing. This being said, to ascertain whether the evolution of our environmental variables displays a chaotic behaviour, we nevertheless used monthly average measures (small data set) and daily average measures (large data set) to cross-check and confirm our findings. On the one hand, the large data set benefits from more values and hence from a better granularity. On the other hand, it is *per se* more exposed to noise than the small data set.

The time period covered and number of data in both data sets are given for each variable in the Table 3.2.

	Small data set	Large data set
Frequency of measurements	Monthly	Daily
Period covered	1985-2016	1994-2016
Number of values:		
EUR-USD FX rate	376	5866
Crude oil price	376	5668
Sugar price	376	5631
Sources:		
EUR-USD FX rate	https://www.oanda.com/lang/fr/currency/historical-rates/	https://www.oanda.com/lang/fr/currency/historical-rates/
Crude oil price	International Monetary Fund http://www.imf.org/external/np/res/commod/index.aspx	https://www.quandl.com/collections/markets/crude-oil
Sugar price	International Monetary Fund http://www.imf.org/external/np/res/commod/index.aspx	World bank http://www.indexmundi.com/commodities/?commodity=su
Description:		
EUR-USD FX rate	Exchange rate (daily closing bid prices from interbank market)	
Crude oil price	Crude Oil (petroleum), simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh	
Sugar price	Sugar, Free Market, Coffee Sugar and Cocoa Exchange (CSCE) contract no.11 nearest future position	
Units:		
EUR-USD FX rate	-	
Crude oil price	USD/barell (bbl)	
Sugar price	US cents/pounds (lb)	

Table 3.2: Composition of the data sets used to analyze the company’s environment

Input parameters & program robustness

Wolf et al. (1985) in their reference paper (more than 7200 citations in Google Scholar), advise to check the stationarity of the results to ensure robust exponent estimates. We have therefore tested the program with our data (the large data set in order to increase our chance to detect

chaos, if any, and reduce the risk of type II error discussed above) while varying the different input parameters of the program.

These input parameters are the following and the results of the calculation of the largest Lyapunov exponents with different values of input parameters are shown in Table 3.3:

- DIM is the dimension of the phase space reconstruction. This is a critical input parameter. When the attractor reconstruction is performed in a space whose dimension is too low, “catastrophes” are likely to result with elements growing at a dramatic rate, providing an enormous contribution to the estimated exponent. This is confirmed with our data for small DIM values in Table 3.3. which lead to infinite exponents. If the dimension is too large, one can expect noise in the data. Increasing the dimension past what is minimally required has the effect of unnecessarily increasing the level of contamination of the data (Wolf et al., 1985, p.297). This is why we performed our calculations for the other input parameters always with the lowest dimension giving a finite λ_1 .
- Reconstruction time delay (TAU) and the time between the data samples (dt), required only for normalization of the exponent (Wolf et al., 1985, p.312) were kept constant (value = 1 as in Wolf et al., 1985, p.299).
- SCALMX is the estimate of the length scale on which the local structure of the attractor is no longer being probed. We have tested a wide range of values for this parameters (from 0,000001 to 0,1) and we can see in Table 3.3 that the program delivers a relatively stable exponent as long as the value is small enough to avoid an infinite result.
- SCALMN is the length scale on which noise is expected to appear. Here again, we have tested a wide range of values (from 0.01 up to 10). We observe only small variations of the largest exponent calculated for rather big variations of the parameter.
- EVOLV is the time step in the evolution time program, i.e. a constant propagation time between replacements attempts. We have tested values of 1 to 10 on EUR-USD data only and saw no real impact on the exponent calculation in our case.

Our various tests indicate a good reproducibility in the calculation of the largest Lyapunov exponent. Despite small variations, the λ_1 calculated are fairly stable. The order of magnitude is respected and, more importantly to our discussion, all calculated values are positive.

Variables	Number of values (NPTS)	Input Parameters					Largest Lyapunov Exponent (λ_1)	
		DIM	TAU	dt	SCALMX	SCALMN		EVOLV
EUR-USD FX rate (1)	5866	1	1	1	1,00E-04	0,3	1	NaN
		2	1	1	1,00E-04	0,3	1	∞
		3	1	1	1,00E-04	0,3	1	∞
		4	1	1	1,00E-04	0,3	1	∞
		5	1	1	1,00E-04	0,3	1	5,21E-04
		6	1	1	1,00E-04	0,3	1	5,44E-04
		7	1	1	1,00E-04	0,3	1	5,63E-04
		5	1	1	1,00E-01	0,3	1	∞
		5	1	1	1,00E-02	0,3	1	∞
		5	1	1	1,00E-03	0,3	1	∞
		5	1	1	1,00E-04	0,3	1	5,21E-04
		5	1	1	1,00E-05	0,3	1	5,21E-04
		5	1	1	1,00E-06	0,3	1	5,21E-04
		5	1	1	1,00E-04	10	1	1,46E-03
		5	1	1	1,00E-04	1	1	1,46E-03
		5	1	1	1,00E-04	0,3	1	5,21E-04
		5	1	1	1,00E-04	0,1	1	7,91E-04
		5	1	1	1,00E-04	0,01	1	1,36E-03
		5	1	1	1,00E-04	0,3	1	5,21E-04
		5	1	1	1,00E-04	0,3	2	5,21E-04
5	1	1	1,00E-04	0,3	3	5,21E-04		
5	1	1	1,00E-04	0,3	10	5,23E-04		
Crude oil price (2)	5668	2	1	1	1,00E-04	0,3	1	∞
		3	1	1	1,00E-04	0,3	1	1,41E-03
		4	1	1	1,00E-04	0,3	1	1,44E-03
		5	1	1	1,00E-04	0,3	1	1,47E-03
		6	1	1	1,00E-04	0,3	1	1,31E-03
		7	1	1	1,00E-04	0,3	1	1,30E-03
		3	1	1	1,00E-01	0,3	1	∞
		3	1	1	1,00E-02	0,3	1	∞
		3	1	1	1,00E-03	0,3	1	1,41E-03
		3	1	1	1,00E-04	0,3	1	1,41E-03
		3	1	1	1,00E-05	0,3	1	1,41E-03
		3	1	1	1,00E-04	10	1	1,52E-03
		3	1	1	1,00E-04	1	1	1,52E-03
		3	1	1	1,00E-04	0,3	1	1,41E-03
3	1	1	1,00E-04	0,1	1	1,52E-03		
3	1	1	1,00E-04	0,01	1	1,52E-03		
Sugar price (3)	5631	2	1	1	1,00E-04	0,3	1	∞
		3	1	1	1,00E-04	0,3	1	∞
		4	1	1	1,00E-04	0,3	1	1,21E-03
		5	1	1	1,00E-04	0,3	1	1,24E-03
		6	1	1	1,00E-04	0,3	1	1,27E-03
		7	1	1	1,00E-04	0,3	1	1,29E-03
		4	1	1	1,00E-02	0,3	1	∞
		4	1	1	1,00E-03	0,3	1	1,21E-03
		4	1	1	1,00E-04	0,3	1	1,21E-03
		4	1	1	1,00E-05	0,3	1	1,21E-03
		4	1	1	1,00E-04	10	1	1,60E-03
		4	1	1	1,00E-04	1	1	1,60E-03
4	1	1	1,00E-04	0,3	1	1,21E-03		
4	1	1	1,00E-04	0,1	1	1,49E-03		
4	1	1	1,00E-04	0,01	1	1,60E-03		

(1) Exchange rate EUR-USD (daily closing bid prices from 1994 to 2016)

(2) Crude Oil (petroleum), simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh (daily average from 1994 to 2016)

(3) World sugar N°11 sugar price (daily average from 1994 to 2016)

Table 3.3: Influence of input parameters on the calculation of largest Lyapunov exponents for 3 time series

(EUR-USD exchange rate, crude oil price, and world sugar price; daily averages from 1994 to 2016; in blue the values of the parameter that are changed while the other input parameters are kept constant)

Our results confirm the absence of long term predictability

i. EUR-USD exchange rate

The Figure 3.7 hereunder compares the time series and largest Lyapunov convergence plots for monthly average and daily average EUR-USD exchange rates from 1985 to 2016 and 1994 to 2016.

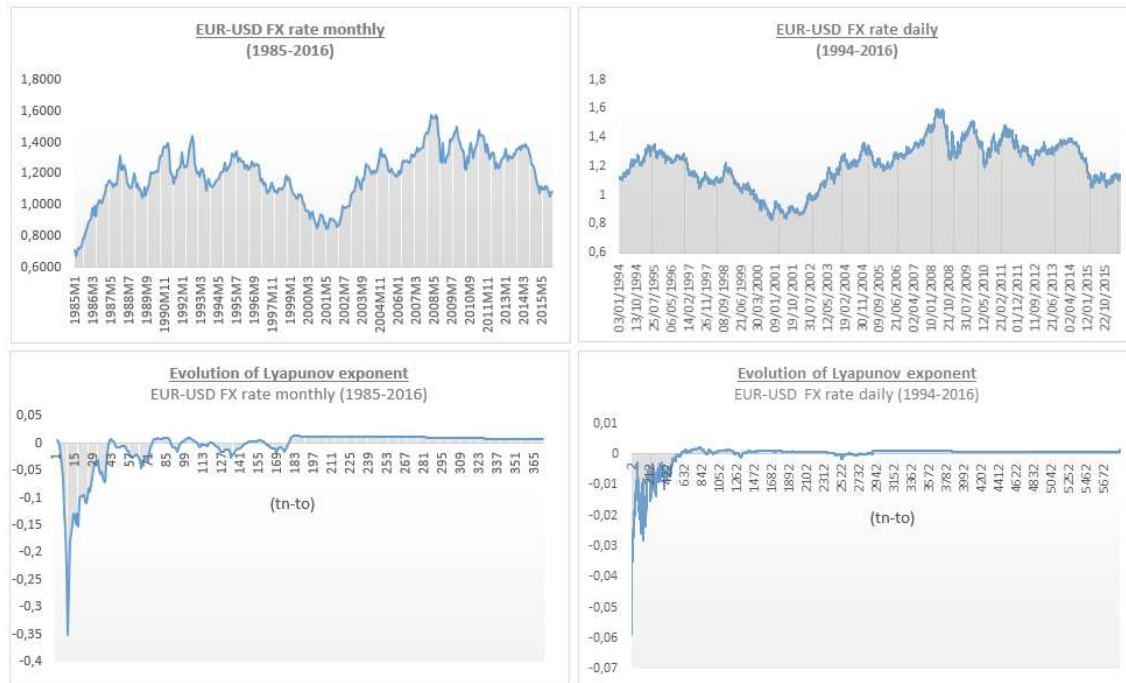


Figure 3.7: Time series for monthly and daily EUR-USD exchange rate and related Lyapunov exponents convergence plots (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

We find λ_1 values, positive in both cases, of 0,00736 and 0,000521 bits/iteration respectively (Table 3.4). This result gives support to Hsieh (1989) who searched for chaos in the exchange rates of five currencies and found that daily exchange rates are not independent of past changes. He found little linear dependence and detected strong nonlinear dependence which is a signature of a chaotic evolution over time.

Monthly	Daily
<u>Input parameters</u>	<u>Input parameters</u>
dim=4	dim=5
tau=1	tau=1
dt=1	dt=1
scalmx=0.0001	scalmx=0.0001
scalmn=0.3	scalmn=0.3
evolv=1	evolv=1
<u>Output parameters</u>	<u>Output parameters</u>
zlyap= 7,36E-03	zlyap= 5,21E-04

Table 3.4: Input parameters and largest Lyapunov exponent calculated for monthly and daily EUR-USD exchange rate (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

ii. Crude oil price

Commodities are variables that are inherently subject to resource constraints. They are therefore prone to display chaotic structures (Baumol & Benhabib, 1989). Adrangi, Chatrath, & Kathy (2001) tested for the presence of low-dimensional chaotic structure in crude oil. They found strong evidence of nonlinear dependencies but the evidence was not consistent with chaos.

Our results, positive largest Lyapunov exponents for both monthly and daily data (Table 3.8), confirm nonlinearity. Whether we can conclude on the presence of deterministic chaos or pure randomness will be discussed in the next section.

iii. Sugar price

Similar to the previous two variables analyzed, sugar price evolution leads to positive largest Lyapunov exponents (Table 3.9) suggesting but not proving (see discussion in section 3.2.6) the presence of chaos.

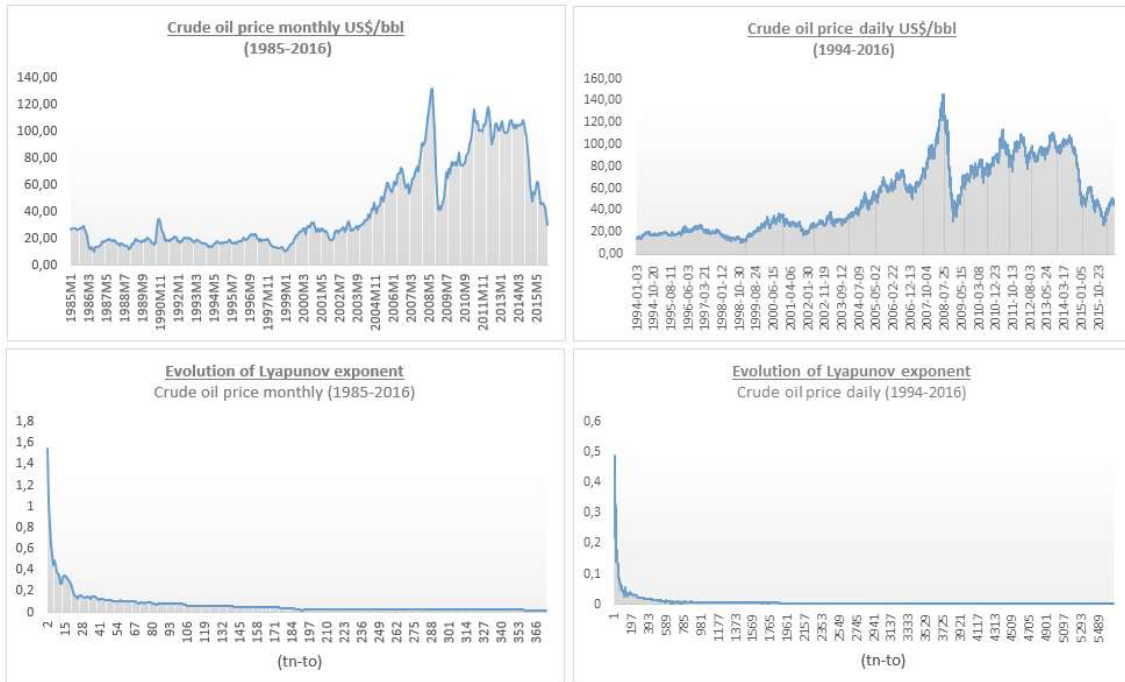


Figure 3.8: Time series for monthly and daily crude oil prices and related Lyapunov exponents convergence plots (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

Monthly	Daily
Input parameters	Input parameters
dim=2	dim=3
tau=1	tau=1
dt=1	dt=1
scalmx=0.0001	scalmx=0.0001
scalmn=0.3	scalmn=0.3
evolv=1	evolv=1
Output parameters	Output parameters
zlyap= 1,71E-02	zlyap= 1,52E-03

Table 3.5: Input parameters and largest Lyapunov exponent calculated for monthly and daily crude oil prices (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

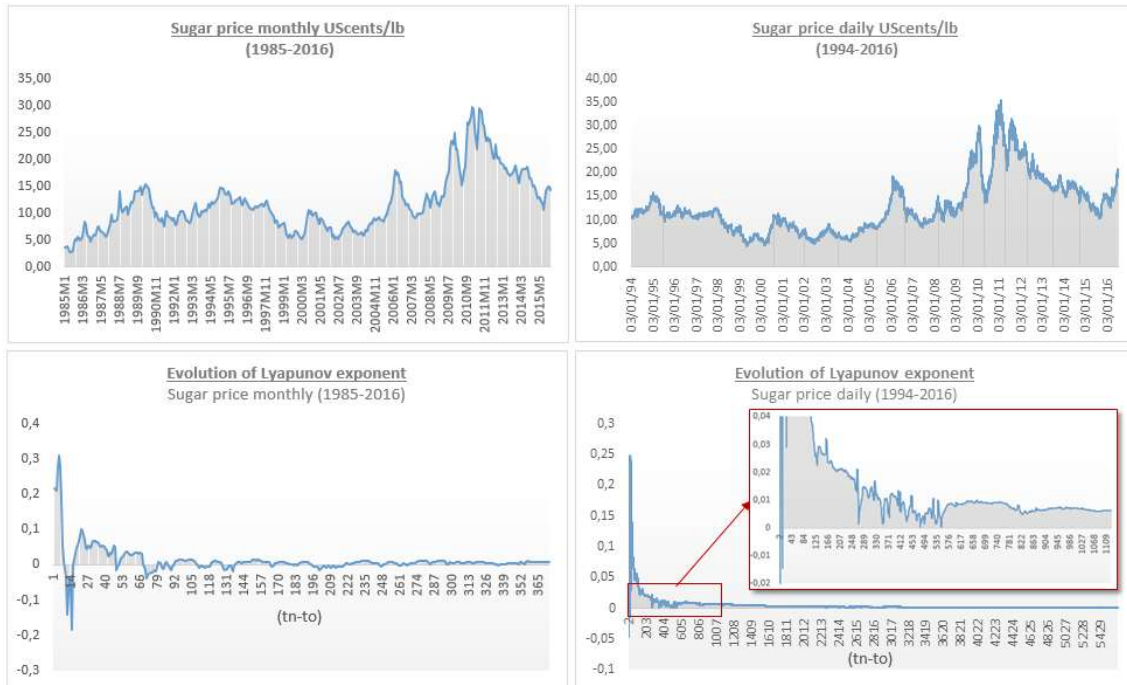


Figure 3.9: Time series for monthly and daily sugar prices and related Lyapunov exponents convergence plots (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

Monthly	Daily
Input parameters	Input parameters
dim=2	dim=4
tau=1	tau=1
dt=1	dt=1
scalmx=0.0001	scalmx=0.0001
scalmn=0.3	scalmn=0.3
evolv=1	evolv=1
Output parameters	Output parameters
zlyap= 8.79E-03	zlyap= 1,21E-03

Table 3.6: Input parameters and largest Lyapunov exponent calculated for monthly and daily sugar prices (monthly averages from 1985 to 2016 and daily values from 1994 to 2016)

Our results generally confirm previous studies although there is no consensus in the literature on the subject. Blank (1991) found positive exponent in agricultural futures price, i.e. soybeans, among other variables. His results were consistent with the hypothesis of underlying generative mechanisms characterized by deterministic chaos but this was based on 336 observations only.

Decoster, Labys, & Mitchell (1992) also found evidence for nonlinear structure in commodity futures including sugar. Conversely, Wei & Leuthold (1998) found that five commodity futures markets were following chaotic patterns (corn, soybeans, wheat, hogs and coffee) but surprisingly not sugar, a result supported by Adrangi & Chatrath (2003) who found strong evidence of nonlinear dependence in the returns of sugar futures markets but not consistent with chaos.

Deterministic chaos or stochastic volatility

In spite of being nonlinear, chaotic systems are sensitive to initial conditions and hence they are deterministic. Conversely, stochastic systems possess some inherent randomness by which a same set of initial conditions (inputs) may lead to an ensemble of different outputs. If the former systems might be relatively predictable on the very short term, they very quickly lose their predictability because of the exponential development of the error made in the definition of the initial conditions (due to measurement error or exogenous noise). The latter systems, pure random ones, are unpredictable in all situations. As already said, this is not the purpose of this dissertation to discriminate between chaos and randomness in our environmental data. In our case, suffice to confirm that they belong to one of these categories (positive λ_1) to conclude on the environmental uncertainty surrounding the company.

Our curiosity has nevertheless been triggered by this question and we decided to investigate it a little further. In addition to satisfying our curiosity, it helps delineating the limits of the algorithm used. We therefore followed Brooks' advice (Brooks, 1998, p.267) and we created sets of data with the same distributional properties and possibly the same autocorrelation structure as our initial data sets, but with nonlinear dependence removed. Scheinkman and Lebaron (1989) suggest to "scramble" the data by sampling randomly the original data to form new random data series. To do so, we have used the RAND() function in Excel software to "randomize" our data. If we get substantially different, lower but yet positive, largest Lyapunov exponents for our initial data sets than for the randomized ones, we can conclude on the strong evidence of deterministic chaos in our raw data.

The Figure 3.7 shows on the left hand side the randomized time series corresponding to the three large data sets used in section 3.2.5, i.e. daily values of EUR-USD exchange rates, crude oil prices and sugar prices from 1994 to 2016; and on the right hand side, the related largest Lyapunov exponents convergence plots.

A simple visual comparison between the data series of Figures 3.7, 3.8, 3.9 and Figure 3.10 confirms the randomization process.

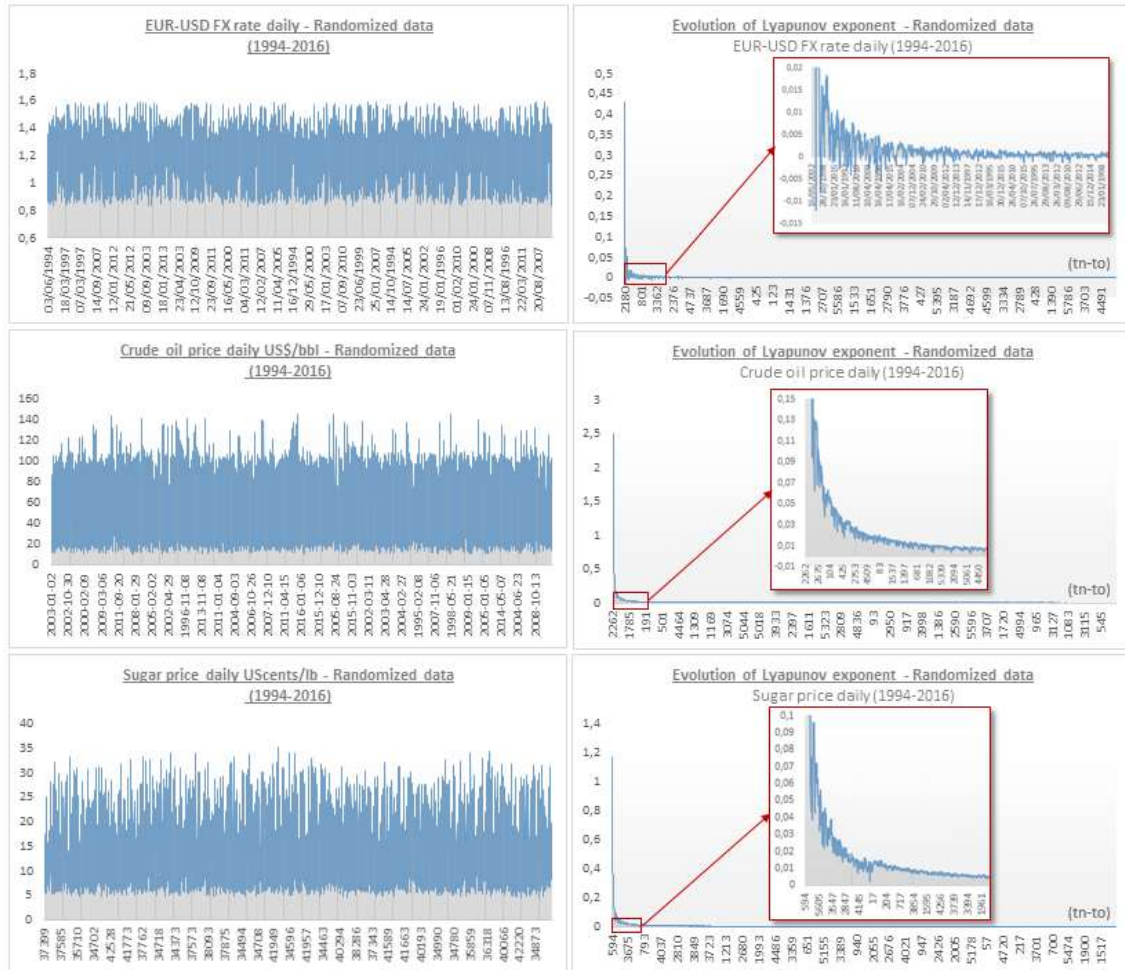


Figure 3.10: Randomized time series and related Lyapunov exponents convergence plots (based on the same daily data as in Figures 3.7, 3.8, and 3.9)

While the largest Lyapunov exponents estimated by Wolf’s algorithm are in every case positive (Table 3.7), thereby indicating that nearby data trajectories diverge exponentially, this cannot be taken as evidence for sensitive dependence on initial conditions since the corresponding exponents for the randomized data are also positive and of the same order of magnitude. Brooks (1998) came to the same conclusion when analyzing the daily returns of the British Pound against ten other currencies from 1974 to 1994 with a more sophisticated filtering technique based on surrogate data.

	Largest Lyapunov exponent λ_1	
	Raw data	Randomized data
EUR-USD FX rate	5,21E-04	5,52E-04
Crude oil price	1,52E-03	8,49E-04
Sugar price	1,21E-03	8,43E-04

*Table 3.7: Comparison of the largest Lyapunov exponents calculated for the raw data and for the randomized ones
(based on the same daily data as in section 3.2.5)*

Although our exponents estimates confirm the exponential divergence of the three environmental variables studied, we are not in a position to conclude on their chaotic (deterministic) behaviors versus nonlinear stochastic (non-chaotic) behaviors. Calculation of the whole spectrum of Lyapunov exponents or using BDS statistics (after the initials of W. A. Brock, W. Dechert and J. Scheinkman) could help shed light on this question but this goes beyond the scope of this dissertation.

Conclusion on the uncertainty of the company’s environment

The narrative revealed how largely exposed the company’s day-to-day activities are to its environment and particularly to three variables: sugar, a commodity traded on the international scene and first cost driver; energy which price is linked to crude oil market; and EUR-USD exchange rates because of a large portion of dollar revenues increasing translation risk. The analysis of the evolution of these variables over the lifetime of the company since its inception lead to the determination of positive largest Lyapunov exponents in the three cases.

Since a positive largest Lyapunov exponent is a strong signature of chaos (or, with the algorithm used, randomness), and that all three variables tested lead to positive largest Lyapunov exponents no matter which input parameters was used in the program, we conclude that the company’s environment displays unpredictable and uncertain behaviour. Indeed, the possible presence of chaos “has important implications for the predictability of the underlying system, since the fact that all initial conditions are in practice estimated with some error (either measurement error or exogenous noise), will imply that long term forecasting of the system is impossible as all useful information is likely to be lost in just a few iterations” (Brooks, 1998, p.265). Where chaos occurs, the two basic forecasting devices, extrapolation and estimation of a structural forecasting model, become questionable (Baumol & Benhabib, 1989).

Galactic has invested quite heavily in large bulk storage capacities for sugar to mitigate the risk related to sugar price volatility. By doing so, the company is able to select the time of closing purchasing contracts, therefore reducing its exposure to spot prices. The company is also using hedging tools to mitigate currency-related risks, i.e. currency swaps and forward contracts. However, if these measures offer a certain protection or at least a certain flexibility on the short term, they are relatively shortlived and they cannot protect the company against volatility in the long run.

Hence, a second conclusion can be drawn: **the company is indeed evolving in a highly uncertain environment.**

At this point of our investigation, it seems appropriate to look already at how the company's various development phases identified in the narrative section are positioning in regards to the evolution of the exogenous parameters that we have just analyzed and to which it appears that the company is highly exposed. Indeed, in the narrative part of this dissertation we identified three phases (epochs) in the company's history since its incorporation (the period named "Antiquitus" being anterior to the company creation). As we have seen in Section 3.1, this periodization was not made arbitrarily. Each epoch corresponds to a clear step in the development of the company from a start-up company to an established international organization. Each epoch is also characterized by a strategic intent and a company structure that differ from the other epochs. The phasing that emerges from the analysis of the company's history results from an inside-out dynamic, or in other words from strategic decisions taken by the management, as a result of either the emergence of new opportunities in the market place or the appearance of serious threats and negative environmental circumstances.

However, as it can be seen on the Figure 3.11.a/b, an interesting correspondance surfaces from the superposition of these phases and the time evolution of the three highly impacting exogenous factors (variables) selected to confirm the environmental uncertainty surrounding the company. The apparent synchronism between the phasing of the company's evolution and the environmental variables analysed gives credit to the the now well-established Lewinian theory of co-evolution (Lewin & Volberda, 1999; Lewin et al., 1999; Lichtenstein, 2000; McKelvey, 1999; Volberda & Lewin, 2003).

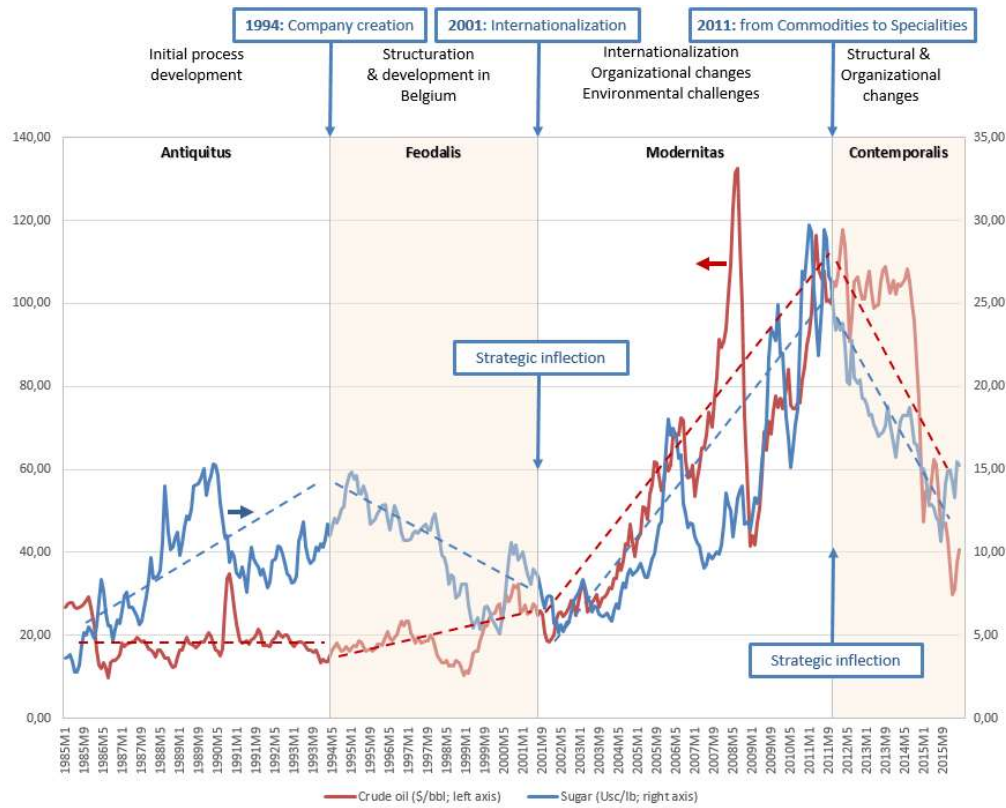


Figure 3.11.a: Superposition of the company's epochs and the time evolution of Crude Oil prices and World Sugar prices.

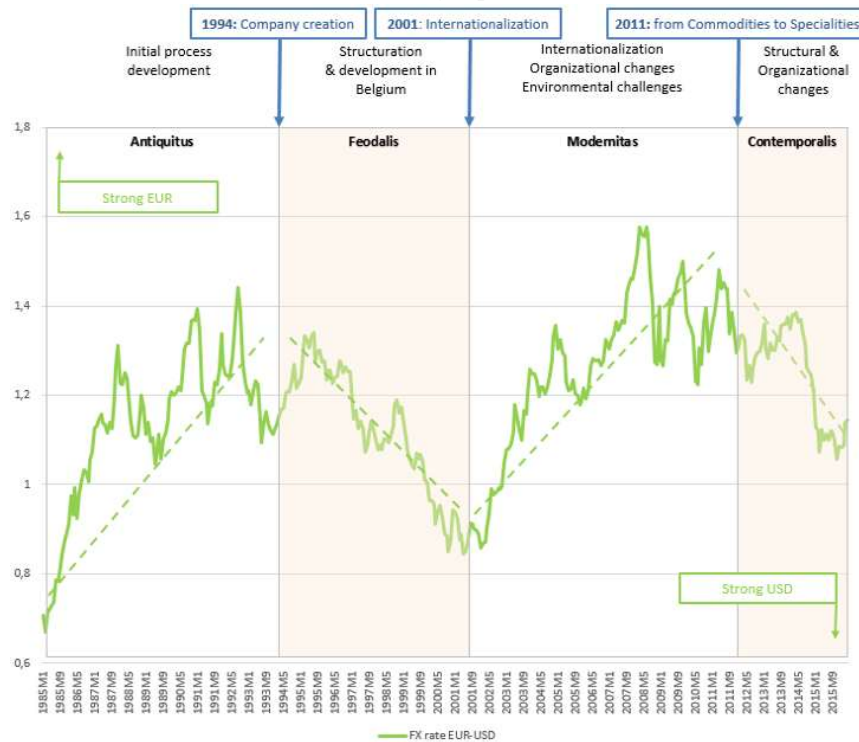


Figure 3.11.b: Superposition of the company's epochs and the time evolution of EUR/USD exchange rates.

Intersections of patterns of ongoing strategic activities with fortuitious events play an important role in shaping the opportunities and threats that a company faces throughout its evolution. This led Burgelman (2011, p.13) to propose “strategic recognition”, that he defines as “the capacity of senior and top management to see the strategic implications of a confluence of forces” as a key adaptive organizational capability. Burgelman further elaborates (2011, p.15) on the concept of “strategic inflection point” signaled by “strategic dissonance” (Burgelman & Grove, 1996), a progressive divergence of strategic actions from strategic intent that is an indicator of contextual change. If this happens, the incumbent survives and eventually enters a new era of profitable growth provided that it is able to come up with a new strategy that takes advantage of the new environmental conditions. Elseways, it may survive but with severely reduced performance prospects or even may disappear.

It is the aim of our research to see if and how organizational ambidexterity, a dynamic capability (O’Reilly & Tushman, 2007), eventually provided a structure that helped keep actions aligned with the company’s strategic intents, but also helped inflect the company’s strategic direction when it was needed so that its survival could be secured.

However, before going further, let us pause for a moment to summarize the few conclusions that can already be drawn from the analysis of the company's environment.

3.2.3. Conclusions on the company's environment

We have shown that the company is evolving in a dynamic context and that the level of dynamism to which the company is exposed is growing as a result of external factors but also because of its own expansion (move n°1 in Figure 3.12). We have also pointed out that the company's environment is highly uncertain and hence unpredictable (n°2 on Figure 3.12) and that the volatility surrounding the company's operations is growing over time.

We can therefore ascertain that the company is lodged in the fourth quadrant (top right side) of the Figure 3.12 (i.e., a large exposure of the company to a highly uncertain environment) which suggests that it would benefit from a truly ambidextrous organization.

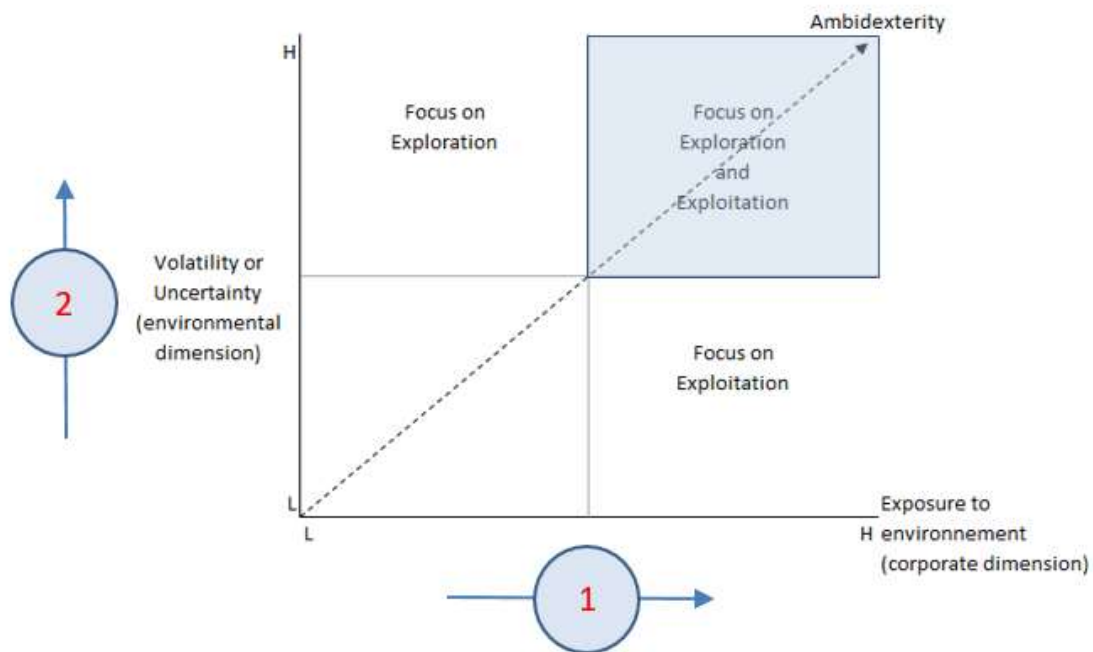
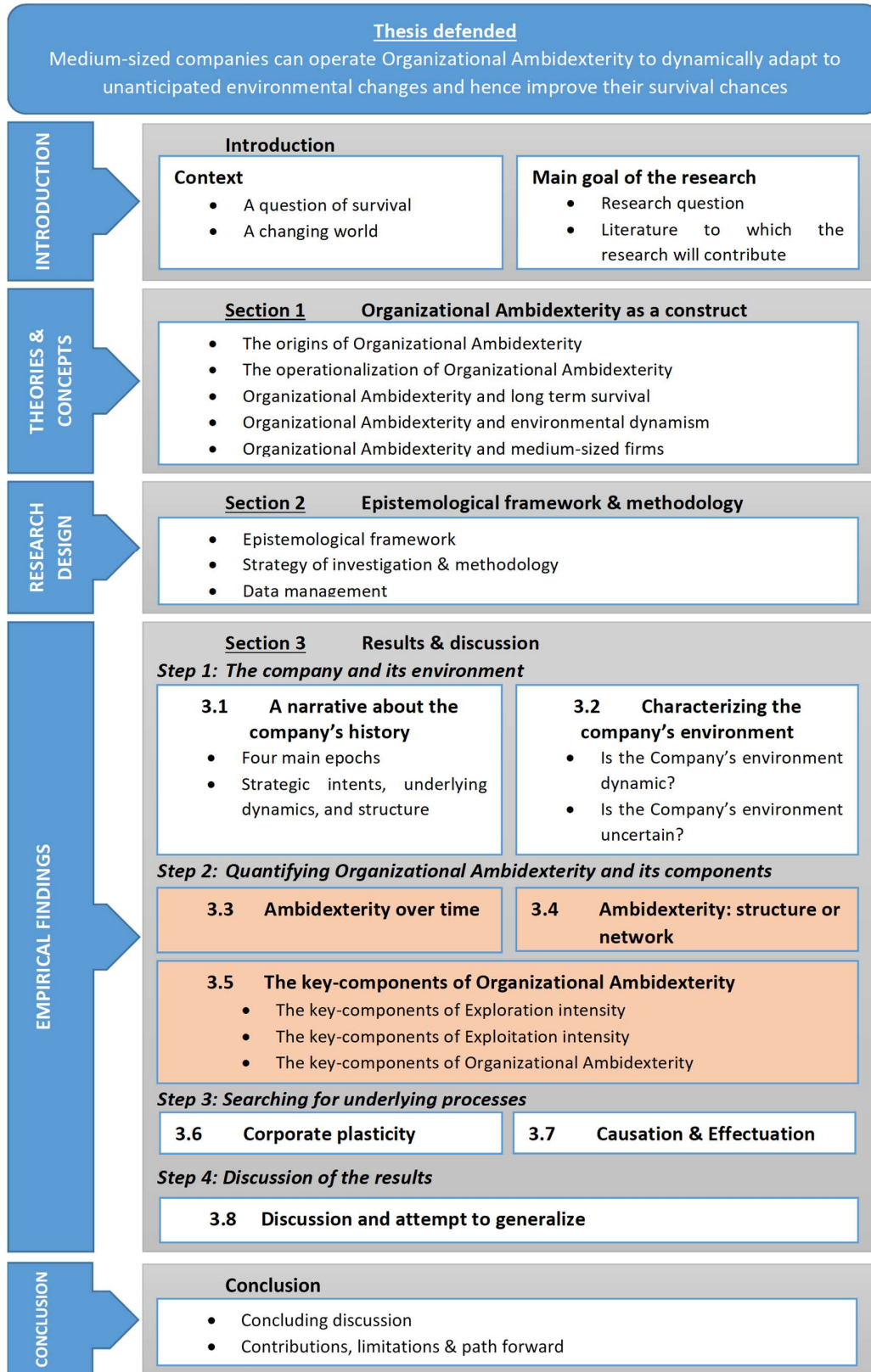


Figure 3.12: Influence of environmental volatility and company exposure to its environment on the Exploration-Exploitation strategy to implement (similar to Figure 1.4)

The following sections serve the purpose of measuring organizational ambidexterity in the various periods of the company's history from its incorporation to the present time as well as providing elements to discuss how this ambidextrous behaviour has eventually been implemented.

Step 2: Quantifying organizational ambidexterity and its components



3.3. The evolution of ambidexterity over time

3.3.1. Ambidexterity, Exploration and Exploitation over time

Our Ambidexterity Score is a combination of Exploration Intensity and Exploitation Intensity. Figure 3.9 shows the development of these three elements over the 25 years time period covered by our study.

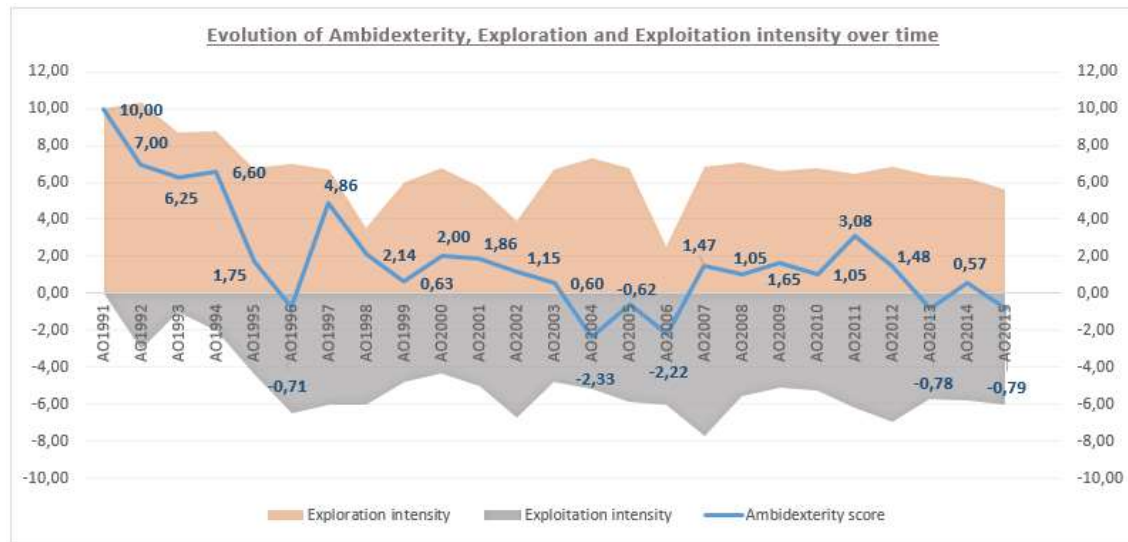


Figure 3.9: Evolution of the Ambidexterity score from 1991 until 2015 (a positive score means an excess of Exploration intensity over Exploitation intensity).

As we choose arbitrarily to have exploration intensity reflected by positive figures (orange surface) and exploitation intensity by negative ones (grey surface), perfect organizational ambidexterity is approached when the ambidexterity score (blue line) reaches zero.

From 1991 to 1993, there is a strong predominance of exploration as R&D is the core activity of the company-to-be (at this point, it is still a separate department of another company, ATC, that will be spinned out in 1993 – see the narrative in Appendix II for more details). The hint of exploitation in 1992 even though the company has not yet any factory is explained by the fact that the whole R&D team had moved to a new location, a former nightclub in Brussels, in order to have more space to shelter pilot scale equipments. From 1993 to 1996, exploitation intensity increases as the freshly incorporated company starts building and operating its first factory. After that, both exploration and exploitation are maintained at relatively high levels of intensity despite the rapid growth of the company (which indicates that the firm has succeeded in growing both activities at about the same pace).

Before going further into details, a few straightforward observations can be drawn from the sight of this graph:

1. The company, deeply rooted in exploration at the beginning of its activities, has quickly put in place exploitation activities while maintaining a high level of exploration. This result is conducive to indicate that the company is quickly driving towards organizational ambidexterity which is reached in a relatively stable manner about 5 years after its inception (1999). After that point, the ambidexterity score is oscillating around the zero value which indicates a good relative balance of exploitation and exploration activities.
2. The company succeeded to implement and maintain a high level of both exploration and exploitation scores (intensity scores between 4 and 7 every year as from the start of the production activities in 1995).
3. There seems to be an excess of exploration over exploitation activities in average over the whole period which reflects the innovation/exploration-driven culture of the company.

The data averaged for each epoch (Table 3.8) help summarize these findings as they show:

- A convergence of the ambidexterity score to a value close to zero (actually, 0.12 for the CONTEMPORALIS period) with a good balance between exploration and exploitation intensities (absolute values of 6.26 and 6.08, respectively)
- A gradual reduction and stabilization of the exploration intensity
- A gradual increase and stabilization of the exploitation intensity in line with the growth of the company's commercial operations (production & sales)

These observations give credit to the concept of dynamic or adaptive ambidexterity defined as the firm's ability to adapt the balance of exploration and exploitation activities to organizational and contextual circumstances over time, while constantly maintaining the two activities in order to capture their synergistic qualities (Laplume & Dass, 2009; Luger, 2014).

	Year	Ambidexterity score	Exploration intensity	Exploitation intensity
ANTIQUITUS	AO1991	10,00	10,00	0,00
	AO1992	7,00	10,33	-3,00
	AO1993	6,25	8,67	-1,00
FEODALIS	AO1994	6,60	8,75	-2,00
	AO1995	1,75	6,75	-4,33
	AO1996	-0,71	7,00	-6,50
	AO1997	4,86	6,67	-6,00
	AO1998	2,14	3,50	-6,00
	AO1999	0,63	6,00	-4,75
	AO2000	2,00	6,75	-4,33
MODERNITAS	AO2001	1,86	5,75	-5,00
	AO2002	1,15	3,89	-6,67
	AO2003	0,60	6,71	-4,75
	AO2004	-2,33	7,33	-5,18
	AO2005	-0,62	6,75	-5,83
	AO2006	-2,22	2,50	-6,00
	AO2007	1,47	6,83	-7,71
	AO2008	1,05	7,10	-5,56
	AO2009	1,65	6,60	-5,09
	AO2010	1,05	6,77	-5,25
	AO2011	3,08	6,47	-6,14
CONTEMPORALIS	AO2012	1,48	6,81	-6,90
	AO2013	-0,78	6,40	-5,67
	AO2014	0,57	6,22	-5,75
	AO2015	-0,79	5,59	-6,00
Average for ANTIQUITUS		7,75	9,67	-1,33
Average for FEODALIS		2,39	6,40	-4,86
Average for MODERNITAS		0,49	6,10	-5,82
Average for CONTEMPORALIS		0,12	6,26	-6,08

Table 3.8: Ambidexterity, Exploration intensity and Exploitation intensity scores from 1991 and 2015.

Now, looking a little deeper at the evolution of the ambidexterity score (Figure 3.10), we see three phases emerging which fit surprisingly well the three epochs we had previously determined (with, sometimes, a certain lag time as the transition between epochs is a progressive process⁴⁹).

⁴⁹ Burgelman & Grove (1996, p.10) use a metaphore to show how transitions to new industry equilibria or new technological regimes can be gradual and difficult to perceive in an extremely dynamic industry: “Think about a computer-generated image being morphed from one state to another – you cannot tell when one ends and the other starts; only the beginning (old image) and the end (new image) are clear. In-between is a dizzying succession of intertwined, overlapping, blurred, fuzzy images”.

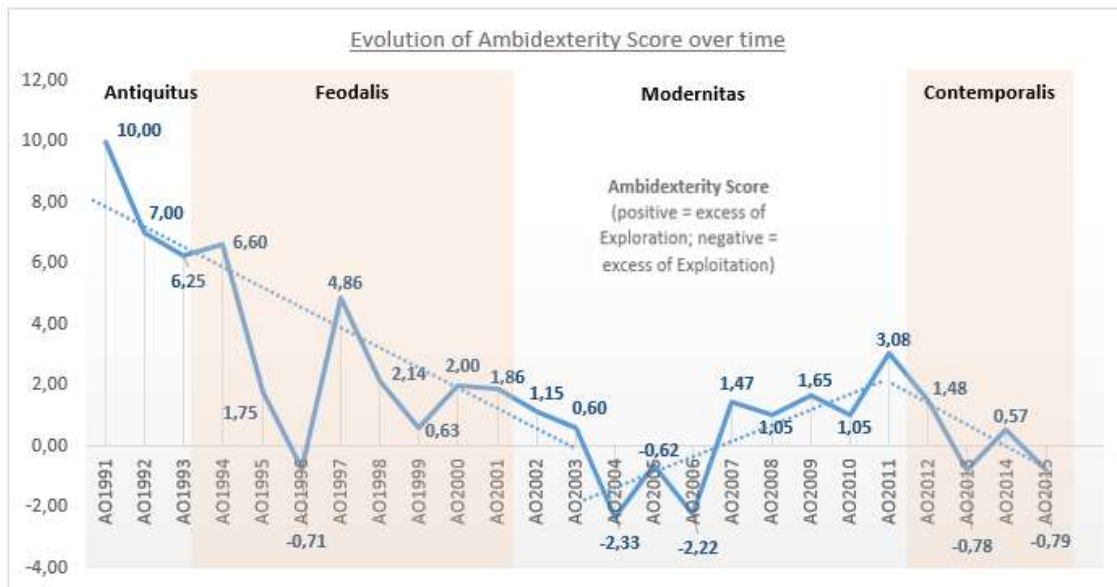


Figure 3.10: Evolution of the Ambidexterity score superimposed the epochs of the company's history.

The parallel with the evolution of the exogenous parameters discussed in section 3.2 (sugar price, crude oil price, and EUR/USD exchange rate) calls for the following comments:

- **When the company's environmental conditions are relaxing** (cheap oil and sugar, weak Euro), such as during our FEODALIS period (1994-2001), **the firm is progressively increasing its focus on the exploitation** of its existing activities and the ambidexterity score is going down, heading to a good balance between exploration and exploitation.
- The lowest ambidexterity score, deeply anchored in exploitation, is reached a couple of years after the US dollar was at its strongest and raw materials and utilities were still at their cheapest. This could indicate that the firm needs about this time to reorient its strategy and activate new levers. Indeed, environmental changes impact the organization in a direct way (e.g., by adapting pricing policy or shifting sourcing patterns) but also indirectly through learning (March, 1991) and experience (Tushman & Romanelli, 1985), both processes which are not immediate and take time.
- Conversely, **when the environment is deteriorating** and margins are under pressure (rising costs, lower profitability on exports due to less favorable exchange rates), a situation the company was facing from 2002 until 2011 (the epoch named MODERNITAS), **the management puts gradually the focus on exploration** in a

quest for new products and new markets delivering higher margins or less exposed to exchange rates, and the ambidexterity score is increasing quite sharply. This observation lends credence to Keller and Weibler (2014) as well as Sidhu *et al.* (2004) who showed that environmental dynamism is positively related to engagement in exploration. As pointed by Walrave and colleagues (2012), it is counterintuitive for most managers to proactively stress exploration in difficult economic times and declining contextual conditions as they usually emphasize exploitation in this situation to maintain liquidity and preserve financial means, eventually blaming the economic conditions to justify downsizing and lay-offs.

- Again, from 2011, the macroeconomic context is releasing (CONTEMPORALIS period) and the company progressively returns to a more balanced mix of exploration and exploitation.

Obviously, from these observations, it is quite difficult to distinguish between the influence of factors internal to the company involved in the phased development of its long term strategy (structuration, internationalization, specialization – centralized structure, decentralized structure, recentralized structure) and that of the external factors that offer new opportunities but also constitute threats and risks (raw material and utility prices, foreign exchange rates, competitive intensity). In the following sections we will try to understand how the company came to develop a relatively well maintained balance between exploration and exploitation during the last 15 years, that is to say, a state of organizational ambidexterity, by first analyzing whether it is a matter of structure or a matter of network.

3.3.2. Structural ambidexterity over time

As we have seen in the literature review (section 1), Duncan (1976) suggested the use of “dual structures” to accommodate simultaneously the conflicting alignments needed for efficiency and innovation. This type of organization, often named “structural ambidexterity” (Tushman & O’Reilly, 1996), calls for a structural separation between activities aiming at exploiting and exploring. The time evolution of our indicator of structural ambidexterity (Figure 3.11) shows overall an excess of separation (managerial decisions and actions are limited to one department) over collaboration between departments.

In the early years prior to the company’s inception, there is no collaboration at all as the company-to-be is actually still a separated department of another corporation. But, as soon as the company was created, departments commenced to collaborate and the structural ambidexterity score started to oscillate around a zero value indicating a relative balance between autonomous and collaborative actions and decisions. Looking at the average values of this indicator for each epoch of the company’s development confirms this trend towards a balance (convergence of the average structural ambidexterity score from 1,00 to a steady 0,12-0,13 as from 2002 already – Table 3.9). This gives credit to Khanagha, Volberda and Oshri (2014) who concluded that there is “a need for recursive iterations between different modes of separated and integrated structures” (p.322).

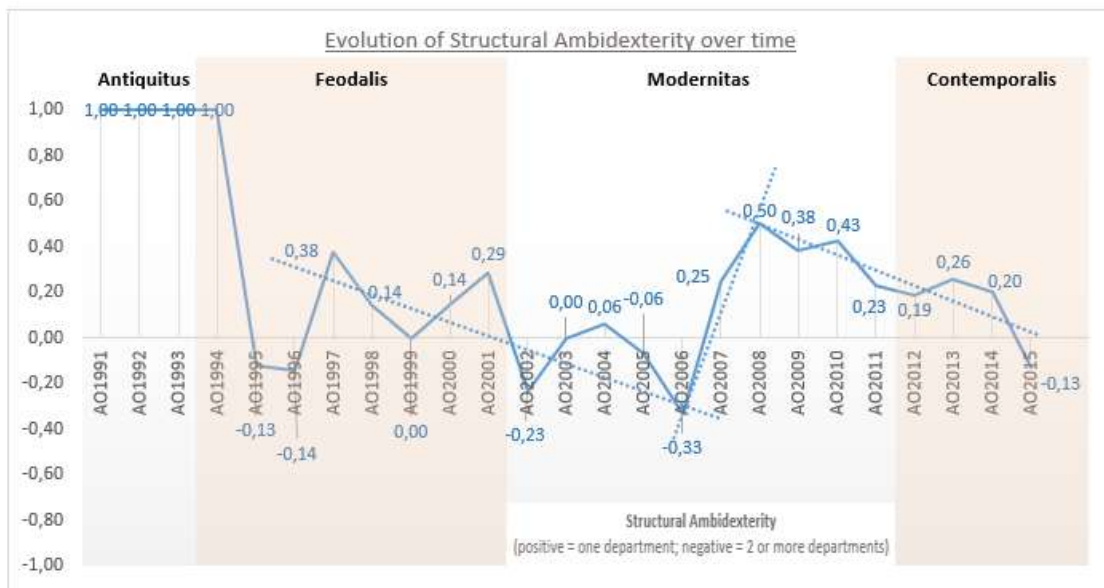


Figure 3.11: Evolution of Structural Ambidexterity from 1991 until 2015 (a positive score indicates a separation between departments whereas a negative one illustrates collaboration).

Although the company was very soon balancing separation and collaboration between departments, the positive values of structural ambidexterity average scores for each epoch indicate nevertheless that the company always had a tendency to favour separation over collaboration. Pursuing with the same line of thought than Schmitt, Probst and Tushman (2010), we can think that it helps “cross-fertilization between units and prevents cross-contamination, as explorative units are protected from exploitative units’ routines and established processes.

(...) Separation evades the impending threat of having to sacrifice efficiency for innovative activities and vice versa” (p.143).

	Year	Structural Ambidexterity
ANTIQUITUS	AO1991	1,00
	AO1992	1,00
	AO1993	1,00
FEODALIS	AO1994	1,00
	AO1995	-0,13
	AO1996	-0,14
	AO1997	0,38
	AO1998	0,14
	AO1999	0,00
	AO2000	0,14
	AO2001	0,29
MODERNITAS	AO2002	-0,23
	AO2003	0,00
	AO2004	0,06
	AO2005	-0,06
	AO2006	-0,33
	AO2007	0,25
	AO2008	0,50
	AO2009	0,38
	AO2010	0,43
	AO2011	0,23
CONTEMPORALIS	AO2012	0,19
	AO2013	0,26
	AO2014	0,20
	AO2015	-0,13
Average for ANTIQUITUS		1,00
Average for FEODALIS		0,21
Average for MODERNITAS		0,12
Average for CONTEMPORALIS		0,13

Table 3.9: Structural ambidexterity score from 1991 and 2015 and the average for each major epoch of the company’s history.

A more detailed analysis of the evolution of structural ambidexterity scores reveals an increase of collaboration over separation during the Feodalis period and the first years of Modernitas, followed by a sudden reversion of this trend during three years, from 2006 to 2008, when the structural ambidexterity score jumps in favor of a separation between departments. After that, a gradual journey towards collaboration materializes again (see the dotted lines in Figure 3.11). Some inferences can be taken from this pattern. First, as already mentioned, the more the company grows and gets structured (Feodalis), the more the departments cooperate. Second, the creation of autonomous subsidiaries overseas (Modernitas) starts with sharing knowledge and transferring technologies which imposes even more collaboration between the departments of the mother company and the newly incepted ventures. However, third, as the subsidiaries progressively gain operational autonomy, they start exploring their own markets and develop

new knowledge on their own which leads to a disconnection between the departments of the different entities. This movement was supported and probably even amplified by the decentralization of decision-making structures that was in place at this time (see Section 3.1.2), but the suddenness of this reversion must be rooted in some external event. Indeed, when the reversion happened in 2006, there was no trace of an intended inflection of the company's strategy. It was right in the middle between two main strategic inflection points clearly identified and acknowledged (2001 and 2011). Hence a fourth insight: the disruption in structural ambidexterity pattern seems totally disconnected from the company's strategy and independent from the overall strategic intent developed and enforced by the company's top-management during this time. The sudden bifurcation of structural ambidexterity score was apparently not premeditated by the management but was a spontaneous reaction to exogenous factors that were not anticipated. As a matter of fact, the change in structural ambidexterity from collaboration to separation coincides with the time when the overall ambidexterity score changes sign (see the red circle in Figure 3.12), i.e. when the company shifted attention from exploitation to exploration, which was an immediate reaction initiated by a rapidly worsening environmental context (surging sugar price, sharp increase of crude oil price and negatively-impacting movements of currencies). We infer that, at least in this case, a negative environmental context triggered a deep modification of the decision-making pattern in favor of more exploratory initiatives which in turn resulted in enhanced separation between departments as this is apparently the way the company conducts exploration (more on that in Section 3.5.1).

After that, the company quickly started again more collaborative projects (the structural ambidexterity pattern turned back towards collaboration as early as 2008) whereas the ambidexterity score reverts trend towards a more balanced mix of exploitation and exploration only three years later.

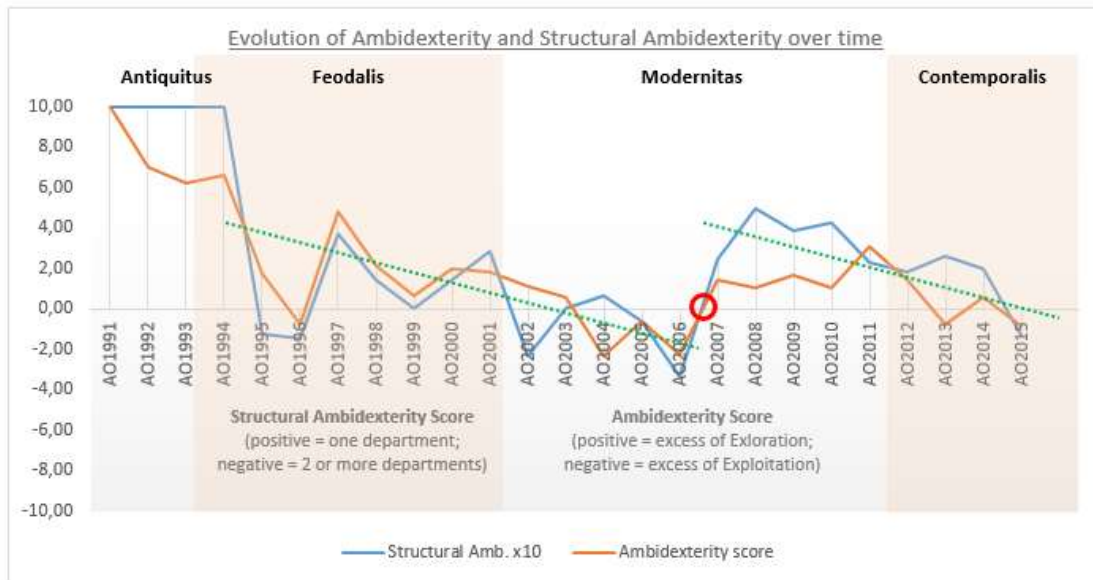


Figure 3.12: Superposition of Ambidexterity score and Structural Ambidexterity score from 1991 until 2015 (the structural ambidexterity score has been multiplied by 10 to fit with the same Y axis as the ambidexterity score).

3.3.3. Network ambidexterity over time

While structural ambidexterity is looking at how exploration and exploitation activities are conducted from a perspective internal to the company, network ambidexterity adopts an external perspective by focusing on how it forges exploratory or exploitative cooperative links with its business environment. Eventhough the company has always had cooperations, the number of partnership events started to increase in 2002 and even more sharply after 2006. Figure 3.13 shows the evolution of partnership intensity that we define as the absolute number of partnership events, i.e. the sum of exploratory and exploitative events, each year.

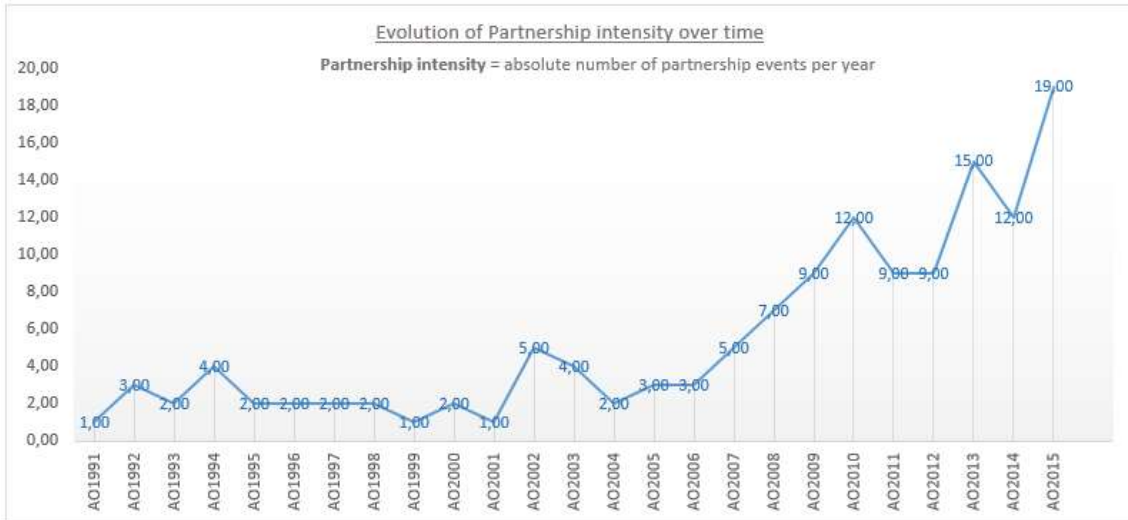


Figure 3.13: Evolution of partnership intensity from 1991 until 2015.

New or old partners

The type of partnership is also an important parameter to understand how the company improved its ambidexterity score throughout its history. Indeed, we can safely assume that engaging in partnerships with new partners is by itself a venture with more exploration intensity than working with old partners, or “repeat partners” (Cummings, 2013), as it widens the landscape of possibilities, brings new ideas and enriches the dialogue with new perspectives. Yet, working with new partners is more difficult. There is a learning period during which both sides need to apprehend how to cope with the other’s culture and to adjust to the other’s way to operate, without even talking about confidentiality measures that need to be taken and trust that needs to be built up.



Figure 3.14: Evolution of the type of partnerships from 1991 until 2015.

Nevertheless, if working with old well-known partners keeps the company and its members in their comfort zone, and that sharing know-how often requires the establishment of long-term relationships in which exchange occurs in a code learned and shared (Von Hippel, 1988), the company doing so exclusively somehow runs the risk to fall in a “success trap” (Junni et al., 2013), organizational inertia (Hannan & Freeman, 1984), convergence and simplicity (Miller, 1993), hence the importance to balance the types of partnerships the company is engaging into (and to strive to reach the zero value for the Y axis in Figure 3.14).

It seems obvious however that a young freshly created company is more exposed to cooperating with new partners than a relatively older company that has had the chance to develop a network of proven partners. Figure 3.14 illustrates this pattern: the company entered into partnerships exclusively with new partners until 2003 and succeeded to come close to a balance between old and new partners only very recently (2013 onwards). Of course, the sharp increase in the net number of partnerships each year after 2003 (Figure 3.13) helps balancing the type of partners by bringing more opportunities to contract new and older partners.

Existing or new markets

Market knowledge is a resource with which managers can bring to light capability deficiencies existing within their company as well as emerging market opportunities that may require the development of new capabilities, a particularly significant need in a turbulent environment context (Atuahene-Gima, 2005). On this, Atuahene-Gima (2005, p.79) notes that “systematic efforts are necessary to track the market changes and to assess the firm’s competence deficiencies to refine existing competencies and to develop the necessary new ones for the new environment”. According to Tushman and O’Reilly (1996), an ambidextrous firm has the capabilities to both compete in mature markets (where cost, efficiency, and incremental innovation are critical) and develop new products and services for emerging markets (where experimentation, speed, and flexibility are critical).

Figure 3.15 outlines the time evolution of the type of market (new or existing) targeted by the partnerships the company entered into. The company started of course with a strong focus on new market but managed to balance the focus of its partnerships very soon after the commissioning of its first factory. The slow but steady drift towards existing markets-oriented

partnerships could, however, indicate that with time it becomes more difficult for the company to find new markets to look at with partners.



Figure 3.15: Evolution of the type of market targeted by the partnerships from 1991 until 2015.

Exploratory or exploitative alliances

An alliance can be perceived as being different from a partnership. We don't elaborate on this here and we consider both as equivalent for the purpose of this dissertation. However, for the sake of clarity and to avoid confusion, we use the expression "type of partnership" to describe whether the partnership is made of new (positive values) or old (negative values) partners whereas the expression "type of alliance" is used to describe whether the partnership is of exploratory (positive values) or exploitative (negative values) nature.

Exploratory alliances or partnerships pay attention to upstream activities in the value chain (Rothaermel & Deeds, 2004) such as knowledge-generating research agreements. Conversely, exploitative alliances focus on downstream activities based on existing knowledge like joint marketing, OEM/VAR⁵⁰ or licensing agreements (Lavie & Rosenkopf, 2006), as well as toll manufacturing or contract manufacturing deals.

⁵⁰ An original equipment manufacturer (OEM) is a company that manufactures a basic product or a component product. A value-added reseller (VAR) is a company that purchases the original or component product from the OEM and then adds to its value by adding features or services to the product, or by incorporating it into a larger product, before finally reselling it, most commonly to end users (source: Investopedia). In our case, we have

Figure 3.16 outlines the evolution of the type of alliances the company went into in the course of its history. Even though it stayed most of the time with an excess of exploratory alliances, the company succeeded to reach a relative balance as early as 1998-1999.

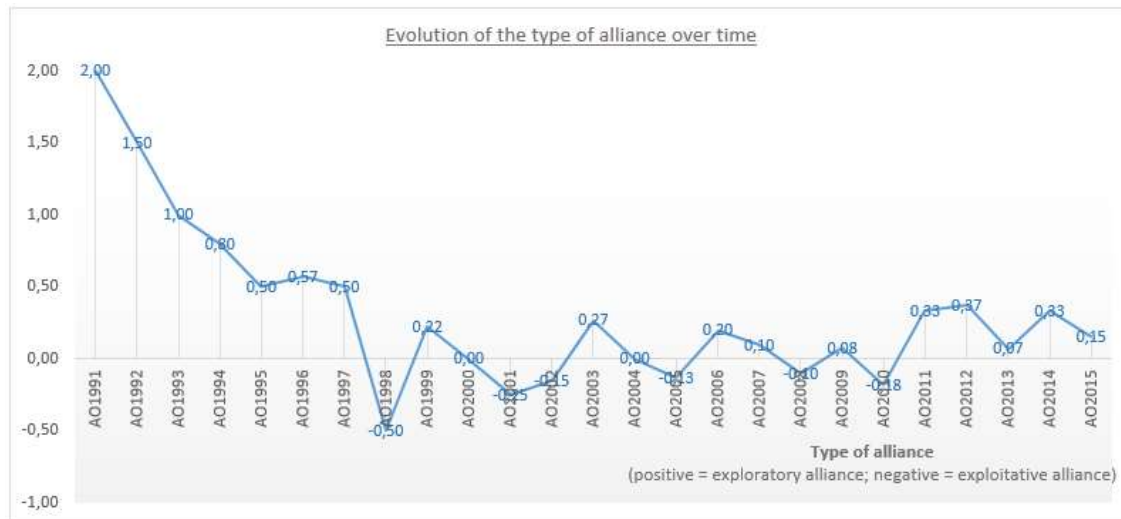


Figure 3.16: Evolution of the type of alliances from 1991 until 2015.

Conclusion about the development of network ambidexterity over time

As a conclusion of this section about network ambidexterity, the company started not surprisingly its operations by engaging into a limited number of partnerships with new partners, mainly of exploratory nature, and targeting new markets. With time and experience, the firm sharply increased the number of collaborations with new as well as with old partners. It progressively reached a relative balance between exploratory and exploitative partnerships. The result, shown in Figure 3.17, is a compounded network ambidexterity score converging close to a zero value which reflects a good level of ambidexterity in the company's relations with external business partners.

however not considered OEM as alliances or partnerships because the core business of our company is to sell chemicals and ingredients which are, by essence, incorporated by the company's customers into their own products. Including this type of supplier-customer relationships here would have resulted in taking into account all commercial relations with customers which is not to be literally considered as partnerships. Similarly, sales to chemical distributors (which could be assimilated to VAR) are not included.

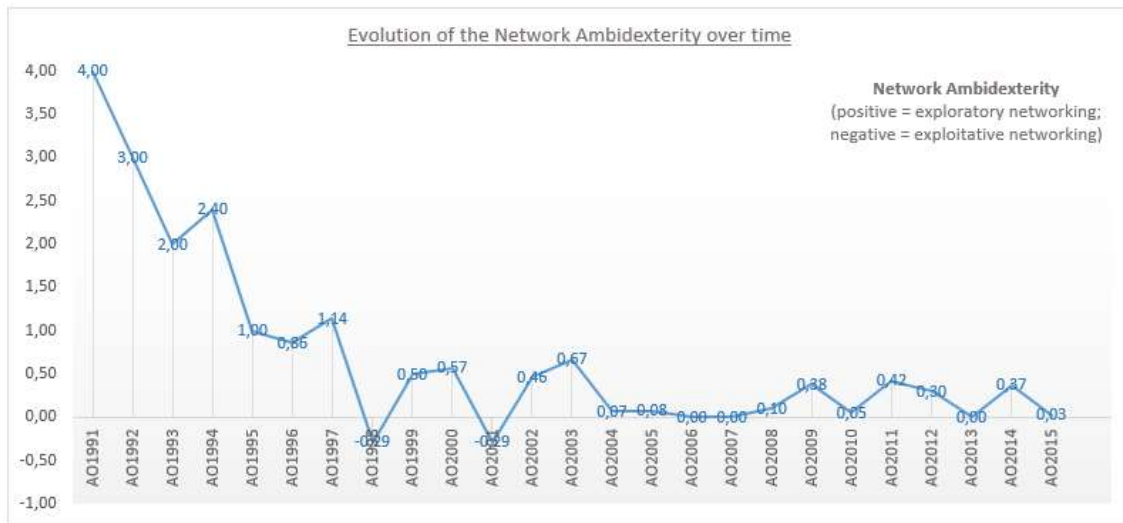


Figure 3.17: Evolution of the aggregated network ambidexterity score from 1991 until 2015.

	Year	Partnership intensity	Type of partner (New/Old)	Type of market (new/existing)	Type of alliance (exploratory/exploitative)	Network Ambidexterity score
ANTIQUITUS	AO1991	1,00	1,00	1,00	2,00	4,00
	AO1992	3,00	1,00	0,75	1,50	3,00
	AO1993	2,00	1,00	0,50	1,00	2,00
FEODALIS	AO1994	4,00	1,00	0,80	0,80	2,40
	AO1995	2,00	1,00	0,25	0,50	1,00
	AO1996	2,00	1,00	0,00	0,57	0,86
	AO1997	2,00	1,00	0,25	0,50	1,14
	AO1998	2,00	1,00	0,00	-0,50	-0,29
	AO1999	1,00	1,00	0,11	0,22	0,50
	AO2000	2,00	1,00	0,29	0,00	0,57
	AO2001	1,00	1,00	-0,13	-0,25	-0,29
MODERNITAS	AO2002	5,00	1,00	0,23	-0,15	0,46
	AO2003	4,00	1,00	0,13	0,27	0,67
	AO2004	2,00	0,00	0,06	0,00	0,07
	AO2005	3,00	1,00	0,00	-0,13	0,08
	AO2006	3,00	0,33	-0,30	0,20	0,00
	AO2007	5,00	-0,20	-0,05	0,10	0,00
	AO2008	7,00	0,43	0,05	-0,10	0,10
	AO2009	9,00	0,56	0,12	0,08	0,38
	AO2010	12,00	0,50	0,09	-0,18	0,05
AO2011	9,00	0,11	0,00	0,33	0,42	
CONTEMPORALIS	AO2012	9,00	-0,11	-0,04	0,37	0,30
	AO2013	15,00	0,20	-0,18	0,07	0,00
	AO2014	12,00	0,17	-0,03	0,33	0,37
	AO2015	19,00	0,16	-0,21	0,15	0,03
Average for ANTIQUITUS		2,00	1,00	0,75	1,50	3,00
Average for FEODALIS		2,00	1,00	0,20	0,23	0,74
Average for MODERNITAS		5,90	0,47	0,03	0,04	0,22
Average for CONTEMPORALIS		13,75	0,10	-0,11	0,23	0,17

Table 3.10: Network ambidexterity score and its components from 1991 to 2015, and the average for each major epoch of the company's history.

3.4. Organizational ambidexterity: structure or network

3.4.1. A matter of structure

We have seen in section 3.3.2. that the company had generally favoured separation over collaboration between departments in its quest to balance exploration and exploitation activities. The same conclusion can be drawn from Figure 3.18 which shows more measurements on the side of activities handled by one department (right hand side) than on the side of activities shared between two or more departments (left hand side).

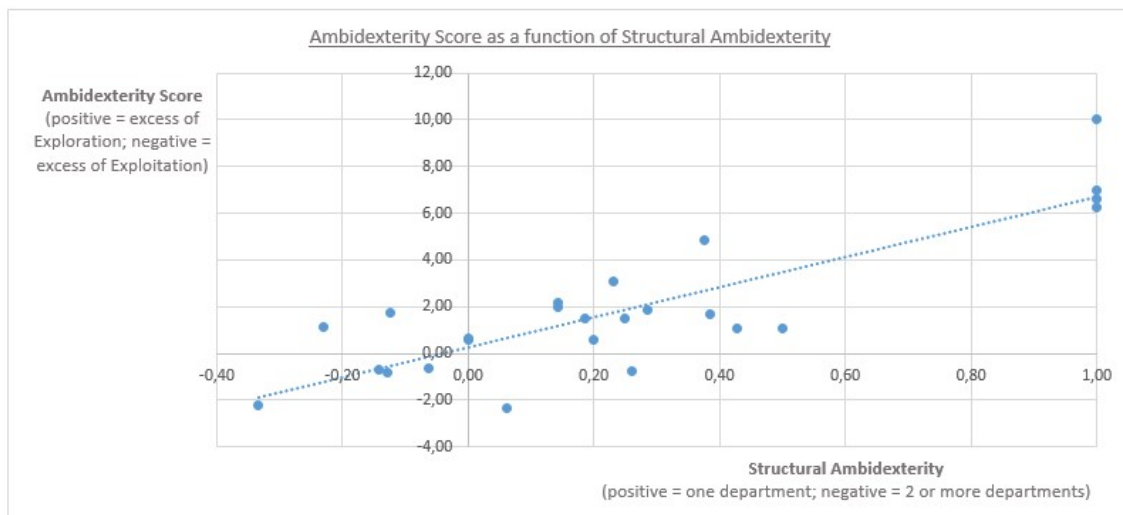


Figure 3.18: Ambidexterity score as a function of structural ambidexterity.

Figure 3.18 also suggests that at Galactic exploratory initiatives (positive ambidexterity scores) are more often conducted by one department (top-right quadrant) whereas exploitative ones (negative ambidexterity scores) seem to benefit from collaboration between departments. Indeed, there is a clear tendency to have a **higher exploration intensity when departments are working independently** (separation, see Figure 3.19) while, conversely, the **exploitation intensity increases when several departments are working together** (collaboration, see Figure 3.20). In other words, at Galactic, exploration is largely an autonomous process whereas exploitation is a collaborative one.

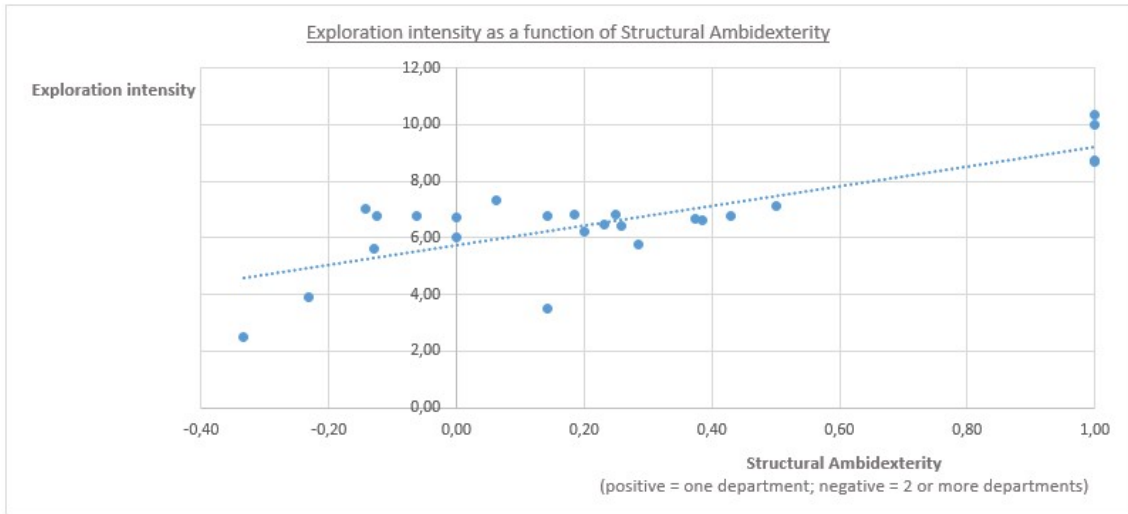


Figure 3.19: Exploration intensity as a function of structural ambidexterity.

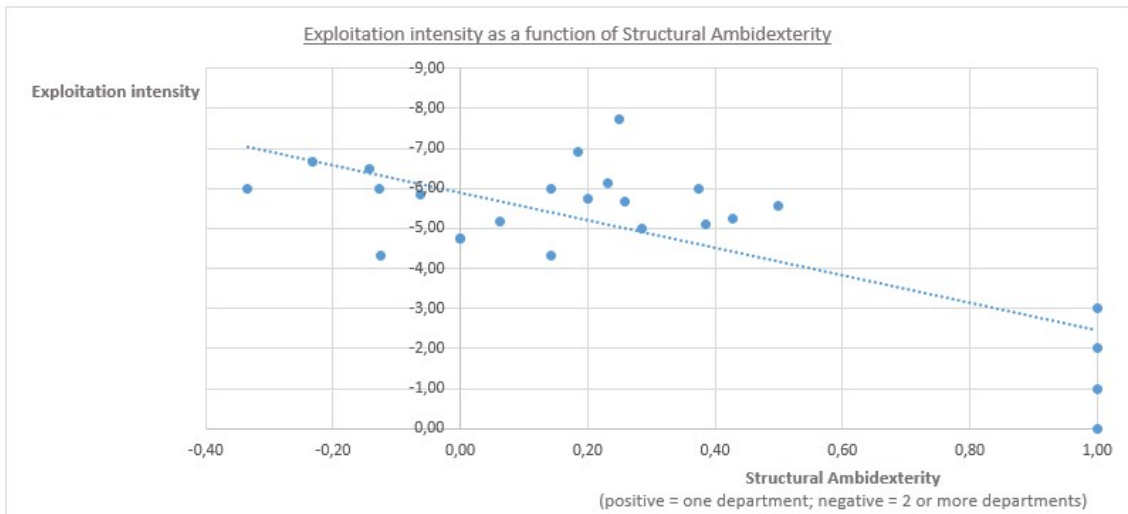


Figure 3.20: Exploitation intensity as a function of structural ambidexterity.

Although true throughout the company’s history, the impact of structure on exploration and exploitation intensities was stronger at the beginning of the company’s activities. Separation or collaboration between departments does not seem to influence largely the level of exploration and exploitation when the company reaches a certain level of maturity (Figure 3.21). This observation suggests that managers who want their organization to reach a certain level of ambidexterity should pay more attention to structure, especially in the first years of existence of their business, to allow exploratory projects to be conducted in clearly defined teams

operating autonomously but, at the same time, to establish bridges between teams so that the exploitation projects can be realized in a participative way.

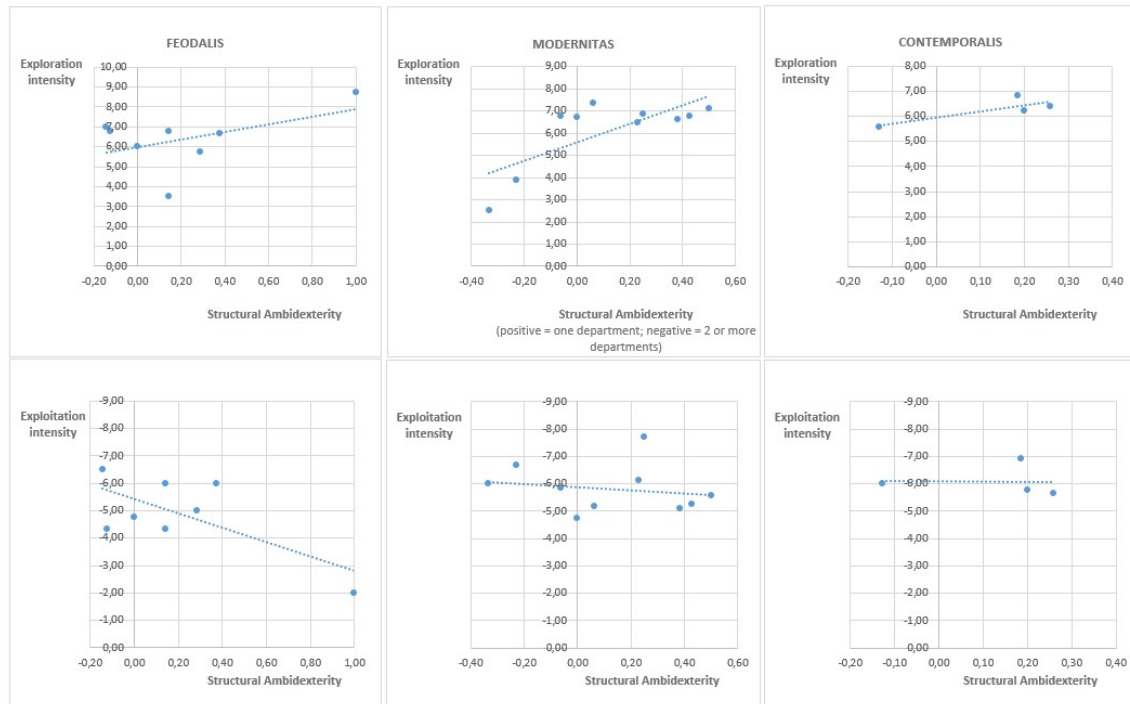


Figure 3.21: Exploration and exploitation intensities versus structural ambidexterity for the different epochs of the company's history.

3.4.2. A matter of network

As per Raisch and his colleagues (2009), organizational ambidexterity is likely to require both internal and external measures as interorganizational activities can enable both exploitative and explorative knowledge processes. Our results seem to support this thesis: **the more partnerships, the more the Ambidexterity Score tends to zero, indicating a balance between exploratory and exploitative forces** (Figure 3.22). However, while the number of partnerships has apparently little impact on the firm's exploration intensity (which is fairly constant and maintained at a relatively high level regardless of the intensity of partnership), it appears to have a more pronounced effect on exploitation intensity (Figure 3.23). So, it is precisely by increasing the number of partnerships of exploitative nature that the company balances the traditionally high number of exploratory collaborations specific to its very culture (the company started as a pure R&D venture) and the high technological level of the industry in which the firm is evolving.

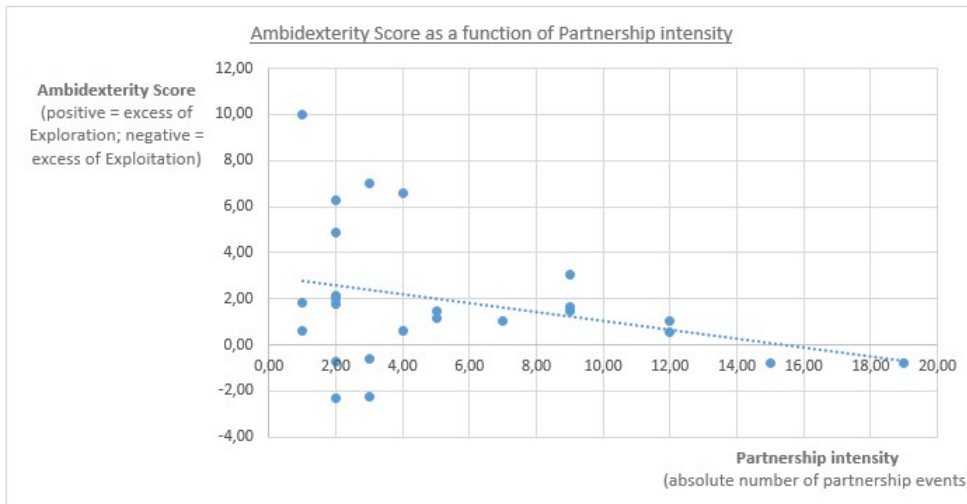


Figure 3.22: Ambidexterity score as partnership intensity.

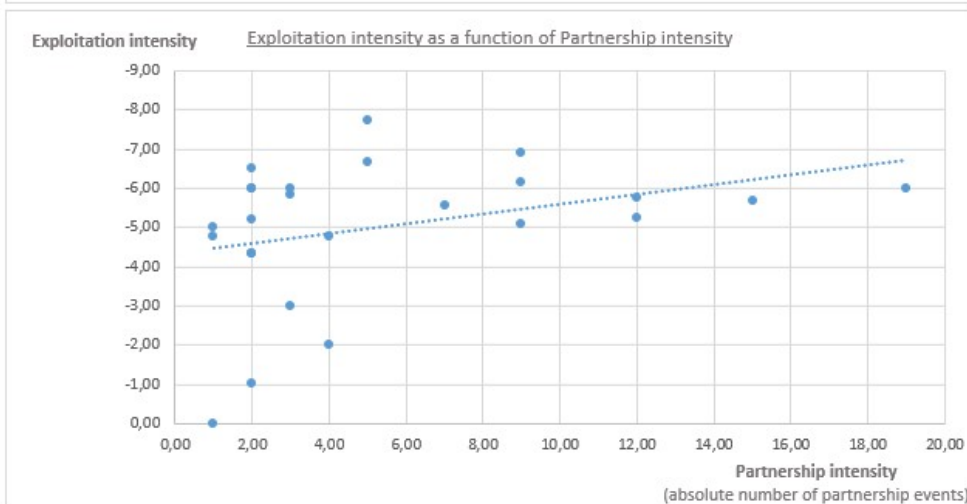
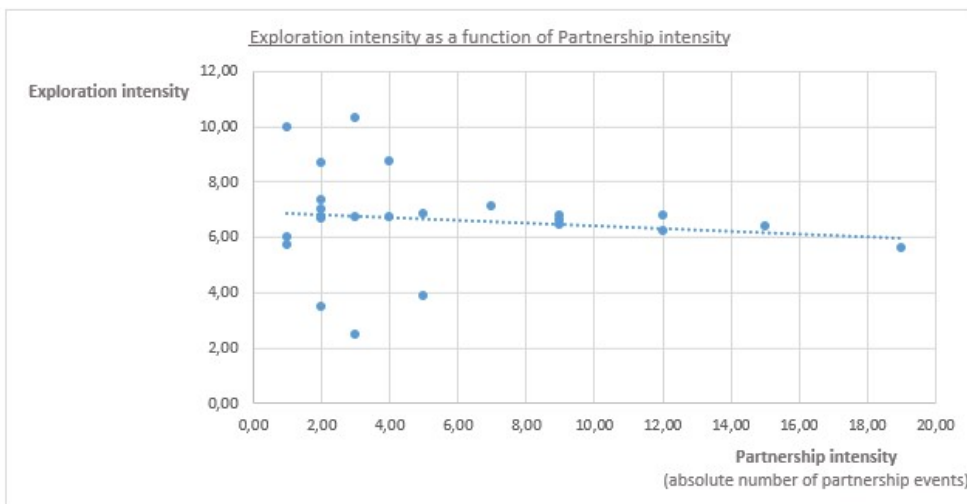


Figure 3.23: Exploration and Exploitation intensities as functions of partnership intensity.

As for the type of partners, new or old, it also seems to have little impact on exploration intensity whereas exploitation benefits from engaging in collaboration projects together with older partners in the frame of recurring agreements with organizations with whom Galactic has already worked before (Figure 3.24).

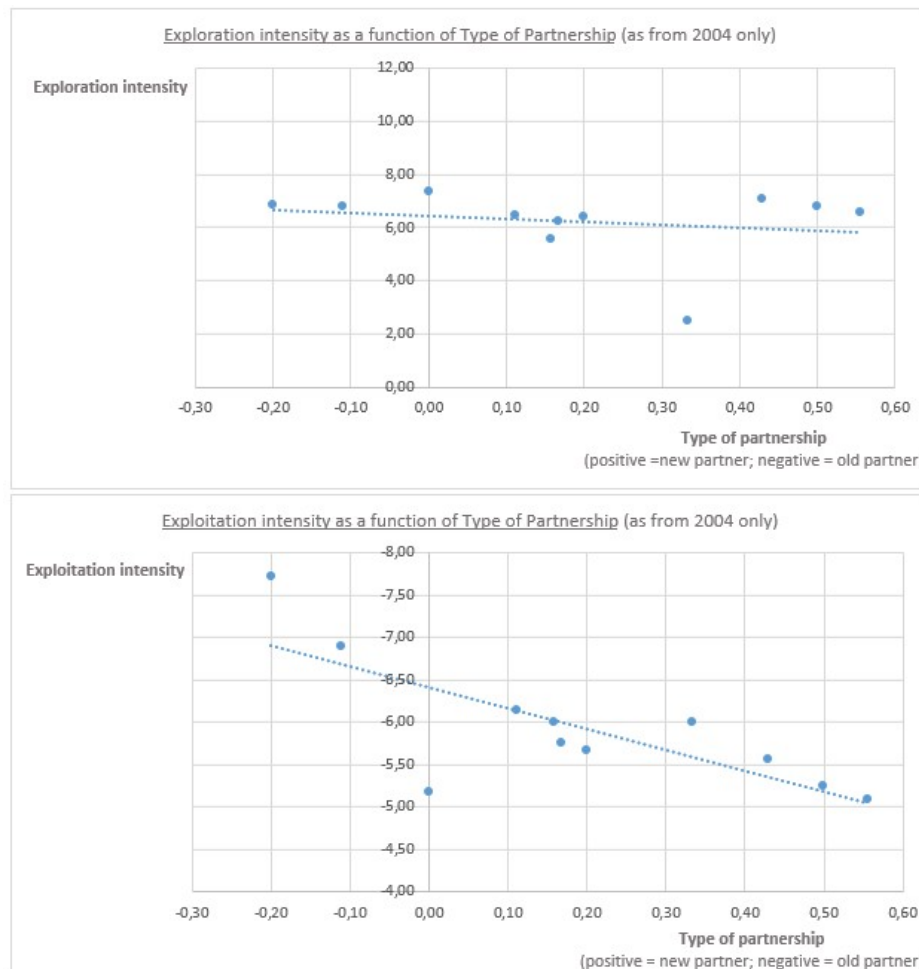


Figure 3.24: Influence of the type of partners (new or old) on Exploration and Exploitation intensities.
 (We focus on the years after 2004 because there were only partnerships with new partners until 2003 – See Figure 3.14)

3.4.3. What matters the most, structure or network?

Structure and network are not exclusive of one another, and organizations can excel on both aspects concurrently. According to Kauppila (2010), the combination of both approaches is even a way to cope with the paradox of exploration and exploitation and “reconcile the brothers” as we titled our Section 1.2.4. He claims that “interorganizational ambidexterity

implies maximization through partnerships (orthogonal exploration and exploitation) and balance (continuous exploration and exploitation) within a firm” (Kauppila, 2010, p.286).

It appears to us useful however to look at which one impacts the most ambidexterity in order to eventually help prioritizing actions when it comes to advising managers. We think it is of particular interest for small and medium enterprises that do not necessarily have the ability or the resources to work on both aspects simultaneously. We therefore decided to use multiple linear regression analysis to model the relationship between our Ambidexterity Score (dependent variable) and two independent variables: Structural Ambidexterity Score and Network Ambidexterity Score, respectively.

For this analysis, we resolved to use the software Sphinx iQ2. 391 observations out of the 410 of our dataset have been taken into consideration. Table 3.11 shows the characteristics of the dependent and independent variables, their correlations and their influence on the model. The Cronbach alpha is 0.71 which reveals an acceptable internal consistency but the model we obtain (Equation 3.5) explains only 46.56% of the variance of the independent variable (multiple correlation coefficient $R = 0.68$; $p(R) < 0.01$; Fischer coefficient $F = 169.04$; $p(F) < 0.01$).

Characteristics of the variables

Variable	Mean	Min	Max	Standard deviation	Skewness	Kurtosis
<i>Independent</i>						
Ambidexterity score	13,95	1,00	24,00	6,30	<0,01	-3,00
<i>Dependent</i>						
Structural ambidexterity	2,19	1,00	3,00	0,98	-0,43	-1,71
Network ambidexterity	0,32	-4,00	4,00	1,50	0,12	-1,97

Correlation matrix

	Ambidexterity score	Structural ambidexterity	Network ambidexterity
Ambidexterity score	-		
Structural ambidexterity	0,48	-	
Network ambidexterity	0,59	0,27	-

Influence of the independent variables

	Standadized coefficients	Contribution
Structural ambidexterity	0,35	40,87%
Network ambidexterity	0,50	59,13%

Table 3.11: Ambidexterity as a combination of structure and network (characteristics of the variables, their correlations and their influence).

$\text{Ambidexterity score} = 8,35 + 2,24 * \text{Structural Ambidexterity score} + 2,21 * \text{Network Ambidexterity score}$

(Equation 3.5)

The sum of the standardized regression coefficients of the model ($0,50 + 0,35 = 0,85 < 1$) shows that these criteria are far from providing a full explanation which justifies the low level of variance explained (46,56%).

Although the model is incomplete as it does not explain even half the variance of the Ambidexterity score, the following lessons can still be learned:

- Both independent variables have a relatively high explanatory power. Their standardized correlation coefficients are relatively high (0,50 and 0,35 for Network Ambidexterity and Structural Ambidexterity, respectively)
- With a contribution of 59,13% of the explained part of the variance of the dependent variable, Network Ambidexterity has a stronger impact on the Ambidexterity score than Structural Ambidexterity which contributes for 40,87% only.

Structural ambidexterity based on separating departments taking care of exploration from the ones in charge of exploitation is frequently considered difficult to implement by SMEs which are often too small and lack resources (Lubatkin et al., 2006; March, 1991). Conversely, network ambidexterity does not require much resources and is therefore more accessible to SMEs. Our results indicate that small companies which are not in a position to allocate separate resources to exploration can nevertheless endeavor towards organizational ambidexterity by developing exploratory and exploitative partnerships. This abounds in the direction of several authors (Lavie & Rosenkopf, 2006; Rothaermel & Deeds, 2004) who suggested externalization and outsourcing as a way of resolving the paradoxical requirements of exploration and exploitation. However, acquiring external knowledge is not sufficient to benefit from it, one has also to integrate it within the organization. This is another tensions-generating challenge that was subject to research on *absorptive capacity* or *combinative capability* which Kogut and Zander (Kogut & Zander, 1992) describe as the organization's ability "to synthesize and apply current and acquired knowledge". This led Raisch *et al.* (2009, p.690) to conclude that "ambidexterity may thus imply the managerial challenge of not only balancing exploitation and exploration but also of integrating external and internal knowledge". If we addressed the former part of this statement, a detailed analysis of the latter falls beyond the limit of our research and could advantageously be the subject of further works.

3.5. The key-components of organizational ambidexterity

The purpose of this section is obviously not to claim to offer a generic and global model adaptable to all situations but more modestly to condense the data specific to our case in a few simple relationships in order to better let emerge the links between components and to better measure their respective impacts on our three principal indicators, i.e. exploration intensity, exploitation intensity and ambidexterity score. This approach should enable us to highlight the most relevant elements of an ambidextrous approach applied to SMEs so as to prioritize the actions to be eventually taken by the managers who wish to develop the present activities of their organizations without jeopardizing their chances to survive the long run.

3.5.1. The key-components of exploration intensity

For this analysis, the 208 observations related to exploration have been taken into consideration from the total number of 410 observations in our dataset. Table 3.13 on the next page shows the correlation matrix for the dependent and independent variables. More interestingly, Table 3.12 hereinafter gives the contribution of each independent variable on Exploration intensity sorted from the most impacting to the least impacting variable.

	Standardized coefficient	Contribution
const	-	-
Exploitative/Exploratory alliance	0.46	18.10
Timeframe	0.28	10.77
Old/New partner	0.26	10.12
Plannification vs- Intuition	0.23	9.07
Efficiency vs- Flexibility	0.21	8.09
Existing/new market	0.20	7.68
IP	0.19	7.49
Markets, Customer groups	0.17	6.77
Experience vs- Creativity	0.17	6.62
Activities, procedures, knowledge	0.16	6.34
Technologies	0.15	5.77
Costs, consumptions & yields	0.08	3.18

Table 3.12: Contributions of each independent variable on Exploration intensity (multiple correlation coefficient $R = 1.00$; $p(R) = <0.01$; Fischer coefficient $F < 0.01$; $p(F) = <0.01$).

In short, it appears that sealing **long term** (the variable “timeframe” contributes greatly) **exploratory alliances** is the most efficient way operated by Galactic to maintain a good level of Exploration intensity. This confirms our previous conclusions (Section 3.3.3. and 3.4.2.) via

another method to scrutinize our data. Our results show that the company takes mainly benefit of external partnerships to drive its exploration activities through exploratory alliances such as research programs with other companies, R&D centers and universities. This is relatively common for medium-sized companies evolving in industries with high technological content as they can't afford supporting all research projects with their own financial means, nor have they enough scientific capabilities to address all possible subjects they might have the need to address in their R&D journey. Moreover, various types of local, regional, national and supra-national support policies incite companies to enter into partnerships and these collaborations are often a mandatory condition for projects to be eligible for grants or subsidies. SMEs are therefore inclined to join these collaborative research programs despite difficulties in terms of intellectual property and, sometimes, in terms of confidentiality.

The contribution of the variable "Old/New partner" also stands out here, and we have seen in Section 3.4.2 that the exploration activities of the company were essentially and quite logically conducted with new partners. The contribution of this variable in Table 3.12 is however surprising as it somewhat contradicts our previous observation that the type of partner, old or new, has actually little impact. We read the contribution of this variable as being a confirmation of the primary importance of entering into alliances and that the type of partner probably does not matter too much as long as partnership there is.

3.5.2. The key-components of exploitation intensity

For this analysis, the 171 observations related to exploitation have been taken into consideration from the total number of 410 observations in our dataset. Table 3.14 on the previous page shows the correlation matrix for the dependent and independent variables, and Table 3.16 below gives the contribution of each independent variable on Exploitation intensity sorted from the most impacting to the least impacting variable.

	Standardized coefficient	Contribution
const	-	-
Markets, Customer groups	0.31	12.41
Activities, procedures, knowledge	0.31	12.31
Technologies	0.27	10.93
Exploitative/Exploratory alliance	0.27	10.82
Experience vs- Creativity	0.26	10.42
Existing/new market	0.25	9.79
Costs, consumptions & yields	0.19	7.75
Old/New partner	0.17	6.69
IP	0.16	6.46
Timeframe	0.15	5.91
Plannification vs- Intuition	0.09	3.39
Efficiency vs- Flexibility	0.08	3.12

*Table 3.16: Contributions of each independent variable on Exploitation intensity
(multiple correlation coefficient $R = 0.96$; $p(R) = <0.01$; Fischer coefficient $F = 158.18$; $p(F) = <0.01$).*

Contrary to Exploration intensity, Exploitation intensity was predominantly supported by **focusing on existing markets and customers** as well as by paying attention to **improving activities, technologies, processes and products**. **Exploitative alliances** such as sub-contracting the manufacture of some products also impacted positively the company's exploitation intensity. We remember from Section 3.4.2 that exploitation benefits from engaging in collaboration projects together **with older partners** in the frame of recurring agreements with organizations with whom the company had already worked before. Similarly, **promoting existing solutions** and **leveraging accumulated experience** helped the company to sustain exploitation.

	Exploration score	Exploitative/Exploratory alliance	Timeframe	Old/New partner	Plannification vs- Intuition	Efficiency vs- Flexibility	Existing/new market	IP	Markets, Customer groups	Experience vs- Creativity	Activities, procedures, knowledge	Technologies	Costs, consumptions & yields
Exploration score	-												
Exploitative/Exploratory alliance	0.52	-											
Timeframe	0.58	0.12	-										
Old/New partner	0.33	0.14	0.02	-									
Plannification vs- Intuition	0.59	0.31	0.59	-0.02	-								
Efficiency vs- Flexibility	0.38	-0.14	0.31	-0.04	-0.02	-							
Existing/new market	0.36	-0.02	0.06	0.36	-0.10	0.13	-						
IP	0.17	-0.25	0.20	-0.17	0.16	0.18	-0.11	-					
Markets, Customer groups	-0.12	-0.21	-0.36	0.08	-0.42	0.19	0.28	-0.17	-				
Experience vs- Creativity	0.39	0.13	0.15	-0.15	0.27	0.06	-0.06	0.10	-0.26	-			
Activities, procedures, knowledge	0.30	<0.01	-0.08	-0.05	0.12	0.14	0.15	0.04	0.07	0.15	-		
Technologies	0.54	0.15	0.26	-0.08	0.46	0.10	0.05	0.15	-0.34	0.60	0.36	-	
Costs, consumptions & yields	0.19	-0.11	0.08	0.10	-0.06	0.35	0.14	0.11	0.06	<0.01	-0.05	0.01	-

Table 3.13: Correlation matrix for the variables explaining the Exploration score
(The Cronbach alpha is 0.61 which reveals a low but still acceptable internal consistency)

	Exploitation score	Old/New partner	Existing/new market	Exploitative/Exploratory alliance	Efficiency vs- Flexibility	Activities, procedures, knowledge	Plannification vs- Intuition	Technologies	Markets, Customer groups	Experience vs- Creativity	Timeframe	Costs, consumptions & yields	IP
Exploitation score	-												
Old/New partner	0.38	-											
Existing/new market	0.54	0.33	-										
Exploitative/Exploratory alliance	0.20	-0.26	0.21	-									
Efficiency vs- Flexibility	0.37	0.17	-0.01	-0.23	-								
Activities, procedures, knowledge	0.45	0.22	-0.05	-0.19	0.61	-							
Plannification vs- Intuition	0.45	0.16	0.21	-0.10	0.23	0.20	-						
Technologies	0.33	0.15	-0.08	-0.23	0.24	0.32	0.37	-					
Markets, Customer groups	0.40	0.10	0.44	0.04	-0.06	-0.11	0.14	-0.25	-				
Experience vs- Creativity	0.44	-0.01	0.05	0.15	0.08	0.11	0.15	0.03	0.12	-			
Timeframe	0.30	0.12	0.25	-0.04	0.11	0.05	0.19	-0.02	0.15	0.05	-		
Costs, consumptions & yields	0.30	0.03	0.04	-0.16	0.12	0.10	0.12	0.23	0.03	0.08	0.03	-	
IP	0.19	0.08	0.03	0.36	0.06	-0.05	<0.01	-0.10	-0.07	0.03	-0.13	-0.08	-

Table 3.14: Correlation matrix for the variables explaining the Exploitation score
(The Cronbach alpha is 0.64 which reveals a low but still acceptable internal consistency)

	Ambidexterity score	Exploitative/Exploratory alliance	Timeframe	Plannification vs- Intuition	Efficiency vs- Flexibility	Activities, procedures, knowledge	Experience vs- Creativity	Technologies	Old/New partner	Markets, Customer groups	Existing/new market	IP	Costs, consumptions & yields
Ambidexterity score	-												
Exploitative/Exploratory alliance	0.55	-											
Timeframe	0.85	0.40	-										
Plannification vs- Intuition	0.90	0.45	0.81	-									
Efficiency vs- Flexibility	0.88	0.30	0.75	0.78	-								
Activities, procedures, knowledge	0.86	0.29	0.66	0.77	0.84	-							
Experience vs- Creativity	0.85	0.48	0.70	0.75	0.72	0.71	-						
Technologies	0.82	0.31	0.64	0.79	0.74	0.77	0.71	-					
Old/New partner	0.22	0.04	0.13	0.08	0.11	0.12	0.05	0.07	-				
Markets, Customer groups	0.36	0.06	0.23	0.21	0.31	0.27	0.26	0.10	0.12	-			
Existing/new market	0.26	0.07	0.16	0.11	0.13	0.13	0.09	0.07	0.33	0.38	-		
IP	0.41	0.12	0.36	0.39	0.40	0.31	0.35	0.32	-0.06	0.02	-0.03	-	
Costs, consumptions & yields	0.33	-0.01	0.20	0.26	0.34	0.28	0.23	0.36	0.03	0.12	0.10	0.12	-

Table 3.15: Correlation matrix for the variables explaining the Ambidexterity Score
(The Cronbach alpha is 0.88 which reveals a good internal consistency)

3.5.3. The key-components of organizational ambidexterity

For this analysis, 390 observations have been taken into consideration from the total number of 410 observations in our dataset. Table 3.15 on the previous page shows the correlation matrix for the dependent variable, the ambidexterity score, and the independent variables; and Table 3.17 below gives the contribution of each independent variable on Ambidexterity Score sorted from the most impacting to the least impacting variable.

	Standardized coefficient	Contribution
const	-	-
Exploitative/Exploratory alliance	0.19	12.66
Timeframe	0.16	10.76
Plannification vs- Intuition	0.16	10.75
Efficiency vs- Flexibility	0.16	10.68
Activities, procedures, knowledge	0.15	10.48
Experience vs- Creativity	0.15	10.40
Technologies	0.13	8.83
Old/New partner	0.09	6.19
Markets, Customer groups	0.09	6.10
Existing/new market	0.08	5.15
IP	0.06	4.35
Costs, consumptions & yields	0.05	3.64

Table 3.17: Contributions of each independent variable on Ambidexterity Score (multiple correlation coefficient $R = 1.00$; $p(R) = 0.00$; Fischer coefficient $F < 0.01$; $p(F) = <0.01$).

Not surprisingly, we find some of the most influential variables of ambidexterity among those that had the greatest impact on exploration intensity and/or on exploitation intensity (Alliances; Timeframe; Activities, procedure, knowledge; and Experience vs. Creativity). Figure 3.25 highlights these correspondances. This seems trivial when one knows that ambidexterity arises from the balance of exploration and exploitation activities, the very basis of our starting posture as explained at large in our literature review. The most influential variable, and one that finds support in both exploration and exploitation, is the formation of partnerships which impact has already been underlined in Section 3.4.3. However, the type of partner (old or new) and even, more surprisingly, the type of market (old or new) in which these partnerships take place do not appear critical to the ambidextrous character of the company. As we have just seen, the ability to form alliances of exploratory nature as well as alliances of exploitative nature is highly impacting exploration and exploitation intensities, respectively; and we can logically infer that holding both simultaneously greatly improves the ambidextrous character of the company. Clearly identifying whether projects are in the short or long term also helps ambidexterity as indicated by the high contribution of the variable “timeframe” (the projects whose timeframe

was not clear were attributed a zero rating for this variable). Although quite understandable without much explanations, this element will nevertheless gain understanding in Section 3.7 where we search for underlying processes and observe that the company resorted to different ones for short and long development cycles.



Figure 3.25: Correspondances between the key-components of Exploration intensity, Organizational ambidexterity and Exploitation intensity (Only the components with contributions higher than 10% are displayed).

Interestingly though, appear in the most influential variables some variables that did not emerge as particularly impacting on either exploration or exploitation intensities (i.e., Plannification vs. Intuition; Efficiency vs. Flexibility) which suggests that the implementation of harmonious and effective ambidextrous management should not simply focus on maximizing exploration and exploitation (the conceptualization of exploration and exploitation as orthogonal dimensions that we had called "Appolo & Dyonisos" in Section 1.2.1) but must also activate certain levers whose combination brings effects on ambidexterity greater than the sum of their effects on each of its components.

The first of these levers lies in the **pursuit of intuitive projects in parallel of well planned ones** (variable "Plannification vs. Intuition"). Plannification and intuition are not always opposed, especially in a context of uncertainty; all decision makers ultimately rely on their intuition and judgement and effective forecasting helps narrowing the decision space in which to exercise intuition (Saffo, 2007) to transform a pure guess into an educated one. This said, there are two ways of starting projects and taking decisions: either by making an extensive evaluation of the possible outcomes *ex ante* (forecasting) and planning precisely each step of the process to go through to achieve the projected objective, or to start the project or taking the decision based on intuition, heuristics, imagination and beliefs. Our results suggest that ambidexterity greatly benefits from having both approaches simultaneously while the extent of

the impact on exploration and exploitation intensities separately is rather limited⁵¹. This point is also further discussed in our search for underlying processes (Section 3.7).

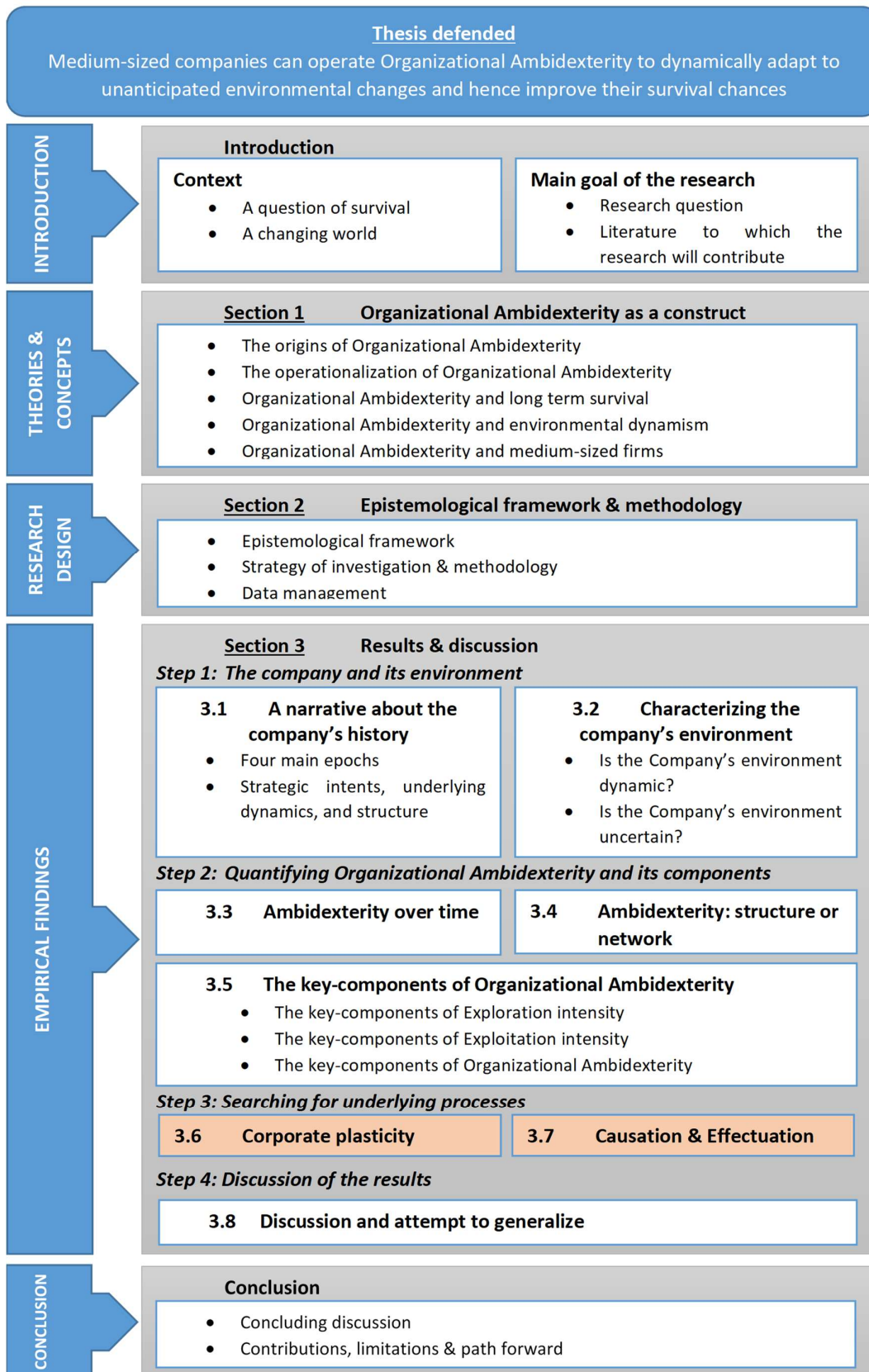
The second lever that contributes positively to organizational ambidexterity without strongly impacting specifically exploration or exploitation is based on **balancing attention to efficiency and to flexibility**, another tradeoff that needs to be addressed by managers as already pointed out by other authors (Adler, Goldoftas, & Levine, 1999; Ebben & Johnson, 2005; Xie, 2012).

We go further in our analysis of this in our search for underlying processes that makes the core of the third step of our methodology and which follows next.

⁵¹ The variable “Plannification vs. Intuition” contributes for 9.07% to exploration intensity and only 3.37% to exploitation intensity.

Step 3:

Searching for underlying processes



As we have seen in Section 3.1 above, the analysis of the company's history has allowed us to delineate phases characterized by specific strategic intents which have resulted, among other things, in significant structural changes during the expansion and the progressive transformation of the company into an international group of rather small size but nevertheless settled in seven locations spread on three continents. In a second step, we have quantified different components of organizational ambidexterity and we have looked at the way they articulated over time in order to identify the levers available to managers to influence exploration and exploitation and help them balance the need for short-term incomes with the necessity of long-term development.

However, the consultation of the many documents that served as the basis for the writing of the company's history has highlighted two elements that are fundamental enough to shed light on the subject of our research and especially on possible processes underlying organizational ambidexterity. It happens that these two elements also came out of our quantitative analysis as some of the main variables influencing organizational ambidexterity without however impacting heavily either exploration or exploitation intensities. We do not pretend that these elements are entirely new to the man of art, nor that they constitute the essential part of what permitted the company to be ambidextrous, but we believe that they are sufficiently obvious in the way the company operates to merit they be discussed and confronted with the existing literature on the subject.

The first element concerns the mobility and multi-disciplinarity of the management as factors of flexibility and adaptability (the variable “Efficiency vs. Flexibility” in our quantitative analysis).

The second element pertains to the variable “Plannification vs. Intuition” of our quantitative analysis and relates to the way by which the company has been able to transform its market approach to face the profound mutation that was about to threaten its very survival.

3.6. Corporate plasticity

“Chaos widens the spectrum of options and forces the organization to seek new points of view. For an organization to renew itself, it must keep itself in a non-equilibrium state at all times.”

(Nonaka, 1988, p.59)

Ashby (1957) showed that, in order for a system to control another system, it is necessary and sufficient that the variety of the former be greater than, or at least equal to, that of the latter. This “law of requisite variety” implies that for an organization to successfully survive all circumstances, it needs to have at least as much variety within itself as the variety of disturbances in its external environment (Kim & Rhee, 2009)⁵². As per Volberda (1996), it is not only the variety of capabilities currently used by the organization that counts but also the collection of potential capabilities that are not yet activated and need to be developed to cope with the possible emergence of opportunities or threats. This approach is in line with March’s exploitation of existing capabilities and exploration of new ones (March, 1991) as well as with O’Reilly and Tushman’s description of ambidexterity as a dynamic capability (O’Reilly & Tushman, 2007) or with Birkinshaw and colleagues in their attempt to bridge dynamic capabilities and ambidexterity perspectives (Birkinshaw et al., 2016).

As highlighted by contingency theorists who believe that there is no best way to organize a company and that the optimal course of action is dependent (contingent) upon internal and external contexts (Ashby, 1962; Nonaka, 1988), nurturing existing capabilities and developing new ones ultimately aims at improving the ability of the organization to adapt to environmental changes; in other words it allows the organization to be flexible. Indeed, in a broad sense, “flexibility involves the creation or promotion of capabilities for situations of unexpected disturbance” (Volberda, 1996, p.361).

⁵² Note that Ashby was particularly influential to Herbert Simon’s work on bounded rationality and its link to decision-making in organizations and artificial intelligence. Interestingly, in a letter to Simon, Ashby writes that “It is my firm belief that the principles of ‘organisation’ are fundamentally the same, whether the organization be of nerve cells in a brain, of persons in a society, of parts in a machine, or of workers in a factory” (Crowther-Heyck, 2005, p.190).

What is strikingly evident from the narrative of the company's history is the plasticity of its managerial team. We like to use the word “plasticity” instead of “flexibility” with reference to the concept of “phenotypic plasticity” in biology which is defined by the Oxford dictionary as the adaptability of an organism to changes in its environment. More precisely, it is the ability of an organism to change its *phenotype* in response to changes in its environment without altering its genotype. The phenotype is made of all observable attributes of the organism such as its morphology but also its developmental and behavioral characteristics; it results from the expression of its genotype, its genetic code, as well as from the influence of environmental factors and the interactions between the two. By homology, transferring the concept from organisms to organizations (McKelvey, 1999), we propose the term “corporate plasticity” to describe all types of organizational responses an organization may display to environmental changes (phenotype variations) without altering its profound makeup (its genotype, its corporate DNA: the “visions, values, and sense of purpose that bind an organization together” (Morgan, 1997, p.95)). In that sense, the idea of corporate plasticity also includes learning phenomena as there is no adaptation to environmental changes without learning (Argyris & Schön, 1978), a characteristic of “intelligent” entities such as living organisms and human organizations.

Without reducing the plasticity of a company to the sole mobility of its management, we nevertheless observe frequent changes in managerial structure during the 25 years of Galactic's history. That said, these changes have an important characteristic, that of talent retention, in that these changes are articulated for the majority around the same people. These adaptations of the managerial structure are multidimensional: they fit into time, space and the very nature of the multiple responsibilities held simultaneously by its members.

In time, because most of its members have participated in the adventure since its inception in many different job positions. A steady management team is obviously an element of stability that helps the company go through crisis and exogenous shocks but it may as well be an element of organizational inertia (Hannan & Freeman, 1984; Volberda, 1996) or cultural lock-in (Foster & Kaplan, 2001b). In the case of Galactic, the drawbacks of having a longlasting managerial structure were mitigated by changes in space and by the different responsibilities held simultaneously by the members of the management team. The need to relocate certain activities on other continents to support the growth of the company and tackle new opportunities and conquer new geographies, mainly during the decentralization phase of its decision-making structures (the period named Modernitas), has triggered the displacement of part of the top

management team to the Eastern part of the world first and to the West right after. Most of these directors were cumulating different responsibilities on different continents⁵³. The essence of this observation in the frame of our research, and maybe the particularism of Galactic's organization, is not that those people were overseeing activities in different places, which is of course the case of any company active on the international scene, but precisely that the content of these responsibilities differed in the various places (see the footnote). It allowed each of the people concerned to be part of new ventures and new developments at the same time as they kept a role in the company's core activities. In this, the company follows the recommendation of O'Reilly and Tushman (2004) who proposed as "integrating mechanism" (Markides, 2013) that the parent company and the subsidiary unit share common managers.

Another point of interest is again not that people held various responsibilities in a given firm, which is very common in medium-sized companies, but that these very different responsibilities were held simultaneously; what the managers of Galactic refer themselves to as having "multiple hats". This kind of organization based on a closely intertwined set of responsibilities among the top-managers facilitates knowledge transfer from the core to newly created entities and between departments but also opens up the management to new opportunities, new perspectives and, in turn, ultimately, helps acquire new knowledge.

Paradoxically, big firms usually have slack resources⁵⁴ which are seen as advantages for the implementation of organizational ambidexterity (Atuahene-Gima, 2005; Lubatkin et al., 2006) and to buffer organizations from external shocks (Meyer, 1982) but they often lack corporate plasticity because of heavy structures and inertia-prone bureaucracy sometimes referred to as "mechanistic" structures (Burns & Stalker, 1961). Conversely, medium-sized companies have fewer hierarchical levels, their managers are more likely to play both strategic and operational roles. Hence, these companies have no choice but to concentrate different activities on few people which forces them into an "organic" mode of organization that inevitably contains the seeds of plasticity and organizational ambidexterity as the management "directly experience the added dissonance of competing knowledge demands inherent in the pursuit of an ambidextrous orientation" (Lubatkin et al., 2006, p.647). Some authors (Burns & Stalker, 1961)

⁵³ For instance, as described in the narrative (Appendix II.3), a general management position in Asia and R&D responsibilities in Belgium for one director; production and supply chain responsibilities in China while heading the engineering department in Belgium for another; or general management responsibilities in USA and production ones in Belgium for a third one.

⁵⁴ Nohria and Gulati (1995, p.1246) define slack as "the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output. Slack resources include excess inputs such as redundant employees, unused capacity, and unnecessary capital expenditures."

have argued that such an “organic” system is more efficient in turbulent conditions whereas “mechanistic” management systems perform better in stable environment.

However, as seen in Sections 3.3.2 and 3.4.1, the company used to favor separation between the departments to conduct its exploration activities whereas exploitative ones were primarily betting on collaboration. This indicates that the organic structure held at the top of the company was partially compensated by a more mechanistic structure within and between the departments. This gives credit to Adler, Goldoftas and Levine (1999) who observed that achieving flexibility and efficiency at the same time may involve partitioning whereby one group of people adopts an organic structure to perform non-routine tasks while another takes on a mechanic structure to execute more routine tasks. Our observations also echo other researches (Tushman et al., 2011) by which managers are invited to hold at the top of the company the tensions arising from the conflicting interests of innovating and exploiting, and “foster a state of constant creative conflict” (opcit., p.76). In any case, tight coordination and integration at the senior management level are essential conditions for ambidexterity (Kauppila, 2010; Smith & Tushman, 2005).

Figure 3.26 combines our conclusions about the organic/mechanistic types of organization at different levels in the company, i.e. top management level versus department level, with our previous observations about the implementation of ambidexterity within the company.

TOP MANAGEMENT									
Type of organization	Organic (different types of responsibilities held simultaneously in different geographies) ("multiple hats")								
Type of ambidexterity	Simultaneous								
DEPARTMENTS									
Type of organization	Mechanistic (boundaries between departments clearly defined)								
Type of ambidexterity	Structural & Network								
Implementation of ambidexterity	<table style="width: 100%; border: none;"> <thead> <tr> <th style="text-align: left; width: 50%;"><u>Exploitation</u></th> <th style="text-align: right; width: 50%;"><u>Exploration</u></th> </tr> </thead> <tbody> <tr> <td style="text-align: left;">Collaboration with other departments</td> <td style="text-align: right;">Separation between departments</td> </tr> <tr> <td style="text-align: left;">Collaboration with external partners</td> <td style="text-align: right;">Collaboration with external partners</td> </tr> <tr> <td style="text-align: left;">(i.e. exploitative alliances primarily with old partners)</td> <td style="text-align: right;">(i.e. exploratory alliances with old and new partners)</td> </tr> </tbody> </table>	<u>Exploitation</u>	<u>Exploration</u>	Collaboration with other departments	Separation between departments	Collaboration with external partners	Collaboration with external partners	(i.e. exploitative alliances primarily with old partners)	(i.e. exploratory alliances with old and new partners)
<u>Exploitation</u>	<u>Exploration</u>								
Collaboration with other departments	Separation between departments								
Collaboration with external partners	Collaboration with external partners								
(i.e. exploitative alliances primarily with old partners)	(i.e. exploratory alliances with old and new partners)								

Figure 3.26: Type of organization and type of ambidexterity at top management level and department level.

At the level of top management, we have just seen that the organic type of organization supports the ambidextrous orientation and we had seen previously that the company succeeds to simultaneously balance its exploratory and exploitative activities. However, to achieve this

result, the top management relies on subsidiaries and departments operating in silos with clearly defined responsibilities, a much more mechanistic type of organization. Although cooperation between departments seems to be always desirable and should be promoted, we have seen that the company tends to conduct its exploratory activities in a separated way, within the same department, as well as by setting up partnerships with both new and old external entities. Conversely, exploitative activities are pursued in a much more collaborative way, both internally between different departments and externally through collaborations with partners generally historical.

Duncan (1976) initially conceptualized organizational ambidexterity as alternating sequences of organic and mechanistic structures. Mechanistic structures support routine operations, functionalization and formal duties (Lavie et al., 2010), therefore being ideal to entail exploitation, whereas organic structures are much less rigid, hence facilitating search for new knowledge and exploration (Burns & Stalker, 1961). Such a temporal sequencing is probably well adapted to rather stable environmental conditions because organizations have time to manage the shifts and benefit from adaptive learning (Cyert & March, 1963), but this approach seems inappropriate under situations of swift and uncertain environmental change (Schmitt et al., 2010). According to Tushman and O'Reilly (Tushman & O'Reilly, 1996), an environmental context of punctuated discontinuities is best dealt with by separating spatially the exploration and exploitation activities (the concept of structural ambidexterity introduced in section 1.2.2. above). Conversely, Jansen *et al.* (2005) observed that organizations operating in highly dynamic competitive environments rely mostly on contextual ambidexterity instead of instating structural separation between units.

It is clear from our observations that Galactic has implemented an organization that combines the different precepts put forward by these authors:

- an "organic" type of organization at the top of the company, probably supported by elements of a contextual ambidexterity well adapted to a particularly dynamic environment as advocated by Jansen and his colleagues (2005),
- a "mechanistic" type of organization largely structural at the operational level;
- all simultaneously, which avoids the problems of "temporal sequencing" noted by Cyert & March (1963).

This type of joint organization is probably quite specific to medium-sized enterprises. Indeed, very small companies generally do not have enough hierarchic levels to allow for different

organization types between the top management and the execution level. The top managers are themselves strongly involved at the operational level and their organizations usually cannot afford creating structurally separated departments or focusing teams on exploration specifically. At the other end of the spectrum, large corporations are often mechanistically organized and their size imposes speciallization of sub-units. In this case, the challenge is to keep these multiple subunits tightly coupled internally and loosely coupled across themselves (Benner & Tushman, 2003). Medium-sized firms are at the junction of these two worlds, large enough to organize themselves structurally but small enough to have their top-management “much closer to the firm’s operating core” (Lubatkin et al., 2006, p.649), playing “both strategic and operational roles” (p.647), and hence experiencing “the added dissonance of competing knowledge demands inherent in the pursuit of an ambidextrous orientation” (p.647).

In view of these elements, we argue that **medium-sized companies can nurture their corporate plasticity and become ambidextrous by adopting an organic structure of management at the top of the company** based on different sets of responsibilities held simultaneously by a limited group of flexible managers, instead of having each one in charge of a single activity as often the case, and to combine this organic structure at the top **with a mechanistic type of organization at the execution level.**

It is precisely with the level of execution that the following section deals.

3.7. Causation and Effectuation

« Human imagination and human aspirations influence each other and reshape one another continually, both directly and through economic artifacts. The swirls and eddies these interactions engender often change the shoreline and make the waters treacherous for economic ship builders and navigators. That is why destinations as well as paths are often unclear in economic decision making. And when destinations are unclear and there are no preexistent goals, causal road maps are less useful than effectual exchanges of information between all stakeholders involved in the journey. Bold expeditions and even one-eyed pirates rule such seas, and voyages to India effectually end up in the Americas.»

(Sarasvathy, 2001, p.262)

At the end of Modernitas (2010-2011), as we have seen previously, the environmental conditions surrounding the company's operations were deteriorating sharply with a gloomy macroeconomic context, extremely expensive feedstocks, rocketing oil prices, increasing competition intensity and commoditization of its flagship products. But these externalities relayed by the middle management and objective financial figures (flattening or decreasing top line, raising raw material and energy bill, squeezed margins and dropping bottom line) are in fact flashing lights on the top-management's dashboard indicating that the situation is worsening and that the very survival of the company may be sooner or later at stake⁵⁵. At first sight though, following our line of thoughts as true believers in the power of organizational ambidexterity, the company's management was already doing the right thing: investing in R&D and developing new knowledge (in short, exploring) while maintaining a relatively high focus on improving operations (exploiting). Indeed, the firm was apparently good at balancing exploration and exploitation and maintaining an ambidexterity score under control for more than a decade by using the various levers detailed in Sections 3.4 and 3.5.

Hence it is not that the company was not innovating prior to the last strategic inflection. It is even the contrary as we have seen that the company stayed majoritary in exploratory territory almost all its life (without forsaking exploitation) and there is even an increase of exploratory focus at the end of Modernitas (see Figure 3.10 in section 3.3.1). As a matter of fact, voices

⁵⁵ A good example of Burgelman's strategic dissonance (Burgelman & Grove, 1996): when information brought up by the middle management and various objective ratios and metrics indicate a discrepancy between the strategic intent and the path really taken by the company on the field.

started to be raised as early as 2004/2005 already as it can be seen from the following abstract of the new business development plan submitted then to the board of directors.

« L'exercice 2004/05 sera très probablement un exercice charnière dans l'évolution de GALACTIC qui devrait voir la concrétisation de projets majeurs (B&G, GALACTIC Inc., Snoopy). Ceux-ci modifieront le positionnement de l'entreprise sur ses marchés et imposeront une modification de sa stratégie globale. Dans le contexte actuel d'expansion des activités de l'entreprise, certaines questions de fond se posent qui devront être tranchées par le management. Une de ces questions concerne la R&D au sens large, et plus particulièrement le développement de produits nouveaux : souhaitons-nous rester suiveurs ou voulons-nous tendre à moyen terme vers une situation de leader ? Si le choix du management et de l'actionnariat se porte sur la seconde alternative, des moyens devront être déployés (moyens humains et matériels). »⁵⁶

And the need to pursue the efforts in research and development was understood and supported up to the highest instances of the company even after the strategic inflection was initiated (abstract of the Minutes of the Board dd. Feb. 22, 2013):

« Combiner sur le nouveau site les commerciaux et le support technique est une excellente chose. Il faudra s'assurer que la recherche et développement contribue pleinement à la réorientation des activités. »⁵⁷

So, if the company succeeded indeed to simultaneously explore and exploit, why was that not enough? Do we touch here the limits of organizational ambidexterity as a mean to cope with environmental changes and surrounding volatility? Why did the management feel the need to profoundly change the company's strategy? Would the new strategy alter in any way the ambidextrous capabilities of the firm?

It was when thinking about those questions during the writing of the company's history (Appendix II) and when investigating the extant literature on the subject that we came across the concept of *effectuation*.

⁵⁶ “The 2004/05 financial year will most likely be a pivotal year in the evolution of GALACTIC, which should see the realization of major projects (B & G, GALACTIC Inc., Snoopy). These will modify the position of the company in its markets and will require a modification of its overall strategy. In the current context of expansion of the company's activities, certain fundamental questions arise which must be decided by the management. One of these questions concerns R & D in the broad sense, and in particular the development of new products: do we want to stay as followers or do we want to move towards a leadership position in the medium term? If the choice of management and shareholders is based on the second alternative, means must be deployed (human and material means).”

⁵⁷ “Combining on the new site the sales and technical support is an excellent thing. It will be necessary to ensure that research and development contributes fully to the reorientation of activities.”

Effectuation theory discerns two logics of decision-making: causation, which assumes that the means are selected to achieve predefined goals; and effectuation, which postulates that the goals stem from the available means⁵⁸. The decision maker decides on what logic to apply in regards to its perception of the future. If he believes that he is dealing with a measurable or relatively predictable future, he will try to gather information about this possible future and will design a strategy to address this future in order to attain his goal. Conversely, if he thinks that he is dealing with a relatively unpredictable situation, he will most likely enter in an experimental and iterative learning process (Sarasvathy, 2001a). Hence, a causal approach appears deeply rooted in planning and forecasting which is notoriously inaccurate (Hogarth & Makridakis, 1981; Mintzberg, 1994) especially in unpredictable environment as “a prerequisite of any form of forecasting, whether judgemental or statistical, is that a pattern or relationship exists concerning the event of interest” (Makridakis, 1990). The crux of effectuation contrarily posits that one does not need to predict the future should one be in a position to control it, i.e. in position to cope with and adapt to any unexpected event that may occur.

In terms of generative mechanisms, we believe we can link the two logics to two different process theories of organizational development described by Van de Ven and Poole (1995). In our eyes, causation follows a teleological model⁵⁹ as a cycle of goal formulation, implementation, evaluation, and modification of goals based on what was learned by the entity, whereas effectuation resorts to an evolutionary model of repetitive sequences of variation, selection, and retention⁶⁰.

Figure 3.27 shows the evolution of causation and effectuation over the 25 years of the company’s history as measured with the rating grid described in Section 2.4.3 (Figure 2.12). We see that Galactic started its activities with an intuition-based effectual approach, which provides support to the entrepreneurial roots of the effectuation concept (Sarasvathy, 2001), but that the company quickly had to activate causal processes based on forecasting to support its growth and development. In such a capital intensive industry characterized by long investment cycles, a certain amount of teleological planning is mandatory. This evolution pulled the

⁵⁸ Remember the metaphor of the cook on Section 2.4.3 who is either buying ingredients needed to cook a chosen meal (a causal approach: the meal defines the recipe which imposes the ingredients) or cooking what can be done with the ingredients at hand (an effectual approach: the ingredients lead to a possible recipe which defines the meal).

⁵⁹ Teleology presupposes causality (von Mises, 1962). “*Agen autem non movet nisi ex intentione finis*” (An agent does not move without the intention of an end) – Saint Thomas Aquinas, *Summa Theologiae*.

⁶⁰ In their paper, Van de Ven and Poole (1995) position this evolutionary process at the level of a population of entities but Burgelman (1991) describe the same evolutionary process at the entity level.

resultant of causation and effectuation measures close to zero value in Figure 3.27 which indicates the coexistence of both logics.

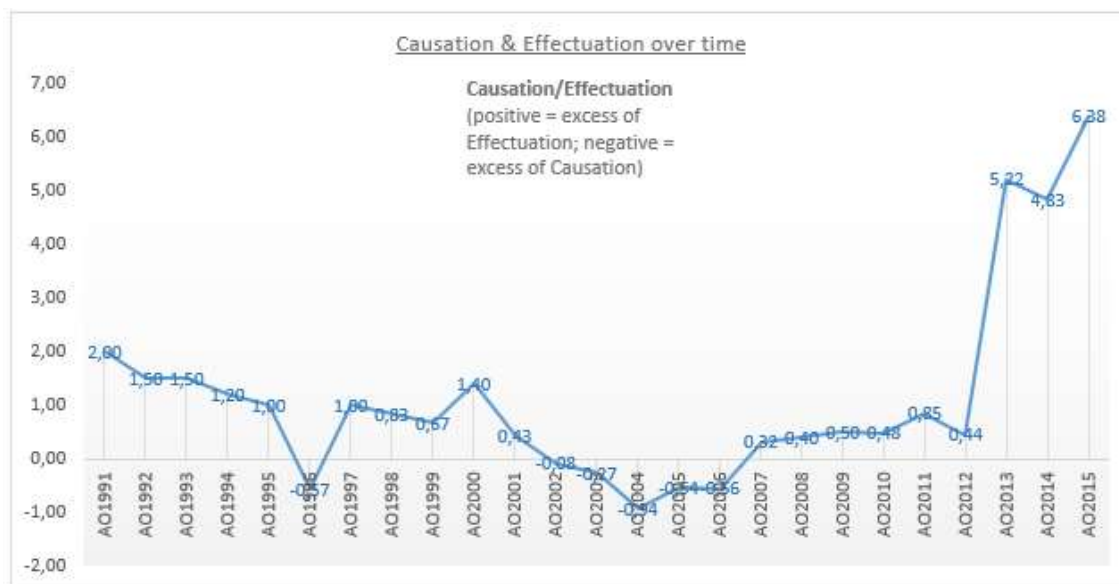


Figure 3.27: Evolution of the Causation and Effectuation from 1991 until 2015 (a positive score means an excess of Effectuation over Causation and vice versa).

Overall though, the Feodalis period (1994-2001) of centralization around a single production site in Belgium was outlined by an excess of effectuation. The company was then exploring its market and developing technologies, offering its customers newly developed products. A detailed analysis of the data reveals however that Galactic was not really seeking *pre*-commitment from those customers. At this point, the access channels to its market, mainly through distributors, did not allow to know well enough its final customers as acknowledged by the management in a Strategic Note to Shareholders dated October 2000.

« Nous vendons actuellement nos produits dans 60 pays et ce au travers de distributeurs locaux. Nous sommes reconnus et nos produits sont appréciés par nos clients. Nous ne connaissons pas bien les clients finaux. La mise au travail de notre Application Technologist nous permet cependant d'améliorer cette situation. »⁶¹

⁶¹ “We currently sell our products in 60 countries through local distributors. We are recognized and our products are appreciated by our customers. We do not know the final customers well. The implementation of our Application Technologist however allows us to improve this situation.”

Obviously, the management became aware of the need to connect with its customers and not rely only on intermediaries like distributors and agents.

The approach of the next period, Modernitas (2001-2011), was more of causal nature as the company was aiming at replicating its past successes on other continents through decentralization of its decision-making structures. The second half of Modernitas showed however again a slow slide towards effectuation when the freshly incepted subsidiaries gained enough autonomy to start exploring new fields on their own. The last period, Contemporalis (as from 2011), displayed a surge of effectual logic mainly triggered by a customer-centric new strategy.

But, what means a “customer-centric new strategy” in 2011 when we have seen that the management started to take measures as early as in 2000 to jump over its distributors and connect directly with its customers? And again, why was this “customer-centric new strategy” necessary when we have seen that the company was rather good at exploring and exploiting at the same time? To which extend this “new strategy” would help survive the economic and market hurdles that were accumulating at the end of the epoch that we named Modernitas?

It is worth noting at this stage that such a demand-based perspective is rather typical of small to mid-sized companies operating in dynamic and concentrated industries (Xie, 2012) like industrial biotechnology, Galactic’s market. In this type of environment, a few dominating players coexist with small competitors but, because of resource constraints, SMEs cannot outperform their competition directly; they often turn their attention to their customers with the intention to create value for them and by doing so gain competitive advantage. Customer value can be defined as the difference between the product utility perceived by the customers and the product price which is affected by the cost of production. Kim & Mauborgne (2004) have showed that competition may be irrelevant when firms offer something customers perceive to be valuable. However, customers’ needs are not stable in dynamic industries, flexibility is critical for the firm to survive in this type of environment (Xie, 2012), and flexibility is precisely what differentiates small companies from larger ones. Small firms are structurally simple, agile, adaptative thanks to short decision-making circuits whereas large companies are often subject to organizational inertia (Hannan & Freeman, 1984; Volberda, 1996), convergence (Miller, 1993) or cultural lock-in (Foster & Kaplan, 2001b).

In the case of Galactic though, it is not that the company was not listening to its customers but precisely that it was listening too much to them to innovate⁶². Trapped in Christensen's "innovator's dilemma" (Christensen, 1997), Galactic was almost exclusively talking to its existing customers about slight changes to the properties and features of its existing products or about the development of new products with properties relatively close to the ones already existing. This syndrome has also been described by Hamel and Prahalad (Hamel & Prahalad, 1994) as the "tyranny of the served market", when firms limit their attention only to that of existing customers. This process led to a series of small incremental improvements to its products and to the addition of more lactic acid-based derivatives to its existing product portfolio. Indeed, if one asks a car-user what he needs, he will most likely answer that he needs a car, probably a slightly different car, maybe a bigger car or a faster one, maybe a shinier car or a car with more gadgets, but still a car. Similarly, asking a lactic acid user what he wants ends-up almost invariably with the development of new forms of lactic acid or new derivatives of it, but not with a radically different solution.

The progressive commoditization of lactic acid in the market place was also playing a role in the fact that the company was innovating but still always within a narrow space around the same subjects. All lactic acid producers were then focusing their efforts and resources on finetuning their processes and improving the existing properties of their products to keep their clientbase satisfied and gain a cost-based competitive advantage. Galactic was no exception. To escape this innovator's dilemma, Galactic had to go beyond its usual crowd of customers and start approaching new prospects, in other markets, prospects with different needs, prospects who were not using lactic derivatives and, eventually, who did not even have the need to⁶³. Understanding the needs and requirements of this new genera of prospects would most probably lead to the development of other products, not slightly different but radically different from the existing ones, by leveraging on the company's skills and expertise. In short, the company had to adopt an effectual approach. It was believed that this new strategy would reduce the

⁶² We insist here on the word "innovate". We consider that innovation and exploration are different notions: innovation is the product of successful exploration. Exploration or research is basically about transforming resources (human and financial) into new knowledge (technological, organizational, social). Innovation is about transforming new knowledge into products or services which respond to the need of customers, end-users or consumers. The exploitation of innovations generates new means (financial means such as profits, human means of higher expertise) which in turn become new resources for more exploration and hopefully, later, more innovations to exploit (see Figure 1.2 in Section 1.2.4).

⁶³ One of the hypotheses supporting the effectuation theory is that "The strategies implemented by the firm will seek to control and create the market rather than to predict and follow it" (Sarasvathy & Kotha, 2001, p.9).

company's exposure to the commoditization process at play and help it bounce back with new solutions in new markets.

The following quote from the company's CEO extracted from the minutes of a Management Meeting held in February 2012 offers an example of this new mindset.

« FVAN⁶⁴ indique que de plus en plus de produits seront directement conçus ou adaptés par rapport à des demandes provenant de nouveaux clients. Nous devons leur montrer que nous sommes des spécialistes dans notre domaine d'activité. »⁶⁵

And another example comes with a slide used to present the new strategy to the company's distributors at a Europe-wide seminar held in the city of Ghent early 2013 (Figure 3.28). This slide highlights the company's intention to move from simple supplier/customer type of relations to real partnerships in order to be able to offer innovative concepts and solutions instead of "me too" products.



Figure 3.28: The intention of the management when enacting the 2012 strategic revolution at Galactic (slide presented at a seminar bringing together all the company's European distributors in March 2013)

⁶⁴ GALACTIC' staff members are identified in the company's organization (including all subsidiaries) since its inception by 4-letter acronyms composed with the first letter(s) of their surname and family name. We adopt the same logic in this dissertation in order to preserve the privacy of the people appearing in the narrative.

⁶⁵ "FVAN indicates that more and more products will be directly designed or adapted in response to requests from new customers. We must show them that we are specialists in our field of activity."

To do so, the company resolved to re-centralize the decision-making processes and merge the sales, marketing and R&D departments with the view to reduce the distance between its scientists and the market, better anticipate customers needs and reduce the “time-to-market” for its innovations. An ambitious program called “Competing for Growth: a new shape for a sustainable future” was designed around three pillars: exploiting the company’s core competencies in product & process development; enhancing the company’s market and application knowledge *through market-driven initiatives and through partnering with customers*⁶⁶; and improving the company’s image and notoriety through increased market presence and enhanced communication. In concrete terms, the first action was to improve what the company called “customer reach”, i.e. targeting and satisfying customers’ needs, by focusing on key-segments and prioritizing markets. Hence, it was decided to increase the sales force, to split them in two teams, i.e. food and non-food, to increase technical resources, and to align those on the sales teams in two teams as well. At the same time, a priority was to restructure the distribution network, not only following a geographical segmentation as it was the case formerly, but by selecting specialists of each market segment instead of generalists “one-stop-shop” type of distributor. If one aim of this set of actions was to increase the effectiveness of market prospection, a rather exploitative approach, the real objective was clearly to put in place a structure that promotes access to end-users and listening to their needs, an obviously exploratory and effectual logic.

A second set of actions was to enhance operational agility by accelerating the speed of response and promoting collaboration. For the former, the speed of response, a point of attention was brought to better anticipate and plan the sales ex-ante (before orders are coming in) so that a better execution ex-post by logistic departments would be possible. A system of key-performance indicators (KPI’s) was also put in place to raise the team members’ awareness towards the main business drivers and success factors. All this stem for causation-tainted exploitative logic. Conversely, to promote collaboration, the management bet on an effectual strategy straddling simultaneously on exploitation and exploration with the freshly acquired Galactic Innovation Campus that would help break the boundaries between the teams (hence improving internal communication) but also that would allow to organize product and

⁶⁶ Two other hypotheses supporting the effectuation theory are respectively that “Early decisions will involve bringing the product into customers’ hands as quickly as possible without regard to detailed calculations of expected return”, and that “Early customers will be chosen either randomly or through strategic partners, and not based on detailed competitive analyses” (Sarasvathy & Kotha, 2001, p.9).

application demonstrations, trainings of customers and distributors, and co-developments with them.

Causal strategy	Effectual strategy
Push	Pull
Volume	Value
Commodity	Specialty
Inside-out	Outside-in
Fill capacity	Fulfill customers needs
Efficiency	Effectiveness
Product focus	Market focus
Intuition	Insight

Table 3.18: Descriptors of causal and effectual strategies

A certain overlapping of causation-effectuation and exploration-exploitation frameworks seems to appear. In fact, Sarasvathy’s concept of effectuation and causation has often been compared to March’s concept of exploration and exploitation. Exploration contains processes of effectuation, whereas causation dominates exploitation (Sarasvathy, 2001a). Sarasvathy speculates that “the problem of allocation of resources between exploration and exploitation might itself be modeled more effectively using an effectuation rather a causation model” (opcit, p.254); and with Wittbank, she claims that without the alternative of effectuation, March’s exploration-exploitation dichotomy hangs unsupported on the exploration side as it is precisely the contrast between effectual reasoning and the predictive rationality of causation that provides the underlying processes supporting exploration and exploitation (Wittbank & Sarasvathy, 2010). In other words, March’s exploration of new possibilities would proceed by an effectual mechanism whereas the underlying process supporting the exploitation of old certainties would be of causal nature.

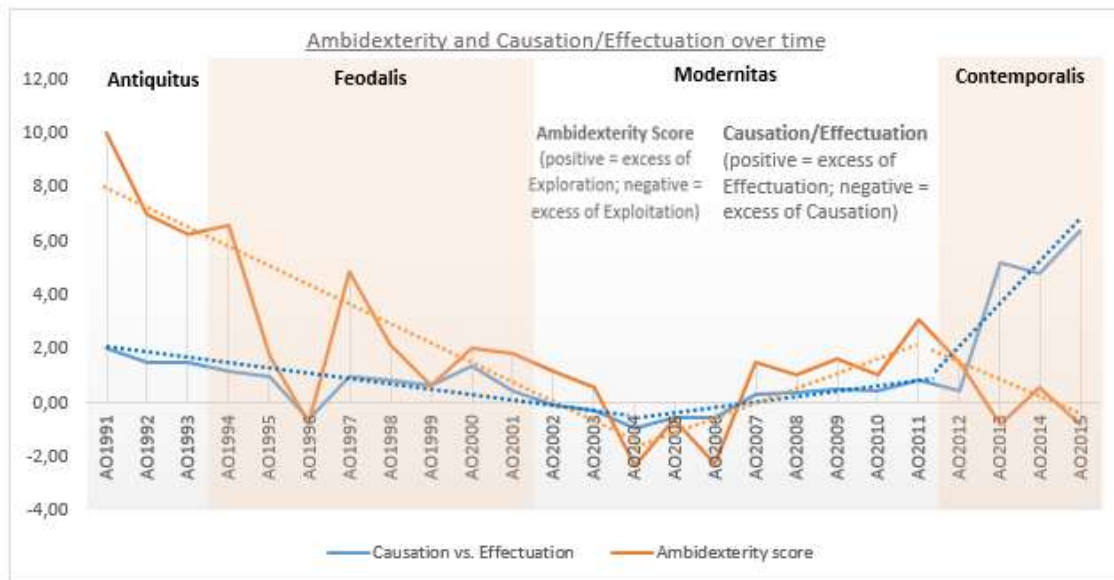


Figure 3.29: Superposition of Ambidexterity and Causation-Effectuation patterns.

Indeed, the comparison of the evolution over time of ambidexterity with that of effectuation brings to light obvious similarities but also, surprisingly enough, clear divergences (Figure 3.29). The two trends appear well correlated ($R^2=0,7848$; Figure 3.30), which supports the **link between ambidexterity and the effectuation framework**, until the beginning of Contemporalis (2012) when they start to part. During this phase of the company's history, Galactic recentralized its decision-making structures and changed strategic intent to escape the commoditization of its flagship products with the development of specialties and customer-driven solutions. This is precisely what explains the surge of effectuation as of 2012 when the company entered in a growing number of projects together with new prospects and customers, in fact searching for their pre-commitment as explained above. The intention of those projects was clearly to better understand their needs so that the company would be able to either propose existing solutions to new problems, which mobilizes existing knowledge, or to develop new solutions by building new knowledge. Although this approach resorts obviously from an effectual logic, it is not of exploratory nature only. As a matter of fact, the projects based on refining existing solutions, i.e. demonstration projects, were much more of exploitative nature whereas the projects aiming at developing new solutions were certainly of exploratory nature. The intensity of effectual reasoning was then distributed on both sides of the exploration – exploitation continuum which explains that organizational ambidexterity improved (orange line in Figure 3.29 approaching zero) at the same time as effectuation increases (blue line in Figure 3.29).

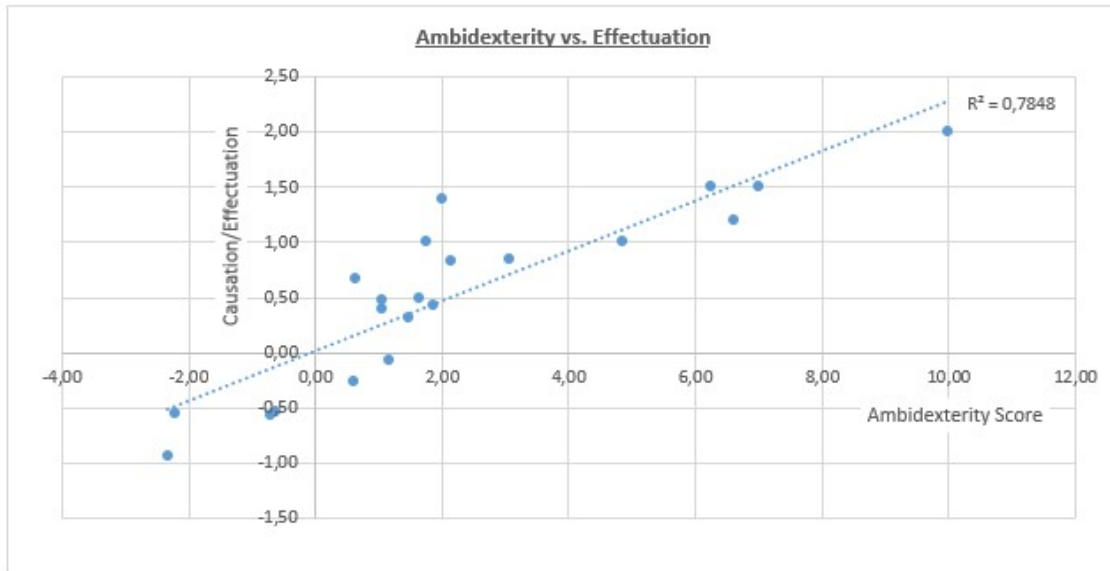


Figure 3.30: Correlation between Ambidexterity and Causation-Effectuation patterns from 1991 to 2011.

This divergence between the trends of effectuation-causation and exploration-exploitation during Contemporalis came as a surprise as, following Sarasvathy (Sarasvathy, 2001b), one could expect effectuation to evolve together with exploration and causation in parallel with exploitation. Our results and their explanation above show that, as close as they might seem at first sight, the two frameworks are subtly distincts. Actually, what our results show during Contemporalis is that, **in some conditions, effectuation can be of exploratory and exploitative nature at the same time**, and not as often claimed that effectuation is inevitably exploratory.

Another divergence between the two frameworks comes when we consider more precisely how some exploration activities were actually carried out by the company.

- Exploration following a causal logic: As we have seen, the company has always sustained a high level of R&D, which explains in large part that its ambidexterity score mainly remained in exploratory domain throughout its life. That said, until 2011, Galactic conducted almost exclusively its research activities on the basis of projects defined by the management of the company in relation to the offering of its competitors and the potentialities expected from existing markets. This "me too" approach was not deprived of inventiveness since the company has distinguished

itself in many respects by the development of innovative processes, as evidenced by a constantly growing patent portfolio, but often for the production of existing products marketed in existing markets. Until 2011, this approach was relatively unstructured and strongly based on the intuition of top management. In terms of processes, rapid market studies were launched to confirm these intuitions, they led to the creation of projects and to the search for financing often through the use of regional, national and supranational support systems. Projects selected and financed were then launched and regularly evaluated and, if successful, resulted in the placing on the market of the product under consideration. We find here the teleological, hence causal, model described by Van de Ven & Poole (1995) mentioned hereabove and characterized by a cycle of goal formulation, implementation and evaluation. In 2011, the company started to better structure its product development procedure through the formal implementation of a stage-gate process⁶⁷ (Figure 3.31).

GALACTIC
THE NEXT NATURE

Product Management Support: proposed approach

It is a **management system** designed to track progress and to support decisions (prioritization & resource allocation) of all our **product development** efforts

Key principles:

a. Stage-Gate model	Product development is done in stages defined by a stage-model. Stage crossing is done by specific committee approval.
b. Deliverables driven	Pre-defined key results or documents, generally associated to a template
c. Issue management	Issue and risks are tracked and resolved separately from the product development pipeline
d. Centralized PM office	Product Management Office (PMO) a) Provides standardization (templates and methodology) b) Monitors progress through deliverables reporting c) Tracks risks and issues

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⁶⁷ A Stage-Gate process is a conceptual and operational road map for moving a new-product project from idea to launch. Stage-Gate divides the effort into distinct stages separated by management decision gates (gatekeeping). Cross-functional teams must successfully complete a prescribed set of related cross-functional activities in each stage prior to obtaining management approval to proceed to the next stage of product development. The Stage-Gate methodology was initially developed by Robert G. Cooper from McMaster University, Canada (R. G. Cooper, 2008).

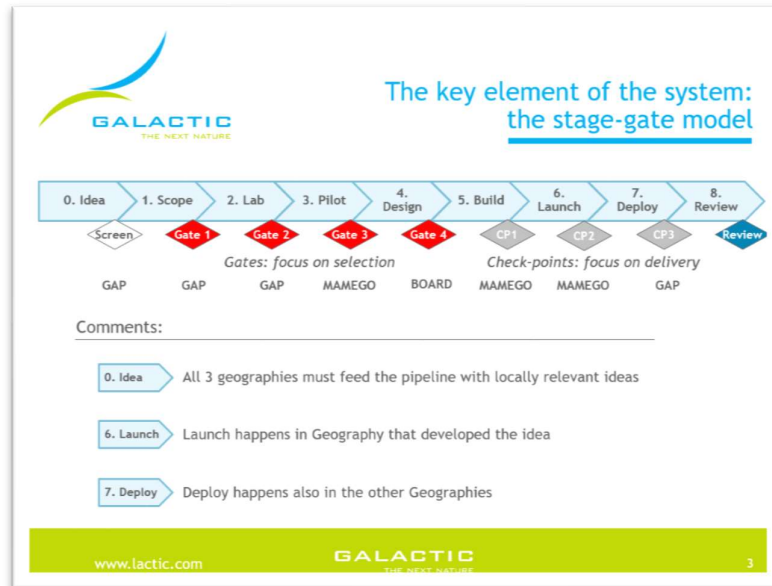


Figure 3.31a,b: Presentation of Galactic stage-gate model for product development (extract of a presentation to the middle management in November 2011)

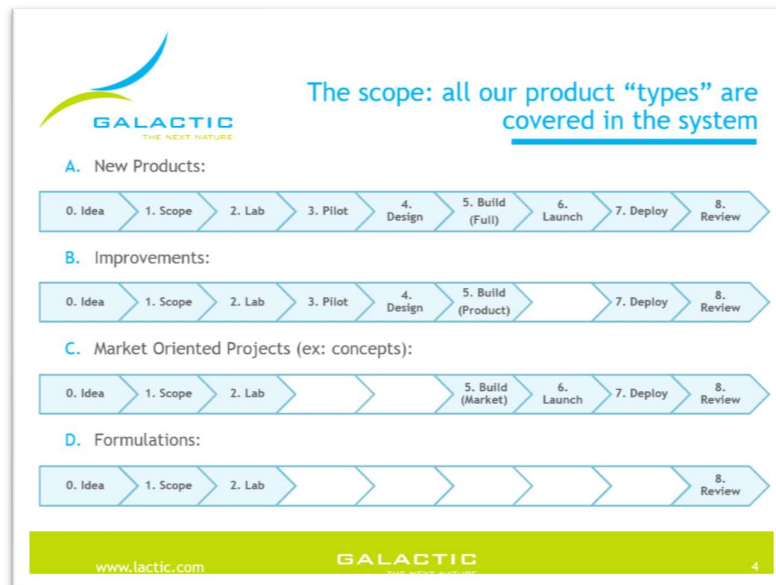


Figure 3.31c: Presentation of Galactic stage-gate model for product development (continued) (extract of a presentation to the middle management in November 2011)

Although this system brings a stronger market orientation into the company’s product development process (see point “C” in Figure 3.31c), it nevertheless remains highly causal in its mindset with a heavy scoping step including thorough product scoping and market definition at the very beginning (stage “1. SCOPE” on Figure 3.32), in short a goal definition which is the essence of a causation logic.

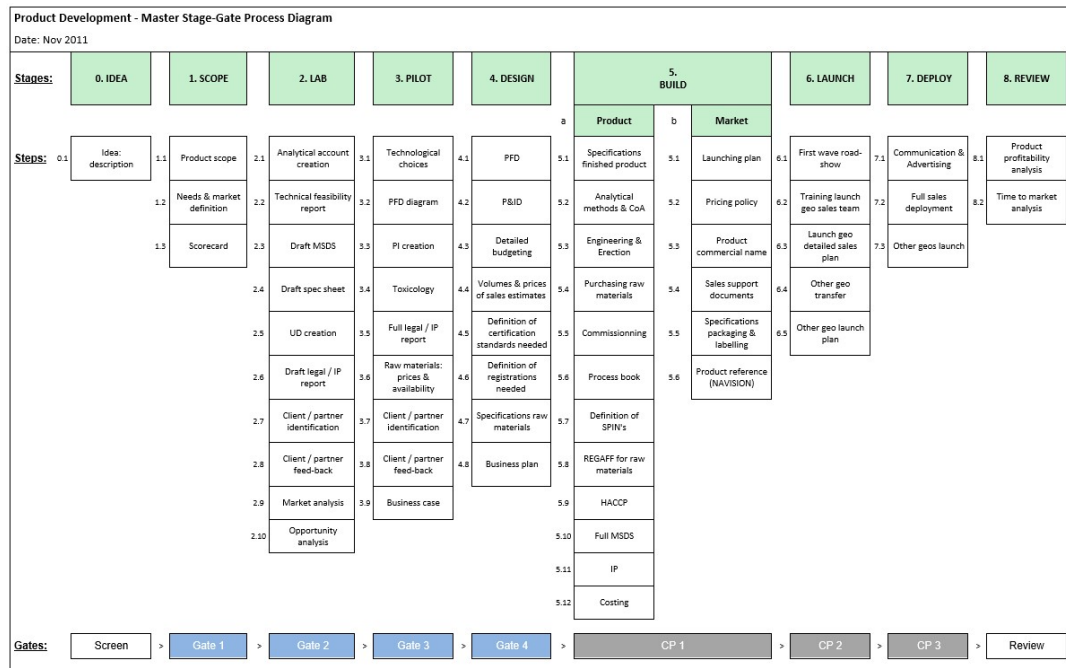


Figure 3.32: Galactic master stage-gate process diagram (as implemented in November 2011)

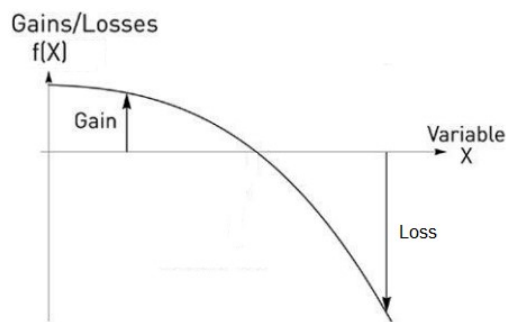
Galactic stage-gate process also involves the establishment of a scorecard which aims at ranking and prioritizing projects by measuring product advantages (uniqueness, differentiation towards competitors, value for money), market attractiveness (market size, market growth and competitive situation), strategic fit (alignment with corporate strategy, strategic importance of the project, technology availability, availability of production assets), technical feasibility (technical easiness, technical certainty); and by assessing risk level and whether the project leverages core competencies. The scorecard also measures a “productivity index” based on NPV⁶⁸ and ECD⁶⁹ calculations. Eventhough this system allows for an efficient and mandatory selection between potential candidates, it lacks adequate sources of variation. Such a traditional inside-out methodology, as efficient as it can be when properly conducted, banks heavily on the organization’s ability to identify market needs. However, by relying only on the evolutions of competition, and as we have seen, by questioning only its traditional customers, the company generates only incremental innovations which are often in the same domain. This approach

⁶⁸ NPV stands for “Net Present Value”, the difference between the present (discounted) value of cash inflows and the present (discounted) value of cash outflows.

⁶⁹ ECD stands for “Expected Cost of Development”, an estimate of development costs in terms of labour, chemicals and equipment.

exacerbates the risk to fall in a “competency trap” where past successes and existing technological trajectories create inertial pressures that prevents the exploration of new technological domains (Bierly & Daly, 2007).

In addition, investing resources before market approval raises the overall risk profile of the company by increasing potential losses in case of failure. It makes the company more fragile, especially in a dynamic environment and highly competitive industry as it has been proven that injecting uncertainty to a fragile system increases the likelihood of negative outcomes (Taleb, 2012). Figure 3.33 illustrates this point.



*Figure 3.33: Evolution of payoffs from exposure to a given variable for a fragile system
Fragile systems display a concave response to a change of variable which results in higher potential losses than potential gains
(adapted from Taleb, 2012, p.273)*

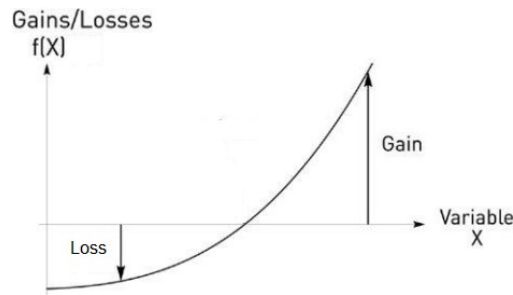
The firm therefore added another dimension to its exploration activities to get out of the innovator’s dilemma and the spiral of commoditization, a dimension based on a different underlying logic, a dimension based on trial and error tinkering, in short: a dimension based on effectuation.

- Exploration following an effectual logic: As of 2012, the company’s top management wanted to implement a customer-centric new strategy. In concrete terms, the firm decided to improve customer reach by increasing the sales force as well as the technical resources in charge of sales support and to instate a formalized system of Technical Support Requests (TSRs) helping the sales people delineate customers’ needs or problems and leverage technical resources to work out solutions. The company also acquired at this time a research center fully equipped with applicative equipment allowing to reproduce most its customers’ processes so that it could test products and develop new solutions for and with them. Finally, to

help the commercial staff prospect new markets and approach new targets, Galactic invested in a Customer Relationship System (CRM) and in a global new products database tracking trends in product innovation and retail successes in consumers packaged goods worldwide. The purpose was, after improving customer reach, to use the company's knowledge in its field of expertise to design solutions better fit to customers' needs or better adapted to new consumers trends⁷⁰. This logic profoundly reversed the underlying dynamic of the company's exploration initiatives and called for a radical change of mindset, not only among the sales force, but within the whole company. The point was then to have the customer as the centre of attention and not only the product anymore. Of course, financial and human resources had to be committed to such a change but the risk profile was by far reduced since many more projects of smaller size were soon started with existing customers but also with new prospects (46, 53 and 87 projects respectively in 2013, 2014 and 2015 in Europe alone). So, thanks to the multiplication of projects, the investment per project became relatively low whereas the probability of having a successful one increased sharply⁷¹. Said differently, losses were limited and potential gains became higher which forms a positive asymmetry typical of trial-and-error tinkering and characteristic of antifragile cases (Taleb, 2012, p.236). In Taleb's framework, such an effectual logic offers optionality. With low cost mistakes, known maximum losses and large potential payoffs, the distribution of these potential payoffs forms a convex function which means that an increase of uncertainty results in a higher likelihood of positive outcomes (Figure 3.34).

⁷⁰ This initiative was resting on different pillars that the company identified as being high potential market trends in adequation with its true skills (food safety, clean labelling, health improvement, cost reduction and green chemistry).

⁷¹ Taleb (2012, p.230) tells us that "payoffs from research (...) follow a power-law type of statistical distribution, with big, near-unlimited upside but, because of optionality, limited downside. Consequently, payoff from research should necessarily be linear to number of trials, not total funds involved in the trials. (...) It means the right policy would be what is called "one divided by n" or "1/N" style, spreading attempts in as large a number of trials as possible (...)."

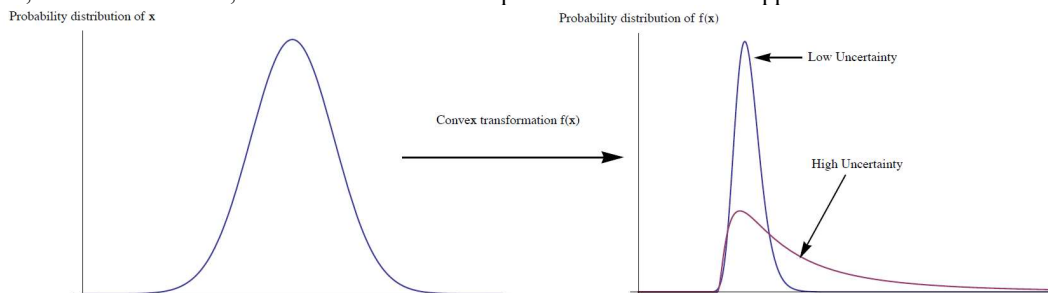


*Figure 3.34: Evolution of payoffs from exposure to a given variable for an antifragile system
Antifragile systems display a convex response to a change of variable which results in higher potential gains than potential losses
(adapted from Taleb, 2012, p.273)*

Another interest of this effectual approach based on multiplying trials with many prospects in many markets without preconceived goal instead of forecasting developments to be made on the basis of in-depth market surveys is precisely that one does not have to understand all characteristics of these markets *ex-ante*⁷². This is particularly useful for medium-sized companies who do not have and cannot afford marketing experts in all domains while they want or need to enter new market fields.

It is important to note however that, during the Contemporalis period, both causal and effectual logics were followed simultaneously by different teams as they require different skills but also because they address different timeframes. Indeed, customer-oriented (“outside-in”) projects have to be conducted in a timely manner as, in general, customers cannot wait ages to find solutions to their problems or pressing issues. Those projects are therefore imbedded in short

⁷² Here again, Taleb (2012, p.439) gives us the theoretical background behind this observation with what he calls “convex transformation” of “robustification rather than forecasting”: if $f(x)$ is the exposure to the variable x or the payoff from x , we can become antifragile to x by modifying $f(x)$ without even understanding x . In plain English, we can benefit from the positive changes of a market (for instance) without knowing the characteristics of this market by improving our exposure to the upsides of this market and limiting our exposure to its downsides. We claim, as our results show, that this is what can be expected from an effectual approach.



The figure above indicates how an antifragile system gains from uncertainty. The distribution of $f(x)$ benefits from uncertainty as the more uncertainty, the more positive outcomes (fatter tail). The negative events are of no significant harm.

[Copyright 2012 by N. N. Taleb. Retrieved from <http://www.fooledbyrandomness.com/ConvexityScience.pdf>]

development cycles usually focused on product/application associations and conducted by market development teams working closely with their respective sales teams. Conversely, strategic R&D projects (“inside-out”) with much longer development cycles are generally oriented towards process/product associations; they form what the company calls “backbone projects”, much more limited in number and conducted by autonomous R&D teams. Figure 3.35 shows a slide summarizing this dichotomous organization as presented in various conferences from 2014 to 2016.

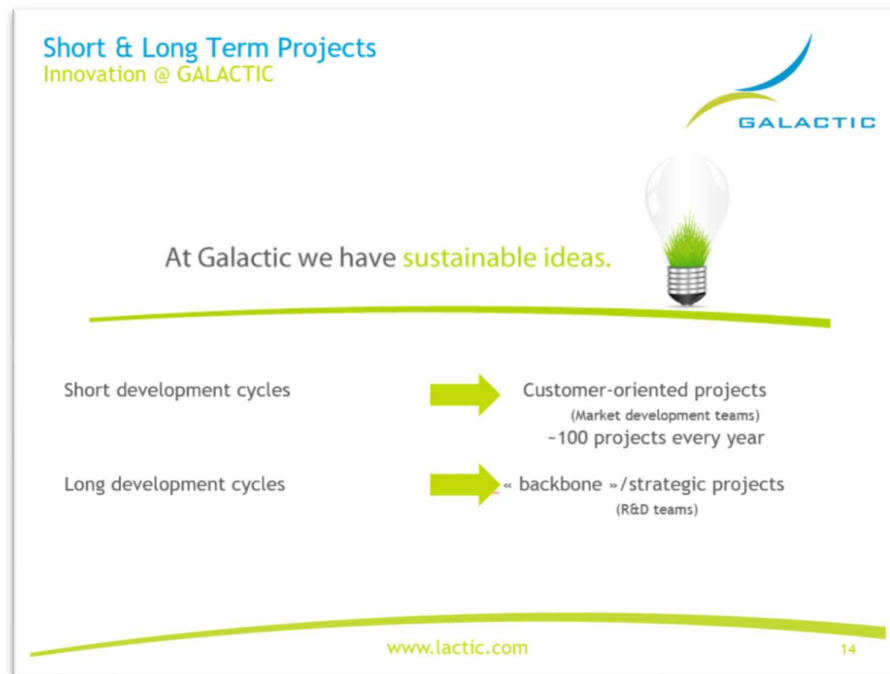


Figure 3.35: Short and long terms projects within Galactic
 (extract from presentations displayed in various conferences, a.o.: “20 years of bio-based innovations: an example of successful bio-business in the real economy”, 5th CINBIOS Forum for Industrial Biotechnology & the Biobased Economy, Mechelen, November 7, 2014; “White Biotech and Real Economy”, Gembloux, May 13, 2016)

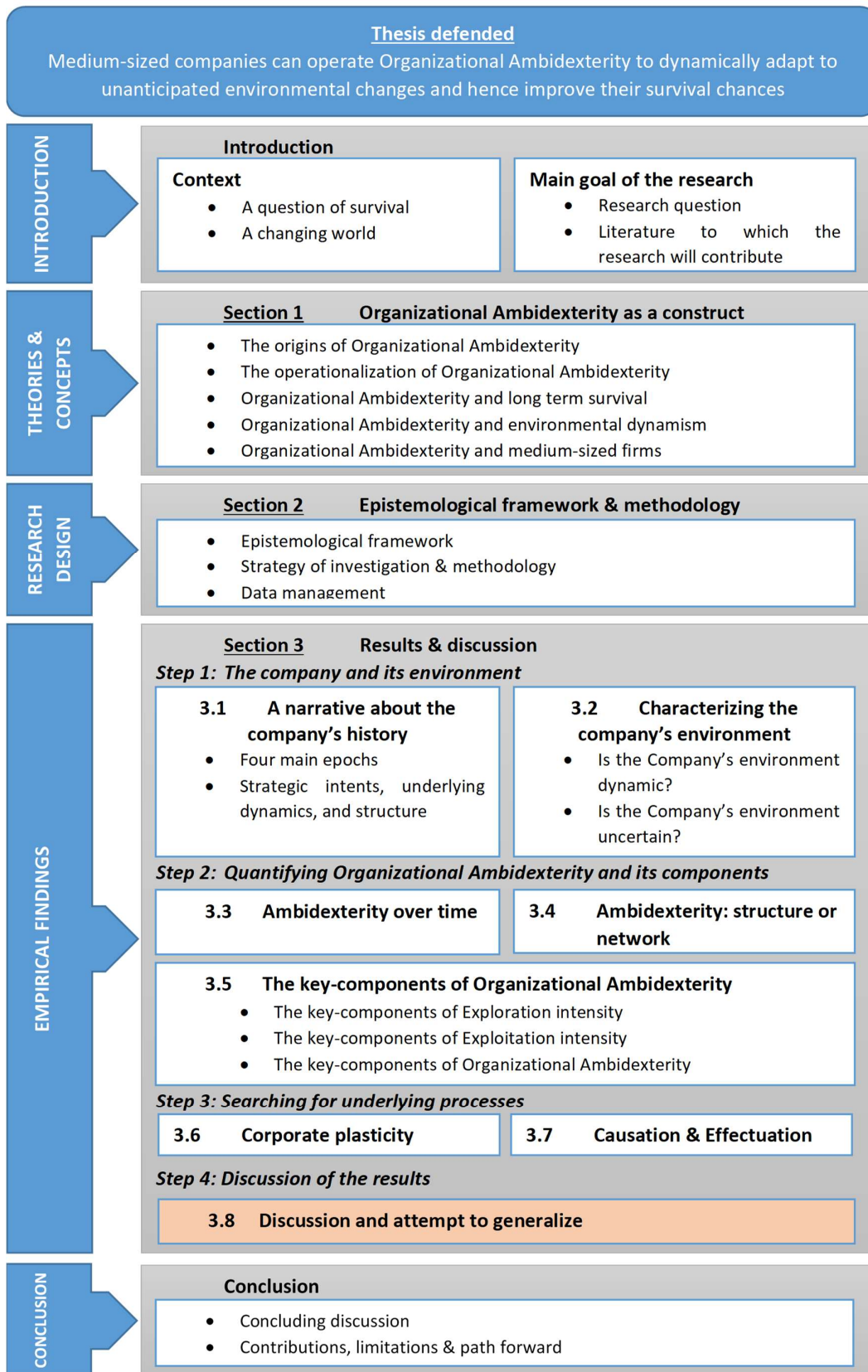
We therefore infer that exploration can be conducted in either a causal or an effectual mode.

As a conclusion of this chapter, our analysis shows that **effectuation can be of exploratory or exploitative nature**, and that **exploration may involve effectual as well as causal underlying processes**. These findings, which to our knowledge have never been formally put forward, highlight subtle differences that may exist between March’s exploration-exploitation framework and Sarasvathy’s effectuation-causation one.

In addition, we highlight the similarities between Sarasvathy's effectuation theory and Taleb's antifragility concept. More precisely, we underline that effectuation may be an efficient robustification method for medium sized companies evolving in highly dynamic industries and unpredictable environments.

Overall, we show in this section that **organizational ambidexterity can be achieved** in medium-sized companies **by**, among other ways, **nurturing a customer-centric effectual approach** thanks to the proper allocation of resources and the right alignment of organizational sub-structures for projects belonging to short development cycles **in combination with maintaining** a strict stage-gate system resorting to **a classical causal logic** for projects imbedded in long development cycles. We argue that the integration of an effectual logic to the company's practices creates an on-going opportunity for variation, selection and retention of new knowledge and new capabilities. The needs of financial and human resources to (partly) conduct innovation and market prospection following an effectual logic is mitigated on the longer run by the improvement (reduction) of risk profile associated with such an approach when compared to a causal one based on a limited number of pre-concieved, rather expensive, goal-minded projects.

Step 4: Discussion



3.8. Discussion and attempt to generalize

“Since the number of organizations is limited and much smaller than the number of possible situations and outcomes, it is very unlikely that two similar situations across organizations will ever be observed. As a consequence, no cause in one organization can have a same effect in another organization.”

(Forgues & Thietart, 1995, p.27)

Contingency theorists teach us that organizations are open systems evolving in environments which have their own dynamics and with which a continuous exchange of information, resources and energy takes place (Thompson, 1967). Consequently, they are not all equally affected by environmental changes. Some organizations may suffer more than others which have better capabilities to generate sufficient slack resources (financial and human) during the implementation of responses to discontinuities. At first sight, size matters in these turbulent circumstances and big corporations might be better equipped to face this challenge than medium-sized companies which are generally much more resource-constrained (Berends, Jelinek, Reymen, & Stultiëns, 2014). Conversely, medium-sized companies differentiate themselves from larger organizations by greater agility, increased flexibility, what we have called a better “plasticity”.

These considerations are very general and it seems obvious that the most appropriate form of organization to deal with the volatility of the environment depends not only on the characteristics of the organization itself but also, precisely, on the multiple characteristics of this environment. However, as these characteristics are generally (and increasingly) difficult to identify (and even more to anticipate), it is advised to establish organizational forms that protect organizations from environmental changes (Nonaka, 1988). In Taleb’s terminology (Taleb, 2007a, 2007b, 2012), it is about making organizations more “robust” to changes or, even better, to render them “antifragile” in the sense that they would not only resist environmental volatility but, eventually, benefit from it. Indeed, an increase in volatility widens the world of possibilities and multiplies the number of opportunities. This said, it is not only a matter of putting ourselves in a position to seize future opportunities but also to reap in the present the fruits of the past. This is precisely the object of organizational ambidexterity (March, 1991).

We recognize that the processes employed by Galactic, our unit of analysis, to build an ambidextrous company can be unique and that raises the question on how should unique

phenomena be studied and generalized. In first instance, our analysis of the Galactic case can be seen just as a passionate testimony of some “tricks” to balance the exploration and exploitation needs of a mid-sized company in an industry with a high technological content, in a particularly dynamic context, and a generally negative outlook over time. However, in single cases such as this one, it is the underlying processes that are often generalizable and not the obvious unique phenomena (Tsoukas, 1989), therefore the aim of our research to identify some processes and mechanisms underlying ambidextrous practices. In this dissertation, we put emphasis on “analytical generalization” as opposed to the traditional “statistical generalization” (Yin, 2009). According to Yin (1994) statistical generalization, often used in studies conducted from a positivist or post-positivist standpoint, is about making inferences about a population (or “universe”) using empirical data collected on a sample as representative as possible of this population. This approach is generally accepted “because research investigators have ready access to formulas for determining the confidence with which generalizations can be made, depending mostly upon the size and internal variation within the universe and sample” (Yin, 2009, p.30). In contrast, in analytic generalization, a previously developed theory (here the organizational ambidexterity framework) is used as a template with which to compare the empirical results of the case study.

We have pointed that our unit of analysis is evolving in a dynamic and unpredictable environment typical of, but obviously not limited to, high technology industries. In addition to being dynamic, the surroundings were largely negative and even worsening for most of the firm’s lifetime because of the incremental evolution of some environmental characteristics as well as the more erratic pattern (exogenous shocks) of others; and the amplitude of the cumulated changes increased over the years indicating a growing volatility around the company’s activities. Farjoun (2007) distinguished two polar types of industry contexts: an *evolutionary context* where the environment is stable; and a *perpetual change context* in which the environment changes continuously. He also considered two intermediate and integrative contexts: a *punctuated equilibrium* where stable periods alternate with periods of flux and exogenous discontinuity; and a *differential change context* characterized by the coexistence of continuity and change triggered either by exogenous sources or by rapid intense rivalry. Our findings indicate that the biotechnology industry in which the company is evolving is primarily lodged in a perpetual and differential change context which is, in our eyes, the case of most industries operating at an international level in the current globalized and interconnected world. The growing uncertainty surrounding the company was not attributable solely to external

factors but also to its expansion in new domains, i.e. new geographic areas and new markets; a situation that increased dramatically its exposure to new environmental components. Logically, the more a company expands in a dynamic environment, the more it becomes exposed to the effects (positive or negative) of this uncertain environment as some environmental changes cumulate their effects whereas others, impacting the company in opposite directions, neutralize or mitigate their effects. We have posited that a growing exposure to an increasingly volatile environment make the conditions under which ambidexterity takes on its full dimension (the fourth quadrant of Figure 3.12). Indeed, in peaceful times of relative stability, companies may either opt to exploit niche markets or to explore new lines of business (Lewin, Long, & Carroll, 1999) and benefit from adaptive learning (Cyert & March, 1963), but they should instil more exploration as environmental dynamism increases, and by doing so, strive for more balance between exploration and exploitation. The more dynamically competitive the environment, the more organizations may have to pursue both activities simultaneously and become more ambidextrous (Auh & Menguc, 2005; Jansen et al., 2006, 2005; Raisch & Birkinshaw, 2008). Following this line of thinking, we can expect that infrequent environmental changes with substantial amplitude (a situation that corresponds to Tushman and Anderson's (1986) punctuated equilibrium), or even more chaotic situations owing to exogeneous shocks, equally call for ambidextrous capabilities to be developed. These conditions are however not specific of the industrial (white) biotechnology and can most probably be extended to other high technology industries such as the other fields of biotechnology (red, green and blue), pharmaceuticals, aircrafts and aeronautics, telecommunications etc... This supports the generalization of our results at least to medium-sized companies operating in high-technology industries at a global level (multiple geographies).

Despite increasing exposure to a dynamic, unpredictable and globally negative environment, the company has succeeded in developing and organizing itself, sometimes to seize new growth opportunities, sometimes to survive deep changes in the context in which it was operating. These changes have resulted in profound modifications in the company's strategy (a period of structuration followed by a period of internationalization itself followed by a period of specialization); its structure (centralized, decentralized and then re-centralized); and its underlying business dynamics (from products to customers when the products were the focus as often in engineer-driven/technology-minded organizations, until a point where customers became the focal point and the central dynamic was inversed from customers to products). Apparently, this echoes quite well what O'Reilly and Tushman (2007, p.10) described as the

conditions for survival: "From a strategic perspective, achieving long-term success requires that firms possess not only the operational capabilities and competencies to compete in existing markets, but also the ability to recombine and reconfigure assets and organizational structures to adapt to emerging markets and technologies". In this paper, the authors make the link between these (dynamic) capabilities and organizational ambidexterity.

Compounding an index based on 12 parameters to measure organizational ambidexterity has allowed us to track its evolution over time in a new and, to our knowledge, unprecedented fashion. There is a relative consensus among prominent scholars to seek for more qualitative, in-depth studies with a dynamic perspective and following a longitudinal survey design as time helps separate noise from real meaning. Raisch and Birkinshaw (2008) for instance have pointed the need for new research that investigates "how organizations adapt and develop ambidextrous structures, contexts, and leadership patterns over time to respond to varying boundary conditions" (p.401), and they claimed that "such a process perspective requires a methodological shift in organizational ambidexterity research". While observing that existing empirical studies mainly rely on cross-sectional surveys measuring ambidexterity and environmental conditions with data on manager's perceptions, they propose (p.402) to "focus on the actual realization of ambidexterity by deploying archival data on exploitative and explorative moves that have been implemented" in order to contribute to the emergence of a process perspective of organizational ambidexterity. By doing so, we saw clearly that the company, deeply rooted in exploration at the beginning of its activities, had quickly put in place exploitation activities while maintaining a high level of exploration. Ambidexterity was reached in a relatively stable manner about 5 years after the firm inception and was maintained thereafter by balancing relatively high levels of exploration and exploitation at all times, despite many environmental hurdles, which lends credence to the concept of dynamic, also called adaptive, ambidexterity (Laplume & Dass, 2009; Luger, 2014). This said, there seemed to be an excess of exploration over exploitation activities in average over the whole period. This somewhat contradicts O'Reilly and Tushman (2007) who claim that the tradeoffs necessary to balance exploration and exploitation are "most often tilted toward exploitation where positive local feedback in the form of customer demand and profits produce path dependence" (O'Reilly & Tushman, 2007, p.10). March (2003, p.14) also argued that "established organizations will always specialize in exploitation, in becoming more efficient in using what they already know". These sources, however, are generally expressed; they don't pinpoint particular industries or contexts. Piao (2014) is more specific in her survey of 98 firms in hard disk drive industry

(HDD). She reports a positive effect on organizational longevity of a form of skewed ambidexterity in the sense that, according to her, firms need to find the right balance between a high intensity of exploitation and a moderate intensity of exploration in order to benefit from the strong main effects of both dimensions while avoiding overly strong interactions and the tensions a high intensity of both can create. This is rather surprising for such a high-tech sector as the HDD industry. Indeed, our results also indicate a positive effect of organizational ambidexterity on the survival of the company, but with a different type of ambidextrous skewness: an overall tendency to favor a slight excess of exploration intensity over exploitation intensity (our ambidexterity score remains in exploration territory most of the time). In view of this, we would think that high-tech industries such as biotechnology but also, we believe, industries such as aeronautics or telecommunications, because of their innovation-driven culture, will naturally have a greater propensity to explore new areas, even if they nevertheless manage to pay sufficient attention to exploiting their existing ones. This is probably even more so for small or medium-sized companies active in pharmaceutical and biomedical sectors which are often the result of spinning off universities or spinning out larger companies, hence starting as pure R&D companies.

As a matter of fact, as Sidhu *et al.* (2004) pointed out, a high environmental dynamism such as in these high technology industries leads to expanded search for information in order to reduce managerial uncertainty. Our results support Keller and Weibler (2014) who showed that environmental dynamism is positively related to engagement in exploration. These results tend to support the assertion that turbulent environments favor organizations forms that are quick at taking advantage from “new opportunities and the appearance of new habitats” (Hannan & Freeman, 1984, p.163). By experimenting with different types of innovations, the firm creates a “catalogue of responses to different and, as yet, unknown demands from the competitive environment” (Forgues & Thietart, 1995, p.23). Note that in addition to promoting the engagement in exploration, environmental dynamism has been found to also impact the efficiency of the exploration initiatives by moderating positively the relationship between exploratory innovation and financial performance (Jansen *et al.*, 2006). In other words, organizations pursuing exploration in dynamic environments see their financial performance improve, whereas organizations focusing predominantly on exploiting existing products, services and markets in such changing environmental conditions are likely to witness a decrease of their financial performances (Jansen *et al.*, 2006). Refining this empirical observation with an agent-based simulation model, Kim and Rhee (Kim & Rhee, 2009) predict

that “exploitative orientation would perform better when the environment changes with low frequency and small amplitude” (p. 15) and that “exploratory orientation would perform better when the environment changes either with low frequency and large amplitude or with high frequency and small amplitude” (p.16).

The fact that Galactic favors exploration (although maintaining a high intensity of exploitation) is only an average observation over its 25-year history. Looking more closely at the evolution of the exploration-exploitation mix in regards to the company's environment, we see that when the company's environmental conditions are relaxing, the firm is progressively increasing its focus on exploiting its existing activities, heading to a good balance between exploration and exploitation. The lowest ambidexterity score, deeply anchored in exploitation, was reached a couple of years after the environmental conditions were at their best which indicates that the firm needs about this time (two years) to reorient its strategy and activate new levers. Indeed, environmental changes impact the organization in a direct way (e.g., by adapting pricing policy or shifting sourcing patterns) but also indirectly through learning (March, 1991) and experience (Tushman & Romanelli, 1985), both processes which are not immediate and which take time. Conversely, when the environment is deteriorating and margins are under pressure (rising costs, lower profitability on exports due to less favorable exchange rates), the management puts gradually the focus on exploration in a quest for new products and new markets delivering higher margins or less exposed to exchange rates. Again, this observation gives credit to Keller and Weibler (2014) as well as Sidhu *et al.* (2004) who showed that environmental dynamism is positively related to engagement in exploration, as explained above. Kauppila (2010, p.285) relayed the same: “Turbulent environments call for adaptive structures and innovation-focused strategies that contribute to increased exploration”. This is however particularly counterintuitive for most managers to proactively stress exploration in difficult economic times and declining contextual conditions as they might be tempted to emphasize exploitation in this situation to maintain liquidity and preserve financial means, eventually blaming the economic conditions to justify downsizing and lay-offs (Walrave and colleagues, 2012).

In addition to measuring ambidexterity and its evolution over the company's 25 years of existence, our research aims at identifying “how can organizational ambidexterity be operated by medium-sized companies”; hence it tries to unveil possible underlying mechanisms that support its implementation. The question can be analyzed from two angles: a perspective internal to the company, which consists of seeing how it organizes its activities in terms of *structure* to support exploratory and exploitative activities, and a perspective external to the

company, which consists in defining how it creates contacts and *partnerships* to balance its exploratory and exploitative initiatives, knowing that both perspectives are not mutually exclusive and may complement or even improve one another (Kauppila, 2010).

Duncan (1976) suggested the use of “dual structures” to accommodate simultaneously the conflicting alignments needed for efficiency and innovation. This type of organization, often named “structural ambidexterity” (Tushman & O’Reilly, 1996), calls for a structural separation between activities aiming at exploiting and exploring. The time evolution of our indicator of structural ambidexterity showed an excess of separation (managerial decisions and actions are limited to one department) over collaboration between departments throughout the whole company history. Following Schmitt, Probst and Tushman (2010, p.143), we can think that it helps “cross-fertilization between units and prevents cross-contamination, as explorative units are protected from exploitative units’ routines and established processes. (...) Separation evades the impending threat of having to sacrifice efficiency for innovative activities and vice versa” (p.143). This can be seen as particularly true for high-tech firms where investment in research and development is substantial (this kind of companies display the highest R&D intensity in terms of expenses compared to sales according to OCDE) and must be kept at a high level to avoid becoming obsolete and being surpassed by contenders. Indeed, separation is particularly efficient to create new knowledge in general and promote radical innovations in particular (Benner & Tushman, 2002).

A more detailed analysis of the evolution of organizational ambidexterity during the different periods of the company's life shows fluctuations between autonomous and collaborative actions. We name “autonomous actions” the ones that are taken by one single department whereas “collaborative actions” refer to the course of actions shared between two or more departments of the company. In the early years prior to the company’s inception, there was no collaboration at all as the company-to-be was actually still a separated department of another corporation. But, right after the company’s creation, departments commenced to collaborate and the structural ambidexterity score started to oscillate around a zero value indicating a relative balance between autonomous and collaborative actions which gives credit to Khanagha, Volberda and Oshri (2014) who concluded that there is “a need for recursive iterations between different modes of separated and integrated structures” (p.322). The creation of autonomous subsidiaries overseas started with sharing knowledge and transferring technologies which imposed collaboration between the departments of the mother company and the newly incepted ventures. However, as the subsidiaries progressively gained operational autonomy, they started

to explore their own markets and to develop new knowledge on their own which led to a disconnection between the departments of the different entities. This movement was supported and probably even amplified by the decentralization of decision-making structures that was in place at this time, but the suddenness of this reversion must have been rooted in some external event. Indeed, when the reversion happened in 2006, there was no trace of an intended inflection of the company's strategy. It was right in the middle between the two main strategic inflection points clearly identified and acknowledged by the company's management (2001 and 2011). Therefore, the disruption in structural ambidexterity pattern seems totally disconnected from the company's strategy and independent from the overall strategic intent developed and enforced by the company's top-management at the time. The sudden bifurcation of structural ambidexterity, from mostly collaborative to mainly separated, was apparently not premeditated by the management but was a spontaneous reaction to exogenous factors that were not anticipated. As a matter of fact, the change in structural ambidexterity from collaboration to separation coincides with the time when the company shifted attention from exploitation to exploration, which was an immediate reaction initiated by a rapidly worsening environmental context. We therefore infer that, at least in this case, a negative and deteriorating environmental context triggered a deep modification of the decision-making pattern in favor of more exploratory initiatives which in turn resulted in enhanced separation between departments as this is apparently the way the company conducts exploration. Indeed, our results show that, at Galactic, exploration is largely an autonomous process whereas exploitation is a collaborative one in the sense that there is a clear tendency to have a higher exploration intensity when departments are working independently while, conversely, the exploitation intensity increases when several departments are working together. Figure 3.36 summarizes the causal chains that seem to emerge from our findings.



Figure 3.36: Simplified causal chains linking the environment to the collaborative or separated nature of structural ambidexterity

This gives credit to Walrave et al. (2012) who found that a negative environment such as a recession requires more attention to exploration, while a positive one demands more attention to exploitation.

This said, the impact we have observed of structure on exploration and exploitation intensities, although true throughout the company's history, was stronger at the beginning of the company's activities. Separation or collaboration between departments did not seem to influence largely the level of exploration and exploitation when the company reached a certain level of maturity. This observation suggests that managers who want their organization to reach a certain level of ambidexterity should pay more attention to structure in the first years of existence of their business, to allow exploratory projects to be conducted in clearly defined teams operating autonomously but, at the same time, to establish bridges between teams so that the exploitation projects can be realized in a participative way. Whether this causal chain can be generalized to all medium-sized firms operating in dynamic industries remains however to be investigated on a larger sample of companies.

While structural ambidexterity is looking at how exploration and exploitation activities are conducted from a perspective internal to the company, network ambidexterity adopts an external perspective by focusing on how the firm forges exploratory or exploitative cooperative links with its business environment. Organizational ambidexterity is likely to require interorganizational activities as they enable both exploitative and explorative knowledge processes (Raisch et al., 2009). Several studies suggest that exploitation and exploration occur both within and between organizations (Holmqvist, 2004; Raisch et al., 2009). In our terminology, exploratory partnerships are those that focus on value creation associated with upstream activities, and exploitative partnerships focus on creating value that is generally related to downstream activities in the value chain (Lavie and Rosenkopf, 2006; Rothaermel and Deeds, 2004). The link between partnerships and organizational ambidexterity, already highlighted by various authors such as Kauppila (2010) for instance, is clearly reflected in our results. As a matter of fact, increasing the number of partnerships of exploitative nature helped the company to balance the high number of exploratory alliances already in place since the beginning of its activities, as is common with high technology companies for which a high intensity of R&D is customary. The ability to form alliances of exploratory nature as well as alliances of exploitative nature is highly impacting exploration and exploitation intensities, respectively; and our results indicate that holding both simultaneously greatly improves the ambidextrous character of the company.

Our findings also indicate that small companies which are not in a position to allocate separate resources to exploration can nevertheless endeavor towards organizational ambidexterity by developing exploratory and exploitative partnerships. We show that network ambidexterity impacts organizational ambidexterity to a larger extent than structural ambidexterity. This observation may help prioritizing actions when it comes to advising managers. We think it is of particular interest for small and medium enterprises that do not necessarily have the ability, the skills or the resources to work on both aspects simultaneously. This resource-based view abounds in the direction of several authors (Lavie & Rosenkopf, 2006; Rothaermel & Deeds, 2004) who suggested externalization and outsourcing as a way of resolving the paradoxical requirements of exploration and exploitation. Especially noteworthy in this context is the study by Powell, Koput and Smith-Doerr (1996) on interorganizational collaboration in the field of biotechnology arguing that “when the knowledge base of an industry is both complex and expanding and that the sources of expertise are widely dispersed, the locus of innovation will be found in networks of learning rather than in individual firms” (p.116) because “sources of innovation do not reside exclusively inside firms; instead, they are commonly found in the interstices between firms, universities, research laboratories, suppliers, and customers” (p.118). This justifies that a medium-sized company active in a very dynamic context like Galactic turns outwards through research partnerships to support its innovation even if it encourages an exploration activity based on the autonomy of its departments (separation). And if companies look outside for new knowledge and innovation, they also engage in partnerships that are motivated by exploitation (Lavie, 2006; Lin et al., 2007) to increase the efficiency of resource utilization by means of outsourcing or contract manufacturing (Kauppila, 2010).

Eventhough the positive impact of external networking and partnering on organizational ambidexterity appears greater than the one of structural ambidexterity in our study and that resource-constrained companies may not have the luxury to conduct both at the same time, Kauppila emphasizes that making use of external partners may not be a sufficient condition for ambidexterity “because it is not the network but the firm that balances exploration and exploitation” (Kauppila, 2010, p.307). The author advises companies to be extroverted in seeking resources and knowledge outside the firm and, at the same time, to be introverted in balancing exploration and exploitation within the firm. Interestingly, our study shows that the elements most impacting exploration *or* exploitation are not necessarily the ones most influencing organizational ambidexterity which means that, in their quest for ambidexterity, managers should pay attention to different variables whether they want to promote exploration,

improve exploitation, or balance both ambidextrously. In other words, the implementation of harmonious and effective ambidextrous management should not simply focus on maximizing exploration and exploitation (the conceptualization of exploration and exploitation as orthogonal dimensions that we had called "Appolo & Dyonisos") but should also activate certain levers whose combination brings effects on ambidexterity greater than the sum of their effects on each of its components, i.e. exploration and exploitation. As a matter of fact, the analysis of the documentation that served as the basis for the writing of the company's history has highlighted two of these levers that appear fundamental enough to shed light on possible processes underlying organizational ambidexterity.

The first lever that we have identified as particularly influential for ambidexterity is based on balancing attention to efficiency and flexibility, a tradeoff already outlined by several scholars such as Adler and colleagues (1999), Ebben & Johnson (2005) and Xie (2012). Nurturing existing capabilities and developing new ones ultimately aims at improving the ability of the organization to adapt to environmental changes; hence to be flexible (Ashby, 1962; Nonaka, 1988; Volberda, 1996) without losing on focus and efficiency. This "corporate plasticity" that we defined as the bundle of all types of organizational responses an organization may display to environmental changes (phenotype variations) without altering its profound makeup (its genotype) came out of the narrative of the company's history as a key-characteristic of Galactic as an organization, not only by the sole geographic mobility of its management over different continents, but more specifically by the different types of responsibilities held concurrently by the senior managers across different group entities. What is interesting here is not that people held various responsibilities in a given firm, which is very common in medium-sized companies, but that these very different responsibilities were held simultaneously; what the managers of Galactic refer themselves to as having "multiple hats". Note that the ability to be "multitasking" is an important attribute of ambidextrous managers as per some scholars (Gibson & Birkinshaw, 2004; Mom, van den Bosch, & Volberda, 2009). This kind of organization based on a closely intertwined set of responsibilities among the top-managers facilitates knowledge transfer from the core to newly created entities and between departments but also opens up the senior management to new opportunities, new perspectives and, in turn, ultimately, helps acquire new knowledge. It allowed each of the people concerned to be part of new ventures and new developments at the same time as they kept a role in the company's core activities. In this, the company follows the recommendation of O'Reilly and Tushman (2004) who proposed as "integrating mechanism" (Markides, 2013) that the parent company and

subsidiary units share common managers. Our observation also gives credit to Mom, van den Bosch, & Volberda (2009) who found that both the participation of a manager in cross-functional interfaces and the connectedness of this manager to other organization members positively relate to ambidexterity at an individual level, and by way at the organizational level.

Large firms typically have excess resources that are seen as benefits for implementing organizational ambidexterity (Atuahene-Gima, 2005; Lubatkin et al., 2006) and to cushion organizations from external shocks (Meyer, 1982), but they often lack corporate plasticity because of heavy structures and bureaucracy (Hannan & Freeman, 1984; Miller & Friesen, 1978). They are sometimes called "mechanistic" structures (Burns & Stalker, 1961). Medium-sized firms have fewer hierarchical levels and their managers are more likely to play both strategic and operational roles (Lubatkin et al., 2006; Raisch & Birkinshaw, 2008). Consequently, these companies have no choice but to concentrate different activities on fewer people, which obliges them to an "organic" mode of operation that inevitably contains the germs of plasticity and organizational ambidexterity. Burns & Stalker (1961) have argued that such an "organic" system is more efficient when the firm is facing turbulent conditions, while a "mechanistic" management system works better when the environment is stable. Some authors argued that organic structures are associated with exploration whereas mechanistic structures are better fit to support exploitation (Brown & Eisenhardt, 1997; He & Wong, 2004; Lewin & Volberda, 1999). Our results seem to support a hybrid form that combines an organic structure at the management level with a more formal, mechanistic, structure at the execution level. Indeed, Galactic favors separation between departments to carry out its exploration activities, at least internally, while the exploitative activities are essentially conducted in a participative way which suggests that the organic structure at the top of the company was partially offset by a more mechanistic structure within and between departments. Indeed, to simultaneously balance its exploratory and exploitative activities, the top management relies on subsidiaries and departments operating in silos with clearly defined responsibilities. Adler et al. (1999) have already observed that achieving both flexibility and efficiency simultaneously calls for sharing the tasks between a group of people taking on non-routine tasks following an organic structure and another group of people performing routine tasks under a more mechanistic and streamlined structure.

As already pointed, this type of joint organization is presumably specific to medium-sized enterprises. Indeed, very small firms do not have ordinarily enough hierarchical levels to allow different types of organization between senior management and the level of execution. Senior

executives are themselves heavily involved at the operational level and their organizations can not afford to create structurally separated structures or focus their teams on exploration only. Conversely, large firms are often mechanically organized and their size requires specialization of their subunits. Medium-sized companies on their side are found at the intersection of these two extremes: they are large enough to organize themselves structurally, and small enough for their senior management to stay close to the operational core of the company (Lubatkin et al., 2006). These elements lead us to conclude that medium-sized firms can nurture their corporate plasticity and become ambidextrous by adopting an organic structure of management at the top of the company based on different sets of responsibilities held simultaneously by a limited group of flexible managers, and by combining this organic structure at the top with a more structured mechanistic type of organization at the execution level.

A second lever that emerged from our study as contributing positively to organizational ambidexterity without strongly impacting specifically exploration or exploitation lies in the pursuit of intuitive projects in parallel of well planned ones. In making decisions, managers depend not only on pure and indisputable facts but rely also on intuition and judgment. Effective forecasting helps reduce the decision space in which to exercise intuition (Saffo, 2007). However, there are two ways to start projects and take decisions: either by conducting *ex ante* an in-depth evaluation of possible outcomes (prediction, forecast) and by precisely planning each step of the process to reach the objective, or to make the decision based on intuition, heuristics, imagination and beliefs. Our results suggest that ambidexterity benefits greatly from having both approaches simultaneously, while the magnitude of their impact on exploration and exploitation intensities separately is rather limited. The effectuation theory, initially put forward by Sarasvathy in 2001 in her analysis of entrepreneurial decision-making processes (Sarasvathy, 2001a), discerns the two logics of decision-making mentioned here above and attributes names to those two approaches: *causation*, which assumes that the means are selected to achieve predefined goals; and *effectuation*, which postulates that the goals stem from the available means.

Therefore, decision-makers decide on what logic to apply in regards to their available means and we can assume that the more constrained the resources, the more inclined decision-makers will be to adopt an effectual approach for their new projects instead of a causal one, hence our interest in this theory in our study of medium-sized enterprises. Yet, decision-makers also decide on what logic to apply in regards to their perception of the future. If they believe that they are dealing with a measurable or relatively predictable future, they try to gather

information about this possible future and they design a strategy to address it in order to reach their predefined goal (causal approach). Conversely, if they think the situation is unpredictable, they most likely start experimenting through an iterative learning process (Argyris & Schön, 1978; Sarasvathy, 2001a) (effectual approach). The causal approach appears deeply rooted in planning and forecasting which is notoriously inaccurate (Hogarth & Makridakis, 1981; Mintzberg, 1994) especially in unpredictable environments, hence our interest in effectuation as an approach particularly well adapted to companies operating in contexts of growing uncertainty. Berends and colleagues (2014, p.619) confirm that viewpoint and write “effectuation concerns action under resource constraints, a central concern for most small firms (...); and action choice under uncertainty”.

In terms of generative mechanisms, causation follows a teleological model (Van de Ven & Poole, 1995; von Mises, 1962), a cycle of goal formulation, implementation, evaluation, and modification of goals based on what was learned; whereas effectuation resorts to an evolutionary model of repetitive sequences of variation, selection, and retention (Burgelman, 1991). Indeed, as Sarasvathy (2001a) explains, Weick’s theory of enactment (Weick, 1979) considers that selection in organizations is the fact of decision-makers and not only of the environment and that this process is not always “causally prescribed” but may follow an effectual logic with the actors making sense of their actions retrospectively (Weick, 1995; Weick, Sutcliffe, & Obstfeld, 2005).

Galactic started its activities with an intuition-based effectual approach, which provides support to the entrepreneurial roots of the effectuation concept (Sarasvathy, 2001), but the company quickly had to activate causal processes based on forecasting to support its growth and development. In a capital-intensive industry characterized by long investment cycles like biotechnology, a certain amount of teleological planning is mandatory. At some point though, a profound change in the firm’s market environment triggered a drastic modification of its strategy despite the fact that the company was able to keep a high level of exploration and exploitation. Actually, the progressive commoditization of the company’s core products made that it was innovating but still always within a narrow space around the same subjects. All producers in the same field were then focusing their efforts and resources on finetuning their processes and improving the existing properties of their products to keep their clientbase satisfied and gain a cost-based competitive advantage. Galactic was no exception. To escape this innovator’s dilemma (Christensen, 1997), Galactic had to go beyond its usual crowd of customers and start approaching new prospects, in other markets, prospects with different

needs, prospects who were not using lactic derivatives and, eventually, who did not even have the need to. Understanding the needs and requirements of this new genera of prospects would most probably lead to the development of other products, not slightly different but radically different from the existing ones, by leveraging on the company's skills and expertise. It was believed that this new strategy would reduce the company's exposure to the commoditization process at play and help it bounce back with new solutions in new markets. The management resolved therefore to re-centralize the decision-making structures and to merge the sales, marketing and R&D departments with the view to narrow down the distance between the firm's scientists and the market, to better anticipate customers needs and to reduce the "time-to-market" for its innovations. As a matter of fact, the company adopted an effectual approach by bringing the customer at the center of its development, a change of mindset that is not that obvious for a company led by engineers who like to pay more attention to processes and technologies than to their users. Such a demand-based perspective is however rather typical of small to mid-sized companies operating in dynamic and concentrated industries (Xie, 2012) like industrial biotechnology. In this type of environment, a few dominating players coexist with small competitors but, because of resource constraints, SMEs cannot outperform their competition directly; they often turn their attention to their customers with the intention to create value for these customers and by doing so gain competitive advantage. Kim & Mauborgne (2004) have showed that competition may be irrelevant when firms offer something customers perceive to be valuable. However, customers' needs are not stable in dynamic industries, flexibility is critical for the firm to survive in this type of environment (Xie, 2012), and flexibility is precisely what differentiates small companies from larger ones. We have seen that the company put in place structures, organic at the top and mechanistic at the execution level, to stay alert and sufficiently flexible to avoid organizational inertia (Hannan & Freeman, 1984; Volberda, 1996), convergence (Miller, 1993) or cultural lock-in (Foster & Kaplan, 2001b).

Some scholars (Sarasvathy, 2001a; Wittbank & Sarasvathy, 2010) argued that exploration proceeds by an effectual logic whereas exploitation does by a causal one, making the link with March's framework (1991). In our view, this is too simplistic as our results show indeed a good correlation most of the time between both frameworks, ambidexterity and effectuation, but it is not always the case and there are periods where both frameworks clearly diverge from one another. Obviously, in some conditions, effectuation is of exploratory and exploitative nature at the same time and not, as often claimed, inevitably exploratory by essence. This is due to the

high number of smaller projects that follow a trial-and-error type of process, or a variation-selection-retention process if one prefers, that an effectual logic allows in contrast with the few well-thought about projects planned in advance that are typical of the causal approach. Some of these multiple projects opened in the marketplace simply mobilize existing knowledge (existing solutions to be applied to existing requirements), others trigger more trials and investigations and generate new knowledge (existing solutions to new requirements, new solutions to existing requirements, or new solutions to new requirements) which will be in turn used to expand the landscape of possibilities for the company. Note that Chandler, Detienne, Mckelvie, & Mumford (2011) also claim that seeking pre-commitments of customers is a dimension shared between effectuation and causation. Berends et al. (2014), on its side, argue that the combination of effectual and causal principles is archetypal of small firms as they leverage their characteristics and resources. In their investigation of product innovation trajectories, they pointed (p.616) among others traits that small firms “scoped innovations to be realizable with available resources; used external resources whenever and wherever these became available; prioritized existing business over product innovation projects;(…) iterated the generation, selection and modification of goals and ideas; and relied on their own customer knowledge and market probing rather than early market research”; hence a bundle of exploration, exploitation and effectuation.

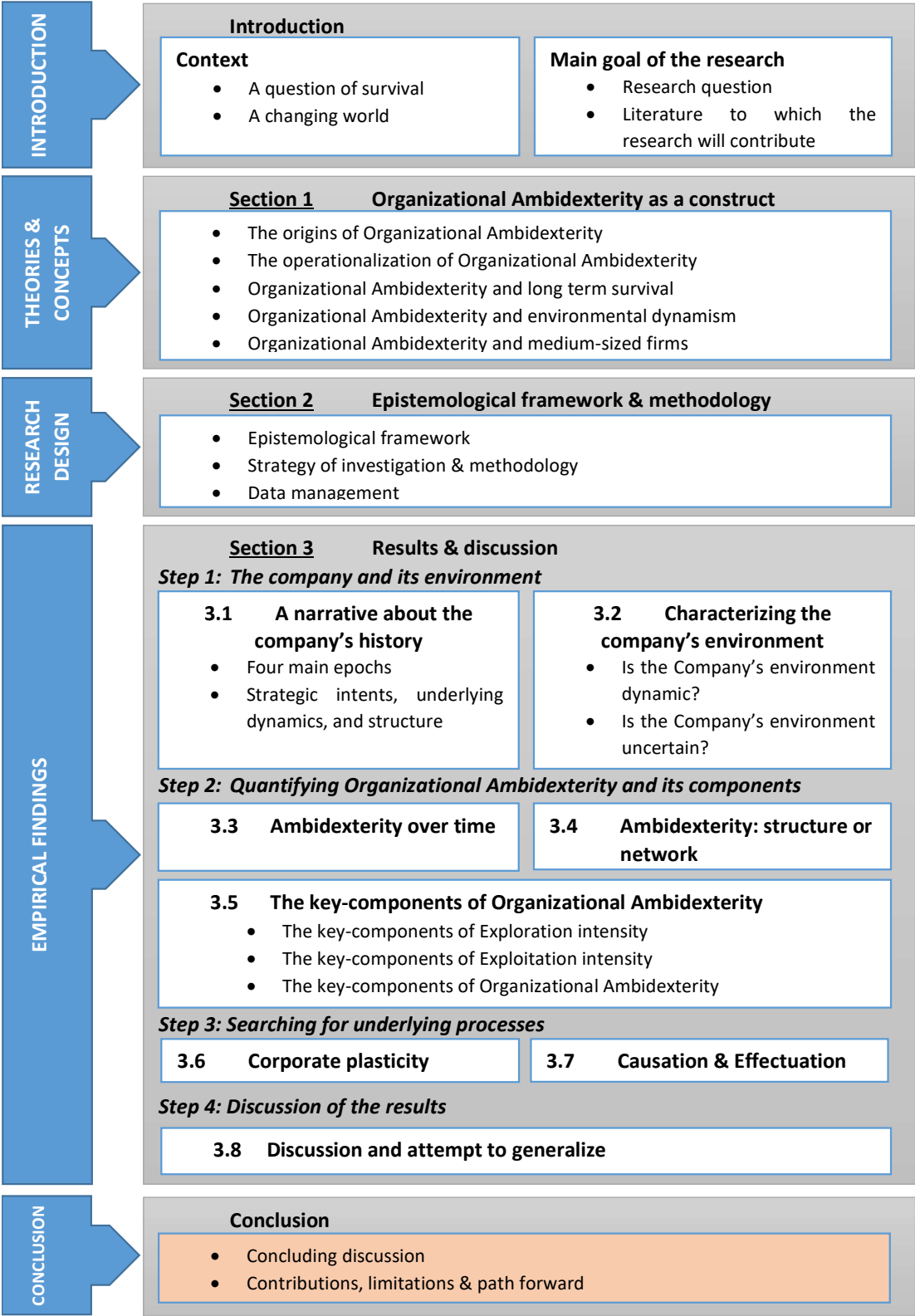
Similarly, our findings indicate that exploration can take on a causal logic as well as an effectual one, especially in regards to the timeframe of the developments at play. Short development cycles call for an effectual approach while long development cycles need a stricter causal approach, especially because of the higher costs linked to long developments. Another positive effect of an effectual approach of particular interest for small or medium-sized companies operating in turbulent market conditions is that thanks to the multiplication of projects, the investment per project becomes relatively low whereas the probability of success increases sharply (“the more you seed, the more you harvest”, as goes an old saying). Therefore, losses are limited whereas potential gains increase which forms a positive asymmetry typical of trial-and-error tinkering and characteristic of antifragile cases (Taleb, 2012, p.236). In Taleb’s framework, such an effectual logic offers optionality. With low cost mistakes, known maximum losses and large potential payoffs, the distribution of these potential payoffs forms a convex function which means that an increase of uncertainty results in a higher likelihood of positive outcomes.

In conclusion, one way to achieve organizational ambidexterity in medium-sized companies is to nurture a customer-centric effectual approach. To do so, the firm can create sub-structures to support multiple trial-and-errors projects directly involving customers in the short run while keeping at the same time a strict stage-gate system resorting to a classical causal logic for projects imbedded in long development cycles. Although expensive, this type of long-term exploration through separated sub-structures is nevertheless needed in high technology industries to support radical innovation (Benner & Tushman, 2002) and stay at the forefront of innovation because radical innovation requires conflicting mindsets and processes that the organization must be able to support (Lewis et al., 2014). We argue that the integration of an effectual logic to the company's practices creates an ongoing opportunity for variation, selection and retention of new knowledge and new capabilities that helps the company to stay ambidextrous and makes it more robust to environmental changes. It offers the remedy longed for by Goodwin and Wright (2004) to counteract the absence of efficient method to anticipate rare events when they call for a "protection for the organization to benefit from the occurrence of negatively-valenced events whilst allowing the organization to benefit from the occurrence of positively-valenced events".

Overall, the integration of our observations, as diverse as they are varied, confirms that organizational ambidexterity is a rich, complex and multilayered concept that must be dynamically analyzed in the light of the company's available resources, especially when they are limited as for the majority of mid-sized firms; but also with regards to the surrounding environmental changes, especially when these are accelerating and becoming unpredictable. According to our results, balancing exploration and exploitation by purposely combining causal and effectual logics at the execution level while maintaining a high level of flexibility at the management level to guarantee enough plasticity for the organization may lead to nurturing a certain level of organized chaos that generates an autogeneous order (Nonaka, 1988) allowing the organization to survive turbulent times or negative contexts for relatively long periods of time.

Conclusion

Thesis defended
 Medium-sized companies can operate Organizational Ambidexterity to dynamically adapt to unanticipated environmental changes and hence improve their survival chances



Conclusion

“What looks to be conceptually simple is often extraordinary complex in execution. It requires that leaders have an understanding of both what to do and how to do it.”

(O'Reilly & Tushman, 2016, Preface, emphasis original)

In real-life situations, organizational ambidexterity is more complicated than the ideal types generally described in academic literature. This is because the organizational context of development and change in which ambidexterity has to take place extends over space and time, allowing for more than one underlying mechanism to be activated. Various parameters influence organizational development, both inside and outside the boundaries of the organization. These different influences can act simultaneously on different parts of the organization, each giving its particular impetus to the ambidextrous intent. The implementation of ambidexterity also takes time. Time allows different underlying mechanisms to come into play, either simultaneously or sequentially, and the process that results therefrom is multilayered and complex. Therefore, trying to explain this process with one mechanism may oversimplify and draw too much attention to one aspect of the ambidextrous process to the detriment of others. Enlightened by our results, we argue that ambidextrous organizations display, wittingly or not, combinations of two or more types of organizational ambidexterity whose generative mechanisms interplay with each other to create complex phenomena. We saw that ambidextrous organizations may vary the intensity of exploration and exploitation in regards to internal forces (e.g. modifications of strategic intent; centralized versus decentralized structure) as well as external ones (e.g. opportunity to conquer new markets and geographies; deterioration of environmental conditions such as raw material prices and exchange rates; commoditization of flagship products). We have also seen that, counter-intuitively, organizations may choose to increase their focus on exploitation when environmental conditions are relaxing and, conversely, enhance their attention towards exploration in difficult times⁷³.

Indeed, organizations exchange information and resources with their environment. Yet, they are not all equally affected by environmental changes. Some organizations may suffer more than others which are better equipped to cope with turbulent circumstances and implement

⁷³ It should be reminded, however, that in our case these movements were parallel to major organizational changes (centralization, decentralization, recentralization).

responses to discontinuities. At first sight, large corporations may have better capabilities to face this challenge as they have generally more slack resources than medium-sized firms which are usually more resource-constrained. Conversely, medium-sized companies differ from larger organizations by greater agility, increased flexibility, what we call a better "plasticity". We argue that SMEs operating in turbulent environments with high technological content would benefit from combining a highly flexible organic-type of structure at the decision-making level with a more mechanistic structure at the operational level. Maintaining a certain separation between departments, especially those in charge of long-term development projects, makes it possible to isolate them from the short-term pressure dampening the radical innovation so much needed by high-tech companies. This separation between departments for projects of long-term exploratory nature should however be complemented, on the one hand, by increased collaboration between departments on exploitative and short-term exploratory projects; and on the other hand, by collaborating with outside partners for both exploratory and exploitative initiatives. Such a network ambidexterity, particularly adapted to smaller companies with limited resources, has also been found to have a greater impact on organizational ambidexterity than structural effects themselves.

The most appropriate form of organization to deal with the volatility of the environment depends of course on the characteristics of the organization itself but also on the multiple environmental components which are increasingly difficult to circumscribe and whose changes become harder to anticipate. It is therefore advisable to establish forms of organization that protect firms against environmental changes (Nonaka, 1998). The aim is to make organizations more robust to change, or even better, to make them "antifragile" in the sense that they would not only resist environmental volatility but would eventually benefit from it (Taleb, 2007a, 2007b, 2012). Uncertainty widens the world of possibilities and increases the number of opportunities. We argue that the integration of effectual logic into business practices at the execution level, especially for short term developments, creates an ongoing and affordable opportunity for the variation, selection and retention of new knowledge and capabilities that helps the company stay ambidextrous and makes it more robust in the face of environmental change. Moreover, we show that the effectuation-causation framework may diverge from the exploration-exploitation framework in some conditions. Both frameworks appear complementary instead of being exclusive from one another and they can be operationalized simultaneously which is of particular interest for resource-constrained smaller firms as effectuation constitutes a cost-effective way to increase the odds of positive outcomes in terms

of exploration and exploitation at the same time. In this sense, ambidexterity and effectuation play as negentropic forces⁷⁴ which allow companies to dynamically maintain a certain level of organization and order, hence to survive and develop, despite the entropic and even chaotic⁷⁵ evolution of the world around them.

Overall, as a final note, we like to repeat that the key to long-term survival in an increasingly changing environment is the ability of firms to dynamically adjust the balance between exploration and exploitation in response to contextual changes. To do this, companies have multiple means of operationalizing organizational ambidexterity (structural, sequential and contextual measures) and related tools (causation, effectuation), but the real world can not be satisfied with the static typologies described in the academic literature. In practice, organizational ambidexterity is a complex and evolutive process that has to adapt dynamically to internal and external factors, most often by setting up a mix or a superposition of measures, variable in intensity, simultaneous, at different levels of the company and by regularly modifying this mix in response to external stimuli and newly acquired internal capabilities.

We hope to have contributed by our work to a better understanding on how to operate organizational ambidexterity in medium-sized firms so as to better prepare for the future without losing efficiency in the present because the evolution of our economies (globalization, hyper-connectivity, etc...) gradually eliminates cases of environmental stability and predictability, and increasingly exposes companies to a context of unprecedented volatility.

Academic contributions

Our approach based on an in-depth longitudinal case study spanning over 25 years of existence of a company is original in the sense that the literature on organizational ambidexterity has generally taken a static approach mainly relying on cross-sectional surveys and much of the work to date has consisted in empirical studies using financial performance, sales performance or eventually knowledge and innovation indicators as dependent variables. Various authors have emphasized the importance of carrying out such kind of longitudinal studies in order to see, for instance, how the relative importance of differentiation (exploration) and integration

⁷⁴ Negentropy is the entropy that a living system exports to keep its own entropy low and, by extension, it is the tendency of human organizations to become better organized, to improve or maintain their capacity and efficiency. The concept was introduced in 1944 by Schrödinger (Schrödinger, 1944) as “negative entropy”, later shortened as “negentropy” by Brillouin (1953).

⁷⁵ “Chaotic” is taken here in its thermodynamic sense.

(exploitation) evolve over time (Raisch et al., 2009) or to elucidate the short-term versus long-term implications of balancing exploration and exploitation (Lavie et al., 2010). Schmitt and colleagues (Schmitt et al., 2010) for instance consider the use of anecdotal and longitudinal case studies on the inter-firm and intra-firm level of analysis as the most promising approach for future research as these study designs provide sufficient insights into complex situations. Our study falls precisely within this framework.

In terms of **methodological contribution**, our work proposes and tests a new method of measuring organizational ambidexterity based on the rating of 12 specific parameters, identified as key-elements for ambidexterity and selected following a systematic and structured process inspired by Gioia's method for grounded theorizing (Gioia et al., 2013) that we have applied to the questionnaires of 20 different researches on organizational ambidexterity published *in extenso* in literature. We combined this rather quantitative approach with an abductive search for the underlying processes of organizational ambidexterity that are activated in regards to contextual conditions. We did that by triangulating between the narrative of the company's history, the various archival documents gathered and the measurements that emerged from the quantitative analysis of managerial decisions and contextual events mentioned above. Going back and forth between the documentary corpus and the academic literature, and refining the code-book with additional dimensions such as the ones about causation and effectuation, have made possible to complete the analysis of the underlying processes that preside over ambidexterity in the company. This combination of quantitative and qualitative methods which, according to our knowledge, has not yet been tempted in a longitudinal study on ambidexterity, is coherent with our epistemic posture as it echoes the recommendation of Mingers, Mutch and Willcocks (2013) who claim that critical realism supports mixed-method research strategies (i.e., a variety of methods in the same research study) on the ground that a particular object of research may well have different characteristics.

We applied the same systematic and structured process to develop a rating grid that could be used for measuring causation and effectuation and following their evolution over time. This method seems novel too as most publications are either conceptual (Sarasvathy, 2001a, 2001b; Sarasvathy & Kotha, 2001; Wittbank & Sarasvathy, 2010) or based on semi-structured interviews and questionnaires (Chandler et al., 2011) which differ profoundly from our approach from a methodological standpoint.

In parallel to the listing of decisions taken by the management over the years, we have recorded hundreds of contextual events that characterized the company's environment over the same period of time. These contextual events include external environmental incidents that occurred beyond the control of the organization (Cheng & Van de Ven, 1996) but which were likely to influence positively or negatively its development. To search for these events, we analysed the archival sources specific to the company (memos, meeting minutes, communications etc...) and other sources external to the company such as databases. This approach helped characterize the multiple facets of environmental changes that impacted the company's development and triggered organizational adaptations within the company with regards to their incremental or erratic and disruptive nature. Although the academic literature on the interactions between companies and their environment is already rich, particularly at the theoretical and conceptual level (e.g. contingency theory, coevolution theory), our methodological approach is rather original in terms of the timeframe to which it applies (25 years) and the level of detail (fine-grained analysis) that only a single case-study allows.

We have also used mathematical tools generally mobilized for the analysis of time series to detect the presence of chaos in the direct environment of the company in order to demonstrate its complex and non-predictable nature which constitutes the initial postulate of our research question. We applied these tools, in this case an algorithm proposed by Wolf et al. (1985), to three types of variables that emerged as particularly impacting in the writing of the company's history, namely the evolution of commodity prices (sugar), energy (crude oil) and exchange rates (eur/usd). This approach is not really innovative since it has already been used by various authors in other contexts (e.g. Adrangi & Chatrath, 2003; Adrangi et al., 2001; Blank, 1991; Cheng & Van de Ven, 1996) but it has nevertheless allowed us to confirm with scientific rigor the unpredictable nature of the environment in which evolves the company rather than staying on an unverified postulate even if it seems intuitively applicable.

In terms of **conceptual contributions**, the approach outlined in this dissertation contributes to organization theory and especially to organizational ambidexterity theory in several respects.

First, it offers a parsimonious explanation of a dynamic view of organizational ambidexterity. The generative mechanisms supporting the ideal types of organizational ambidexterity (mainly structural, simultaneous and network) supplemented by the closely related framework of effectuation serve as theoretical building blocks, and the complexity of the survival process of

a medium-sized firm in unpredictable and largely negative environment can be analyzed as the time-dependent interplay among these building blocks. Second, our approach points out previously ill-explored explanations of organizational ambidexterity, particularly how ambidexterity can be dynamically operated in resource-constrained organizations and especially in medium-sized companies.

In addition to refining the ambidexterity theory, this study contributes to the literature on effectuation, which is still largely conceptual, by revealing dynamics of effectual logic in the real life context of a medium-sized firm. We showed that effectual logic is not limited to entrepreneurial situations, as often claimed in literature, but may also develop long after the companies' inception. Sarasvathy tells us that "... as an entrepreneurial company grows beyond a critical size, effectual reasoning has to be supplemented with and even replaced at times by causal modes of thinking" (Sarasvathy, 2001, p.5). As such, our study supports the first point, the need to balance the two modes of thinking, but provides an example that contradicts the second one, the idea that effectuation should be literally replaced by a causal approach.

Moreover, whereas Sarasvathy's concept of effectuation and causation has often been compared to March's concept of exploration and exploitation, and we have indeed seen a strong correlation between both patterns over long periods, we showed nevertheless situations in which both frameworks diverge. In the same way that exploration and exploitation co-exist within a company and must be balanced and perpetually adjusted to adapt to internal changes and anticipate external changes (co-evolution: Lewin & Volberda, 1999; Lewin et al., 1999; Lichtenstein, 2000; McKelvey, 1999; Volberda & Lewin, 2003); causal and actual processes can also coexist and be modulated so as to dynamically adapt to contextual changes.

Finally, our work contributes to link Taleb's fragility/antifragility (concavity/convexity) theory and Sarasvathy's causation/effectuation theory. Of course, in our case, the link that we highlight between those two theories is limited to exploratory, mainly innovation-related, activities but it is probably generalizable to other domains such as entrepreneurship for instance. This assertion offers room for future studies though.

Managerial recommendations

In addition to the theoretical contributions, this dissertation provides insights into how managers of medium-sized companies can effectively create ambidextrous organizations. However, if we recommend managers to encourage ambidexterity within their organizations, we also advise them to **constantly adjust the balance** of exploration and exploitation **in regards to internal and external forces** at play, especially when evolving in turbulent environments or going through critical periods, by shifting attention from one to the other in a timely manner. It may seem obvious and relatively simple to set up for companies that have the necessary resources and expertise, often large companies. On the other hand, it can be much more of a challenge for smaller companies that must make choices to ensure their short-term survival while preparing for their future.

Therefore, to help managers in this quest, we propose the advices listed hereunder on the basis of our observations. The reader will forgive the triviality or the obviousness of some recommendations that we deemed nevertheless useful to recall in order to offer managers a wider range of possible actions. The following list is organized in the form of a gradation from the most general recommendations (#1 to #5) to those which focus more particularly on the originality of our results (#6 to #9) and answer more precisely our research question of "how" to set up an ambidextrous strategy, especially in the context of medium-sized companies generally characterized by limited resources in both human and financial terms.

Advice #1: Constantly monitor the organization's environment and its exposure to it.

The need to combine exploration and exploitation must be reflected by decision-makers with regards to the exposure of their organization to the volatility of their environment. Some sectors are less exposed and some business environments are less volatile, they can afford higher emphasis on one dimension or the other.

- In an environment stable by nature, companies can focus on operations: the risk of failure is low and the cost of ambidexterity is not justified.
- In a turbulent environment (volatile and uncertain), companies in sectors with little exposure to changes must open to the outside by exploring new technologies and new business models to prepare for the next disruption which, despite the low exposure, is not less likely to impact it sooner or later.
- In a very uncertain environment (such as for example activities with high technological content operating in an international context), businesses will

benefit from the implementation of an ambidextrous strategy. In this case, it seems justified for these organizations to trade part of their short-term productivity against their long-term survival. The key to long-term survival in an increasingly changing environment is the ability of enterprises to dynamically adjust the balance between exploration and exploitation in response to contextual changes.

Advice #2: Improve exploration intensity

Should there be a need to increase exploration, the managers of medium-sized companies evolving in industries with high technological content which can't afford supporting all research projects with their own financial means or which do not have enough scientific capabilities to address all possible subjects they might have the need to address in their R&D journey should prioritize long term exploratory alliances such as research programs with other companies, R&D centers and universities to maintain a good level of exploration intensity.

Advice #3: Keep on exploring in difficult times

When the environment is deteriorating and margins are under pressure (rising costs, lower profitability on exports due to less favorable exchange rates), managers should put the focus on exploration in pursuit of new products and new markets delivering higher margins or less exposed to exchange rates, even if this seems counterintuitive to most of them. Indeed, they usually feel inclined to emphasize exploitation in this situation so as to maintain liquidity and preserve financial means.

Advice #4: Improve exploitation intensity

In contrast to the above, managers who need **to improve the exploitation intensity** of their organization may focus on existing markets and customers and pay attention to improving activities, technologies, processes and products. Exploitative alliances such as sub-contracting the manufacture of some products also impact positively the exploitation intensity, as do the promotion of existing solutions and leveraging accumulated experience.

Advice #5: Pay attention to structure

Managers who want their organization to reach a certain level of ambidexterity should pay attention to structure, especially in the first years of existence of their business, to allow exploratory projects to be conducted in clearly defined teams operating autonomously but, at the same time, to establish bridges between teams so that the exploitation projects can be realized in a participative way.

Moreover, structure and strategic intent should be aligned. When information brought up by the middle management and various objective ratios and metrics indicate a discrepancy between the strategic intent and the path really taken by the company on the field, managers may have to adapt their corporate strategy sometimes to seize new growth opportunities, sometimes to survive deep changes in the context in which they are operating. In this case, managers should not hesitate to drastically change the structure of their organization. There is a need for recursive iterations between different modes of separated (decentralized) and integrated (centralized) structures. Decentralizing temporarily the decision-making structures can be a way to explore new markets and dislodge the firm from its set of practices in such a way that it escapes its developmental trajectory.

Advice #6: Enter into partnerships

We have shown that structural ambidexterity and network ambidexterity are not exclusive of one another, and that, contrary to the generally accepted idea, medium-sized organizations can excel on both aspects concurrently. Structure and network both have high explanatory power on organizational ambidexterity which means that managers who can afford investing in both simultaneously should. However, if a choice has to be made because of limited resources, it would be more effective to prioritize network ambidexterity, that is to say, to create exploitative and exploitative partnerships, rather than to favor structural ambidexterity, namely to separate the departments in charge of exploiting existing knowledge from the ones that develop new knowledge.

In industries with high technological content, many firms are naturally involved in exploratory collaborations. Managers should balance this high focus on exploration by increasing the number of partnerships of exploitative nature in order to avoid the “failure

trap” of underdeveloped ideas by which innovations are replaced by new ideas before they have had the chance to be converted into practical reality that contributes to the company's revenue stream, a state of “constant shifting in alternatives in which exploration drives out exploitation” (O’Reilly & Tushman, 2007, p.13).

Companies like to work with old well-known partners because it keeps their members in their comfort zone, and sharing know-how often requires the establishment of long-term relationships in which exchange occurs in a code learned and shared. However, the company doing so exclusively somehow runs the risk to fall in a “success trap”, organizational inertia, convergence and simplicity. Hence, we advise managers to balance the types of partnerships the company is engaging into and combine collaborations with old partners and with new partners.

But still, the implementation of harmonious and effective ambidextrous management should not simply focus on maximizing exploration and exploitation but must also activate certain levers whose combination brings effects on ambidexterity greater than the sum of their effects on each of its components.

The first of these levers is based on balancing attention to efficiency and to flexibility (Advices #7 and #8 hereunder), hence:

Advice #7: Nurture corporate plasticity with an organic type of organization at the top level.

Finding the right balance between efficiency and flexibility emerged as an important parameter to maintain high level of ambidexterity especially in volatile context. Indeed, for an organization to successfully survive all circumstances, it needs to have at least as much variety within itself as the variety of disturbances in its external environment. Hence, the more turbulent the environment, the more variety needed within the firm. Moreover, it is not only the variety of capabilities currently used by the organization that counts but also the collection of potential capabilities that are not yet activated and need to be developed to cope with the possible emergence of opportunities or threats. Here again it is a great challenge for medium-sized companies to have such variety when resources are constrained and when their size limit the range of skills that they can enjoy internally. A way to cope with this situation is to have a stable management

team whose members hold several types of responsibilities, separated in space, in different sub-units, and in a simultaneous fashion. It allows each of the people concerned to be part of new ventures and new developments at the same time as they keep a role in the company's core activities. In this, the company follows the recommendation of O'Reilly and Tushman (2004) who proposed as "integrating mechanism" (Markides, 2013) that the parent company and the subsidiary unit share common managers. This kind of "organic" mode of organization based on a closely intertwined set of responsibilities among the top-managers facilitates knowledge transfer from the core to newly created entities and between departments (exploitation) but also opens up the management to new opportunities, new perspectives and, in turn, ultimately, helps acquire new knowledge (exploration). It therefore contains the seeds of plasticity and organizational ambidexterity.

Advice #8: Combine the organic type of organization at the top with a mechanistic structure at the execution level.

High-tech firms who need to constantly thrive for innovation often separate their R&D structures from the other departments with the aim to prevent cross-contamination between units and to avoid sacrificing efficiency on the altar of innovative activities (Schmitt et al., 2010). Indeed, separation is particularly efficient to create new knowledge in general and promote radical innovations in particular (Benner & Tushman, 2002). Therefore, the top management relies on subsidiaries and departments operating in silos with clearly defined responsibilities, a mechanistic type of organization. Yet, if exploratory projects are conducted in clearly defined teams operating autonomously, it is important to establish, at the same time, bridges between teams so that exploitation projects can be realized in a participative way. Moreover, as important is the need for recursive iterations between different modes of separated and integrated structures.

The second lever that contributes positively to organizational ambidexterity without strongly impacting specifically exploration or exploitation lies in the pursuit of intuitive projects in parallel of well planned ones (Advice #9). Our results suggest that ambidexterity greatly benefits from having both approaches simultaneously while the extent of the impact on exploration and exploitation intensities separately is rather limited, hence:

Advice #9: Combine an effectual approach on the short term with a causal approach for the long run.

One way to achieve organizational ambidexterity in medium-sized companies is to nurture a customer-centric effectual approach. To do so, managers can create sub-structures to support multiple trial-and-errors projects directly involving customers in the short run while keeping at the same time a strict stage-gate system resorting to a classical causal logic for projects imbedded in long development cycles. As expensive as it may seem, this type of long-term exploration through separated sub-structures is nevertheless needed in high technology industries to support radical innovation (Benner & Tushman, 2002) and stay at the forefront of innovation because radical innovation requires conflicting mindsets and processes that the organization must be able to support (Lewis et al., 2014). Conversely, the effectual approach of customer-centered projects helps contain development costs whereas the probability of success increases sharply. Even more: with low cost mistakes, known maximum losses and large potential payoffs, these projects profit from the volatility of the environment in which these firms are evolving.

The preceding advices, if successfully implemented by the company we have studied, must of course be analyzed in the light of the particular situation of each organization (the local idiosyncratic dimension we mentioned in the foreword of this thesis). They can be implemented all or only some but, once again, managers should remain attentive to the actual situations their organizations are facing and dynamically adapt the mix of measures to be taken to maintain the efficiency of their present operations while protecting themselves against the surrounding uncertainty and preparing for the future.

Limitations

Whereas our research offers implications and contributions to existing literature on organizational ambidexterity, it is not free from limitations.

In first instance, our study builds on an in-depth single-case longitudinal case study. As such, we need to be cautious in generalizing our results to firms of different size or operating in dissimilar industries.

A second limit comes from the rating method used in our code-book. Our rating method is actually based on positive values for exploration and negative values for exploitation (without value judgement). It does not reflect the intensity of the effect of each decision on the company's development as it was not possible to judge the quality of each decision or its consequences, especially in a context of uncertainty, inconsistency, and incomplete information as the one in which the company evolved for most its life⁷⁶. In addition to the difficulty of assessing the quality of a decision, our position as an actor of the company in question could have led to an endowment bias in our analysis in the sense that the qualitative evaluation of the decisions taken by the management could be tainted by our preexisting beliefs or hypotheses. From this point of view, and to avoid such endowment bias, we designed a method which is somewhat quantitative by nature. This reduces the fineness of our analysis but we mitigated the effect of this limitation by summing all the ratings of each year so that the exploratory or exploitative intensity of each year could be measured (Section 2.4.3).

Moreover, as already explained in the Section 2.4.2 about code-book design, our study could not be subjected to an independent double coding due to the limited time allowed for a DBA but also because the material analyzed, largely made of internal company documents, resorts to a specific jargon difficult to apprehend for external researchers. A deep understanding of the company, its culture and products, as well as the impediments and extraneous influences was also deemed necessary to be able to proceed to an objective, appropriate, relevant and fruitful coding. The simple coding of our data is therefore a deliberate and assumed choice.

Another limit to our study has been raised in Section 2.4.3. On the margins of a vision of ambidexterity on the scale of the organization (structural ambidexterity) and its direct entourage (network ambidexterity), our review of the extant literature had highlighted a dimension at the level of the individual called contextual ambidexterity. However, the very nature of most documents constituting the corpus of our archival sources did not permit a clear enough identification of stretch, discipline, support and trust; i.e. the attributes describing organizational context as per Ghoshal and Bartlett (1994) brought forward by Birkinshaw and Gibson (2004) as the cornerstones of contextual ambidexterity. This can be explained by the

⁷⁶ We refer here to the *quality* and not the *correctness* of decisions. A decision can be right or correct in given circumstances but it does not mean that there is not another decision delivering better results in the same circumstances. The quality of a decision can only be judged in regards to its consequences when compared to the consequences of a different decision in the same context. This would suppose to identify all possible consequences of all possible decisions in a given situation which is impossible given the limits of rational decision making (Simon, 1976).

fact that our archival sources contain essentially documents made by managers and intended to managers (minutes of management meetings, minutes of board meetings, internal memos etc...) whereas contextual ambidexterity precisely displaces the decision process from a centralized management team to decentralized sub-units or even to the individual employees themselves. Consequently, in spite of an attempt to structure a coding grid using the same Gioia's type of systematic approach as previously adopted to analyze the other aspects of organizational ambidexterity, we had to resolve to leave the analysis of individual context on the side.

At last, a limitation may come from the narrowness imparted by adherence to a simple theory of ambidexterity. As Van de Ven & Poole explain (1995, p.533, brackets added): "if it is true that the interplay of multiple forces often drives development, then conducting research with a simple a priori theory in mind actually may impede adequate explanation. The researcher may look only for indicators of that particular theory, ignoring other possible explanations. In the best case, this myopia results in an incomplete account of development and change". We tried to avoid such confirmation bias in the analysis of the source material by adopting a systematic approach in the design of our code-book and by abductively searching for underlying processes and alternative theories. This approach has led for instance to the integration of the causation and effectuation framework to our analysis.

Hints for future research

In this dissertation, we propose a new methodology to measure organizational ambidexterity on the basis of the rating of 12 specific parameters identified as key-elements for ambidexterity and selected following a systematic and structured process inspired by Gioia's method for grounded theorizing (Gioia et al., 2013) that we have applied to the questionnaires of 25 different studies on organizational ambidexterity. This method allowed to trace the evolution of ambidexterity and its components over the 25 years of existence of our unit of analysis. It would be advantageous to apply this method to other companies, active in other fields and exposed to other contexts, so as to validate it and to compare the results with ours so as to be able to better delineate their generalizability.

We applied the same systematic approach to measure the evolution of causation and effectuation over time. As far as we could see in literature, it is a first. Testing the method with units of analysis of different sizes, activities and environments would also contribute new knowledge to this rather new field of management science.

As a further matter, the longitudinal nature of our research brings time into the ambidexterity framework, an aspect little investigated in the literature in spite of its dynamic inherent character. More work to refine the understanding of how the components of ambidexterity (exploitation and exploration intensities), and the various forms of ambidexterity (network or structural) are articulated in different contextual situations over time could also greatly complement the theoretical corpus of ambidexterity.

Moreover, we have determined the positive effect of both exploratory and exploitative partnerships on ambidexterity. Yet, acquiring external knowledge is not sufficient to benefit from it, one has also to integrate it within the organization. This is another tensions-generating challenge that has been the subject of research on absorptive capacity or combinative capability which Kogut and Zander (1992) describe as the organization's ability "to synthesize and apply current and acquired knowledge". This led Raisch et al. (2009, p.690) to conclude that "ambidexterity may thus imply the managerial challenge of not only balancing exploitation and exploration but also of integrating external and internal knowledge". If we addressed the former part of this statement, a detailed analysis of the latter fell beyond the limit of our research and could advantageously be the subject of further works.

Another fundamental aspect of our research that has not yet been enough studied in the extant literature is the similarities and divergences between March's theory of exploration and exploitation in relation to that of effectuation and causation dear to Sarasvathy. Here again, additional in-depth anecdotal and longitudinal studies in various contexts and domains are needed to enrich our understanding of the matter.

On the margins of a vision of ambidexterity at the level of the organization (structural ambidexterity) and its direct entourage (network ambidexterity), two forms of ambidexterity that we have investigated in our research, our review of the extant literature had highlighted a dimension on the scale of the individual named "contextual ambidexterity". The very nature of most documents constituting the corpus of our archival sources (see Section 2.4.1 Data generation) did not permit a clear enough identification of stretch, discipline, support and trust; i.e. the attributes describing organizational context as per Ghoshal and Bartlett (1994) brought forward by Birkinshaw and Gibson (2004) as the cornerstones of contextual ambidexterity. We discussed the reasons for that in Section 2.4.3. Therefore, in spite of an attempt to structure a coding grid using the same Gioia's type systematic approach as previously described, we had to resolve to leave the analysis of individual context on the side. This, however, could be the

subject of a forthcoming study on the basis of a different set of archival documents, closer to the individuals instead of being of managerial nature (secondary data), or based on interviewing employees and managers at different levels in the company (primary data). In this latter case however caution will be needed to avoid falling in the two bias typical of longitudinal studies when gathering primary data *a posteriori*: forgetting and rationalizing (Thiétart, 2014).

Finally, our work contributes to link Taleb's fragility/antifragility theory, and especially his Barbell theory⁷⁷, to Sarasvathy's causation/effectuation theory but the link that we highlight is limited to exploratory, innovation-based, activities. Future research could investigate whether our findings also apply to other domains such as entrepreneurship for instance.

⁷⁷ Taleb's barbell theory builds on a dual strategy by which a combination of two extremes, one safe and one speculative (like in our case, the combination of an effectual logic and a causal one), is more robust (and eventually even antifragile) than a "monomodal" strategy which is based on medium-risk ventures only (Taleb, 2007b, 2012).

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Appendixes

Appendix I

Survie à long terme dans un contexte d'incertitude croissante : L'ambidextrie organisationnelle est-elle la réponse ? – Article published in French in *Revue Economique et Sociale*, March 2016.

Survie à long terme dans un contexte d'incertitude croissante: L'ambidextrie organisationnelle est-elle la réponse?

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> Les managers sont constamment exposés à la complexité croissante de notre monde trépidant, globalisé, interconnecté et hyperconcurrentiel. Dans un tel contexte de moins en moins prévisible, structurer une organisation et concevoir une stratégie qui équilibre les besoins de rentabilité à court terme et la survie à long terme devient de plus en plus difficile. L'ambidextrie organisationnelle a été proposée comme moyen de gérer ces objectifs contradictoires mais son effet sur la longévité des organisations reste largement non-démonstré. Nous discutons cette problématique en la situant dans la littérature académique et proposons que les métiers fortement exposés à un environnement très incertain bénéficient de la mise en pratique d'une stratégie ambidextre selon un processus évolutif et dynamique superposant différentes mesures, variables en intensité, à plusieurs niveaux de l'entreprise et par la modification régulière de ce mix en réponse aux stimuli extérieurs et aux capacités internes nouvellement acquises.

Mots-clés : ambidextrie organisationnelle, incertitude, exploration, exploitation, survie à long terme.

Le monde change à un rythme toujours plus rapide et l'espérance de vie des entreprises ne cesse de se réduire. Si elle était de près de 90 ans pour une société du S&P 500 en 1935, elle n'était plus que de 15 ans en 2005 (Foster & Kaplan, 2001b). Les changements dans l'environnement

des organisations se caractérisent par deux types d'évènements: le dynamisme environnemental, lent et continu, qui présume un certain degré de prédictibilité, et les chocs exogènes qui font référence à des «rafales environnementales soudaines, inattendues et incontrôlables» (Lavie et al., 2010, p.119), des «perturbations passagères disruptives et potentiellement inamicales» (Meyer, 1982, p.515). De nombreux chercheurs ont tenté de mieux comprendre les causes organisationnelles du succès et de l'échec, et la plupart d'entre eux ont reconnu que faire face aux changements imprévisibles impose à la fois d'exploiter les compétences existantes et d'explorer de nouvelles avenues de manière à équilibrer le court terme et le long terme.

Duncan (1976) fut le premier à utiliser le terme d'«organisation ambidextre» quand il a incité les entreprises à mettre en place des «structures duales» nécessitant différentes perspectives temporelles et des capacités managériales particulières pour accueillir simultanément les alignements contradictoires nécessaires à l'efficacité (perspective à court terme) et à l'innovation (perspective à long terme). Cette idée de combiner des activités tant d'exploitation que d'exploration a été popularisée par March en 1991 (March, 1991). Au-delà du trait humain permettant aux individus d'utiliser les deux mains avec une égale dextérité, la métaphore de l'ambidextrie fait référence à la capacité d'une organisation à exploiter les compétences existantes et à explorer de nouvelles opportunités avec la même habileté. La recherche sur l'ambidextrie comme concept organisationnel a connu une fulgurante ascension au cours des 10 dernières années et est maintenant considérée comme un paradigme de recherche émergent en théorie organisationnelle (Birkinshaw & Gupta, 2013). L'hypothèse implicite que l'ambidextrie organisationnelle est nécessaire pour la performance à long terme a même été évoquée comme le "principe de l'ambidextrie" (Raisch & Birkinshaw, 2008, p.392). Cependant, alors que ces déclarations sont devenues une croyance durable parmi les chercheurs en gestion, cette hypothèse reste largement normative. En effet, comme Piao l'a observé très récemment (2014), cette proposition a, étonnamment, reçu peu d'attention et n'a jamais été réellement démontrée empiriquement. Une grande partie du travail à ce jour s'est limitée à étudier l'influence de l'ambidextrie organisationnelle sur la performance exprimée en termes financiers, commerciaux ou en termes d'innovation, mais rares sont les études consacrées à son effet sur la pérennité des entreprises. De même, les résultats empiriques sur la relation entre l'ambidextrie et l'hostilité de l'environnement restent limités et contradictoires (Schmitt et al., 2010).

Aussi, la question de savoir si l'ambidextrie organisationnelle offre un moyen d'améliorer les chances de survie à long terme dans un monde d'incertitude croissante reste largement sans

réponse, en particulier pour les entreprises de taille moyenne qui ne possèdent pas les ressources financières pour fortement diversifier leurs activités. Plusieurs voix éminentes ont plaidé pour que des études qualitatives et longitudinales soient réalisées afin de fournir une meilleure compréhension de la complexité de gérer en période de turbulences et de comprendre comment l'ambidextrie organisationnelle peut être effectivement mise en pratique (Lavie, Stettner, & Tushman, 2010; O'Reilly & Tushman, 2013; Raisch, Birkinshaw, Probst, & Tushman, 2009).

Nous cherchons à combler ce vide dans la littérature en discutant la problématique aux niveaux théorique et managérial, et en la situant dans la littérature académique. Nous proposerons pour finir des pistes de réflexions qui permettront aux managers d'appréhender la manière de mettre en place l'ambidextrie organisationnelle en vue d'améliorer les chances de survie à long terme de leur entreprise.

L'AMBIDEXTRIE ORGANISATIONNELLE

LA MONTEE DE LA RECHERCHE SUR L'AMBIDEXTRIE ORGANISATIONNELLE

March et Simon (1958) ont avancé que les organisations peuvent améliorer leurs performances en séparant les unités faisant usage des succès existants de celles qui cherchent à identifier de nouvelles opportunités, et Burns et Stalker (Burns & Stalker, 1961) ont fait valoir que les systèmes de gestion «mécanistiques» caractérisés par des relations hiérarchiques claires et des responsabilités bien définies sont plus efficaces dans un environnement stable, alors que les «systèmes organiques», moins formels, seraient mieux adaptés aux conditions turbulentes. De son côté, Thompson (1967) a affirmé que la force d'une organisation repose sur un compromis entre efficacité et flexibilité. Pour lui, l'efficacité des pratiques existantes est nécessaire pour que l'organisation puisse maintenir son avantage concurrentiel, alors que la flexibilité est indispensable pour éviter qu'elle ne se retrouve prise au piège de routines et de procédures obsolètes, une situation décrite comme une inertie organisationnelle (Hannan & Freeman, 1984), une simplicité organisationnelle (Miller, 1993) ou un blocage culturel (Foster & Kaplan, 2001b).

En 1991, March analyse la dualité entre efficacité et flexibilité du point de vue de l'apprentissage organisationnel. Il note que le principal défi auquel les entreprises sont confrontées en matière d'adaptation est la nécessité d'exploiter les capacités existantes tout en fournissant en même temps des efforts suffisants d'exploration pour s'adapter aux changements

technologiques et aux mutations de la demande des marchés (March, 1991). Dans la lignée de l'approche basée sur la connaissance (*Knowledge-Based View*), Levinthal et March (1993) soulignent la difficulté d'équilibrer des objectifs opposés tels que «l'exploitation des vieilles certitudes» et «l'exploration de nouvelles possibilités» face à une réalité qui pousse à favoriser l'un ou l'autre. Ils concluent que les organisations abordent ce problème par la simplification et la spécialisation, ce qui conduit à différentes formes de «myopie d'apprentissage».

Deux décennies après Duncan, Tushman et O'Reilly (1996), reprenant le concept de "structures duales", ont avancé la nécessité d'une séparation structurelle entre les activités visant à gérer de manière simultanée le changement évolutif (incrémental) d'une part, et le changement révolutionnaire (discontinu) d'autre part. Ce fut l'émergence de l'*ambidextrie* dite *structurelle* ou *simultanée*.

Dans le prolongement de leurs travaux sur les discontinuités technologiques, le design dominant et le principe d'équilibre ponctué, Tushman et ses collègues ont repris le schéma évolutif qui prévoit des périodes relativement longues de changement progressif ponctuées par de courtes rafales de changements intenses pour conclure à la nécessité d'aligner à court terme la stratégie, la structure et la culture des entreprises mais aussi de détruire périodiquement cet alignement afin de l'adapter aux changements environnementaux dans un processus séquentiel. Le temps a fait son entrée et a donné naissance à la notion d'*ambidextrie séquentielle* (Geerts et al., 2010). Dans le même esprit, les entreprises ont été décrites pour leur tendance à la «commutation rythmique» (*rythmic switching*) (Brown & Eisenhardt, 1997) ou à la «vacillation» (Boumgarden et al., 2012) dans un mouvement de va-et-vient entre des périodes d'exploration et des périodes d'exploitation. Le raisonnement qui sous-tend cet argument est qu'il est plus facile pour les entreprises d'alterner différentes structures formelles de temps à autre que de changer les fondements de leur culture. Les chercheurs ne sont cependant pas unanimes sur le concept d'*ambidextrie séquentielle*: Gupta, Smith et Shalley (Gupta et al., 2006), ainsi que Boumgarden et ses collègues (2012) par exemple, considèrent que l'*ambidextrie* se réfère à la poursuite *synchrone* de l'exploration et de l'exploitation, alors que la différenciation temporelle, telle que l'équilibre ponctué, constitue d'après eux un mécanisme radicalement différent. Pour autant, tant l'*ambidextrie simultanée* que l'*ambidextrie séquentielle* (équilibre ponctué, vacillation) s'efforcent de résoudre le dilemme exploration/exploitation par des mesures structurelles.

L'année 2004 a marqué un autre tournant dans la conceptualisation de l'ambidextrie organisationnelle avec Gibson et Birkinshaw (2004) qui s'écartent du corpus existant de l'ambidextrie structurelle pour introduire la notion d'*ambidextrie contextuelle*. Leur idée est qu'un contexte caractérisé par une combinaison d'exigence, de discipline, de soutien et de confiance (les quatre attributs décrivant le contexte organisationnel selon Ghoshal et Bartlett (1994)) permet aux individus d'utiliser leur propre jugement sur la façon de partager leur temps entre des activités d'alignement (exploitation) et des activités axées sur l'adaptation (exploration). Promouvoir l'ambidextrie dans une organisation ne se réduit pas seulement à décider de la structure organisationnelle la plus appropriée, mais devient aussi une réflexion sur la manière d'engendrer un ensemble de stimuli et de pressions pour motiver les collaborateurs à agir de la façon souhaitée, ce qui déplace le processus de décision d'une équipe dirigeante centralisée vers des sous-unités décentralisées ou même vers les employés eux-mêmes.

NOUVELLES DIRECTIONS

Jusqu'à la fin des années 90, la plupart des travaux sur l'exploration et l'exploitation ont essentiellement porté sur le niveau de l'organisation elle-même. Alors que certains chercheurs se sont intéressés à l'impact de l'ambidextrie au niveau des sous-unités (départements, équipes) et au niveau individuel avec l'ambidextrie contextuelle, des travaux sur le niveau inter-organisationnel ont commencé à apparaître. La formation d'alliances peut en effet être considérée comme une forme d'exploration et d'exploitation (Park et al., 2002; Rothaermel & Deeds, 2004) dans le sens où les alliances exploratoires offrent la possibilité d'accéder à de nouvelles connaissances et d'explorer de nouveaux marchés et technologies (Grant & Baden-Fuller, 2004) tandis que les alliances d'exploitation peuvent être utilisées pour tirer le meilleur parti de ressources complémentaires et des compétences existantes par-delà les frontières de l'organisation (Lin et al., 2007).

Plus récemment, des chercheurs ont aussi commencé à enquêter sur l'importance du leadership dans la gestion des contradictions et des compromis auxquels les organisations font face (Lubatkin, Simsek, Ling, & Veiga, 2006; Smith & Tushman, 2005; Vaccaro, Jansen, van den Bosch, & Volberda, 2012). Tushman et al., dans un article intitulé explicitement «Le PDG Ambidexre» (2011), font valoir que les décisions concernant le présent et l'avenir de l'entreprise doivent être prises au niveau le plus haut et ils proposent des approches différentes pour maintenir les tensions au sommet et éviter qu'elle ne percolent vers le bas de la pyramide

hiérarchique. En fait, la capacité des dirigeants à saisir les opportunités à travers l'intégration et la coordination de ressources existantes aussi bien que nouvelles pour surmonter l'inertie organisationnelle est au cœur des *capacités dynamiques*, définies comme «la capacité de l'entreprise à intégrer, construire et reconfigurer les compétences internes et externes pour répondre aux changements rapides de l'environnement» (Teece, Pisano, & Shuen, 1999, p.516). Cette capacité de l'entreprise à «synthétiser et appliquer les connaissances actuelles et acquises» a parfois été décrite comme «capacité combinatoire» (Kogut & Zander, 1992, p.384) ou «compétence architecturale» (Henderson & Cockburn, 1994). Comme l'ont souligné Raisch et ses collègues (2009), l'ambidextrie organisationnelle pose donc le défi non seulement d'équilibrer exploration et exploitation, mais aussi d'intégrer les connaissances internes et externes. Dès lors, l'ambidextrie organisationnelle vue comme une capacité dynamique au niveau de l'équipe dirigeante peut aider les organisations à substituer un environnement de sélection externe dans lequel les mauvais choix peuvent conduire à un échec fatal pour l'entreprise par un processus de sélection interne qui autorise des échecs locaux sans pour autant emporter la destruction de l'ensemble de l'organisation (Burgelman, 2002).

Toutefois, bien que ces auteurs se concentrent principalement sur le rôle des équipes dirigeantes, d'autres comme Burgelman et Grove (2007) reconnaissent que les processus autonomes d'exploration peuvent aussi être informels et décentralisés, et résulter des efforts de cadres intermédiaires. En bref, la direction pourrait être considérée comme le principal moteur d'un changement discontinu ou radical, alors que le «middle management» peut être vu comme l'acteur d'un changement progressif ou incrémental (Raisch & Birkinshaw, 2008).

Ces différentes conceptualisations illustrent le fait que les organisations sont confrontées à des situations très différentes qui ont un impact certain sur l'intensité d'exploration et d'exploitation nécessaire et sur la façon d'atteindre l'ambidextrie. Par exemple, une approche séquentielle peut être mieux adaptée à des environnements stables (Geerts et al., 2010), alors que l'ambidextrie structurelle peut être plus appropriée à un contexte turbulent (O'Reilly & Tushman, 2013). De même, une approche contextuelle est probablement bien adaptée pour soutenir et renforcer l'innovation incrémentale au niveau local, mais pourrait être difficile à gérer efficacement face à des ruptures technologiques (O'Reilly & Tushman, 2013). Les entreprises peuvent effectivement combiner différentes formes d'ambidextrie à différents niveaux organisationnels (individu, équipe, département, entreprise, collaboration/alliance) de façon concomitante (Kauppila, 2010) mais les ressources investies dans l'exploration, à quelque niveau que ce soit, ne sont alors plus disponibles pour des activités d'exploitation, et inversement. Dès lors, si

l'exploration et l'exploitation sont nécessaires, sont-elles concurrentes ou complémentaires ? Le management soucieux à la fois de la rentabilité à court terme de son organisation et de la pérennité à long terme de celle-ci se doit-il d'essayer de maximiser les efforts portés à ces deux dimensions ou doit-il plutôt essayer de trouver un juste équilibre ? Les deux points de vue se défendent comme nous le montrons ci-après.

EXPLORATION ET EXPLOITATION : CONCURRENCE OU COMPLEMENTARITE ?

Apollon et Dionysos

Chaque organisation est un faisceau de conflits, d'oppositions, de tensions, de contrastes et de contradictions, et l'étude des dualités et des paradoxes ont longtemps été d'un grand intérêt pour les théoriciens de l'organisation. Parmi les nombreuses caractéristiques ambivalentes des organisations, un thème central et récurrent est l'importance et la difficulté d'accommoder stabilité et changement (Cummings, 2013), de réconcilier ordre et chaos (Forgues & Thietart, 1995).

Dans la mythologie grecque, Apollon et Dionysos sont frères, tous deux fils de Zeus. Pour les philosophes présocratiques Apollon représente la mesure, la raison, la rationalité et l'ordre, alors que Dionysos figure l'excès, le chaos, l'irrationnel, «la force qui donne la puissance séminale à la poursuite de la vie» (Taleb, 2012, p.256). Un parallèle évident apparaît avec la définition de March de [l'apollonienne] exploitation représentée par «le raffinement, le choix, la production, l'efficacité, la sélection, la mise en œuvre et l'exécution» qui contraste avec [la dionysiaque] exploration qui implique «la recherche, la variation, la prise de risques, l'expérimentation, le jeu, la flexibilité, la découverte et l'innovation» (March, 1991, p.71, crochets ajoutés). En outre, le concept de «destruction créatrice», développé par Karl Marx et Werner Sombart (Reinert & Reinert, 2006) et popularisé par Joseph Schumpeter (1942) comme une théorie de l'innovation économique et du cycle des affaires peut être considérée soit comme un antécédent, soit comme un produit de l'exploration (Abernathy & Clark, 1985). L'exactitude historique veut toutefois que ce soit Nietzsche qui le premier inventa le terme en référence à Dionysos qu'il voyait comme «créativement destructeur» et «destructivement créateur» (Taleb, 2012, p.256).

La culture grecque antique ne considérait pas Apollon et Dionysos comme opposés ou rivaux, au moins jusqu'à l'influence du rationalisme de Socrate, mais plutôt comme deux forces entrelacées et complémentaires. Plusieurs auteurs conceptualisent l'ambidextrie

organisationnelle d'une manière similaire en considérant que l'exploitation et l'exploration ne sont pas mutuellement exclusives, mais sont plutôt des dimensions additives ou multiplicatives par nature (Gibson & Birkinshaw, 2004; He & Wong, 2004; Jansen et al., 2006; Lubatkin et al., 2006). Pour ces auteurs, l'exploration et l'exploitation sont des activités indépendantes, orthogonales l'une par rapport à l'autre (voir la figure 1a). Elles doivent toutes deux être maximisées et une organisation ambidextre est une organisation qui a la faculté de *combiner* simultanément des niveaux élevés de ces deux activités (Gupta et al., 2006; Lavie & Rosenkopf, 2006). Elle se situe dans le quadrant supérieur droit de la figure 1a.

Pour soutenir l'argument selon lequel l'exploration et l'exploitation peuvent ne pas être contradictoires, Gupta et al. (2006) indiquent par exemple qu'elles peuvent avoir lieu dans des domaines complémentaires, tels que la R&D et le marketing par exemple, qui ne se disputent pas nécessairement les mêmes ressources. Allant plus loin que de considérer que l'exploration et l'exploitation ne sont pas nécessairement en concurrence, certains auteurs de défendre que chaque dimension a en fait un effet de renforcement de l'autre, à savoir que «un haut degré d'effort d'exploitation peut souvent améliorer l'efficacité d'une entreprise dans l'exploration de nouvelles connaissances» et, d'une manière analogue, que «la maîtrise de processus exploratoires d'une entreprise peut également améliorer sa capacité à se livrer à une exploitation réussie» (Cao, Gedajlovic, & Zhang, 2009, p.784).

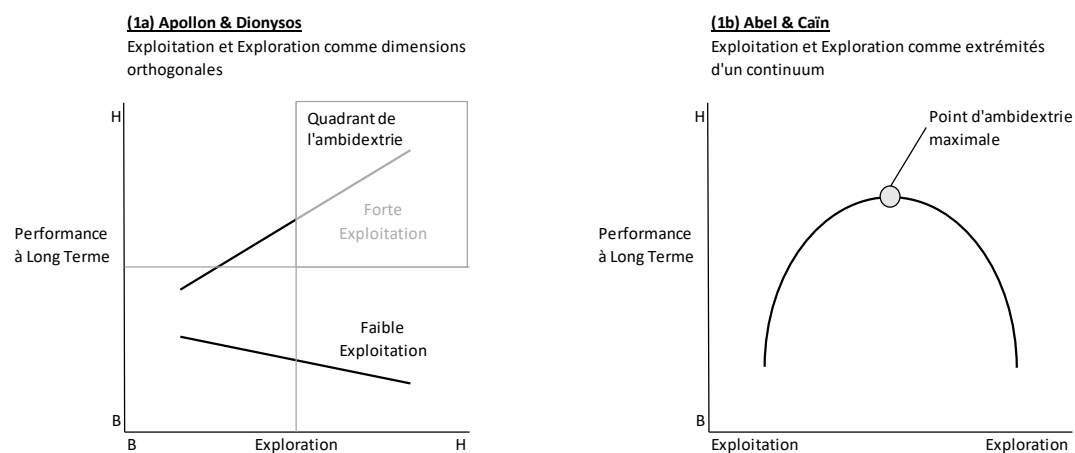


Figure 1 : Les deux conceptions de l'exploration et de l'exploitation : dimensions orthogonales ou deux extrémités d'un continuum (adapté de Gupta et al., 2006)

Abel et Caïn

D'autres auteurs estiment cependant que les deux dimensions sont mutuellement exclusives (Auh & Menguc, 2005; March, 1991; Simsek, Heavey, Veiga, & Souder, 2009; Smith & Tushman, 2005) en ce qu'elles sont en concurrence pour les mêmes ressources au sein d'une organisation (ressources financières, ressources humaines), et qu'elles produisent des résultats divergents parce que les retours de l'exploration sont «systématiquement moins certains, plus éloignés dans le temps et plus éloignés du lieu de l'action» que ceux de l'exploitation (March, 1991, p.73). La métaphore mythologique ne s'applique plus et nous proposons une référence biblique avec deux autres frères, Abel et Caïn, fils d'Adam et Eve. Selon le livre de la Genèse, Caïn a tué son frère par jalousie après que Dieu ait favorisé Abel plutôt que lui.

Selon cette école de pensée, l'exploration et l'exploitation constituent les deux extrémités d'un continuum (Lavie et al., 2010) et il y a un compromis entre ces deux dimensions au sein des organisations qui peut être relié à la performance organisationnelle par une relation curviligne en forme de U inversé en fonction de la performance de l'organisation (voir la figure 1b) (Laplume & Dass, 2009). La gestion de ce compromis consiste à trouver un juste équilibre entre exploration et exploitation et une entreprise sera considérée comme ambidextre si elle parvient à maintenir cet équilibre.

Les détracteurs de ce point de vue lui opposent les coûts de coordination et de communication engendrés par la recherche d'un équilibre entre objectifs contradictoires, mais Cao et al. ont constaté empiriquement qu'un tel équilibre («Abel et Caïn») serait plus bénéfique pour les entreprises dont les ressources sont limitées, alors qu'une combinaison («Apollo et Dionysos») améliorerait les performances des entreprises ayant un meilleur accès à des ressources internes et externes (Cao et al., 2009). Ces résultats suggèrent que les gestionnaires opérant dans des contextes caractérisés par de maigres ressources peuvent bénéficier d'une gestion prioritaire des compromis entre exploration et exploitation plutôt que d'essayer de maximiser une dimension au détriment de l'autre.

AMBIDEXTRIE ORGANISATIONNELLE ET SURVIE A LONG TERME

«Le maintien d'un équilibre approprié entre exploration et exploitation est un facteur primordial dans la survie du système» écrivait March (1991, p.71). Bien que la littérature sur le sujet soit parsemée de ce type de déclarations, cette hypothèse n'a jamais été réellement démontrée. Une

grande partie du travail à ce jour s'est limitée à des études empiriques utilisant comme variables dépendantes la performance financière (rentabilité, profits, ventes sur actifs, flux de trésorerie), la performance des ventes (croissance des ventes, croissance des parts de marché) ou éventuellement la connaissance et l'innovation (brevets, Q de Tobin), mais très peu de publications se sont penchées sur les antécédents de la longévité. L'étude récente de l'industrie des disques durs sur une période de 20 ans menée par Piao (2014) constitue une exception qui confirme l'effet positif d'une forme déséquilibrée d'ambidextrie par laquelle les entreprises doivent trouver le juste équilibre entre une haute intensité d'exploitation et une intensité modérée d'exploration de manière à bénéficier des effets principaux de ces deux dimensions tout en évitant les tensions qu'une intensité élevée des deux peut amener. On peut néanmoins lui reprocher de mesurer la longévité par le nombre d'années durant lesquelles les entreprises de son échantillon sont restées actives dans leur industrie. En considérant que la sortie d'une firme de cette industrie correspond à sa dissolution, elle néglige la possibilité que les entreprises peuvent avoir volontairement cédé leur activité disques durs ou restructuré leur portefeuille d'activités à un moment donné. Il y a de nombreux exemples d'entreprises qui se sont adaptées aux changements environnementaux en réinventant leurs modèles d'affaires et qui opèrent maintenant dans des secteurs ou des technologies totalement différents de ceux par lesquels ils avaient commencé. IBM, le fabricant de matériel informatique transformé en société de conseil, est probablement l'exemple le plus emblématique d'un tel changement révolutionnaire.

Burgelman et Grove (2007) adoptent une approche différente et originale en combinant sur une période de plus de 35 ans une recherche de terrain longitudinale et l'expérience managériale d'un des auteurs devenu directeur général de l'entreprise étudiée, Intel Corporation. Dans cette proposition, les auteurs font particulièrement valoir que la longévité des entreprises dépend de leur capacité à adapter les cycles d'exploration (assimilée à des processus autonomes) et d'exploitation (assimilée à des processus induits) aux diverses formes de dynamiques stratégiques imposées par les changements environnementaux suffisamment importants pour transformer les «règles du jeu».

Fort de cette connaissance, Laplume et Dass (2009) ont proposé le concept d'*ambidextrie adaptative*, qui se rapporte à une forme mixte d'ambidextrie structurelle et d'ambidextrie séquentielle permettant d'adapter dynamiquement l'équilibre exploration/exploitation aux circonstances organisationnelles et contextuelles. Plus récemment, Luger (2014) a présenté le même concept sous le nom d'*ambidextrie dynamique*. Si les différentes formes d'ambidextrie statique consistent à opérer sur un point donné du continuum exploration-exploitation,

l'ambidextrie dynamique permet à l'entreprise d'ajuster ce point en réponse à l'évolution des exigences environnementales et d'ainsi augmenter ses chances de survie à long terme.

PISTES DE REFLEXION ET CONCLUSIONS

Le paradoxe d'une ambidextrie potentiellement conflictuelle à court terme mais garante de performance à long terme constitue une hypothèse généralement bien acceptée (Lavie et al., 2010). Elle permettrait aux entreprises d'absorber avec plus d'efficacité les périodes de fluctuations fortes et imprévisibles de leur environnement. Si son effet positif sur la performance (financière et commerciale) et sur l'innovation a été démontré empiriquement, il n'en va pas de même pour son impact sur la longévité des organisations qui constitue pourtant une de ses hypothèses fondatrices.

Notre analyse de la littérature académique nous permet cependant de tirer quelques conclusions intermédiaires qui revêtent une dimension pratique essentielle pour les managers.

Tout d'abord, il apparaît que les entreprises ont intérêt à maximiser autant que possible les deux composantes de l'ambidextrie, à savoir l'exploration et l'exploitation, pour autant qu'elles disposent des ressources financières et humaines nécessaires («Apollon & Dionysos»). Dans le cas contraire, il convient d'arbitrer entre ces deux dimensions («Abel & Caïn»). On peut donc considérer qu'une organisation est ambidextre si elle arrive soit à explorer et exploiter simultanément, ce qui nécessite un management capable de concilier les deux tendances et d'apaiser les conflits qui peuvent en résulter, soit à osciller entre des phases d'exploitation et des phases d'exploration, ce qui demande une flexibilité intellectuelle et une plasticité organisationnelle.

La nécessité de combiner exploration et exploitation doit cependant être réfléchi par les décideurs à l'aune de l'exposition de leur organisation vis-à-vis de la volatilité de leur environnement. Certains secteurs d'activité étant moins exposés et certains environnements d'affaires moins volatils, ils peuvent se contenter de porter un accent plus marqué sur l'une ou l'autre des deux dimensions. Ainsi, dans un environnement stable par nature, les entreprises peuvent se focaliser sur l'exploitation : le risque d'échec est faible et les coûts liés à l'ambidextrie ne sont pas justifiés (quadrant inférieur droit de la figure 2). Dans un environnement turbulent (volatil et incertain), les entreprises de secteurs peu exposés aux changements doivent s'ouvrir sur l'extérieur en explorant de nouvelles technologies et de

nouveaux modèles d'affaires pour se préparer à la prochaine disruption qui, malgré la faible exposition, ne risque pas moins de l'impacter tôt ou tard (quadrant supérieur gauche de la figure 2). A l'inverse, les métiers fortement exposés à un environnement très incertain (tels que par exemple les activités à haut contenu technologique évoluant dans un contexte international) bénéficieront de la mise en pratique d'une stratégie ambidextre (quadrant supérieur droit de la figure 2). Dans ce cas, il paraît justifié pour ces organisations d'échanger une partie de leur productivité à court terme contre leur survie à long terme.

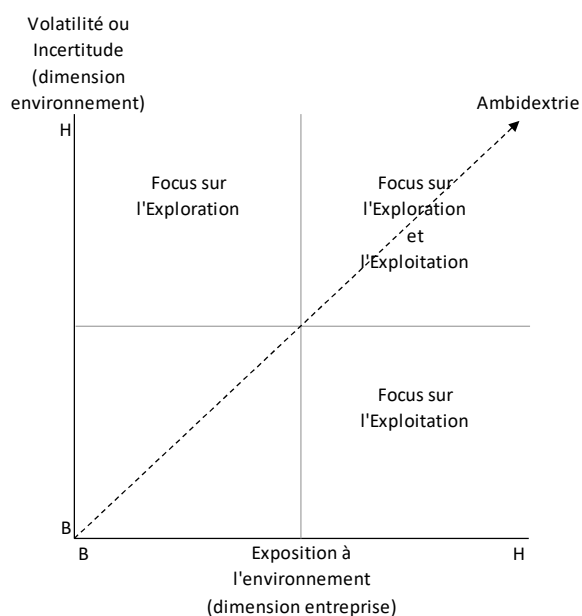


Figure 2 : Influence de la volatilité de l'environnement et de l'exposition de l'entreprise à cet environnement sur la stratégie d'Exploration-Exploitation à envisager

Ensuite, il semble que la clef de la survie à long terme dans un environnement toujours plus changeant réside dans la capacité des entreprises d'ajuster de manière dynamique cet équilibre entre exploration et exploitation en réponses aux changements contextuels. Pour ce faire, les entreprises disposent de multiples moyens d'opérationnaliser l'ambidextrie organisationnelle (mesures structurelles, séquentielles, contextuelles) mais le monde réel ne peut se satisfaire des typologies statiques décrites dans la littérature académique. Dans la pratique, l'ambidextrie organisationnelle est un processus complexe et évolutif qui doit s'adapter de manière dynamique aux facteurs internes et externes, le plus souvent par la mise en place d'un mix ou d'une superposition de mesures simultanées, variables en intensité, à plusieurs niveaux de

l'entreprise et par la modification régulière de ce mix en réponse aux stimuli extérieurs et aux capacités internes nouvellement acquises.

L'effet de ces mesures sur la pérennité des organisations demeure toutefois une hypothèse qui demande à être vérifiée empiriquement, et au-delà de la confirmation d'un lien causal, les recherches futures devront se pencher de manière détaillée sur les méthodes de mise en pratique de l'ambidextrie organisationnelle par des études qualitatives et longitudinales afin de mieux comprendre *comment* l'opérer au quotidien car l'évolution de nos économies (globalisation, hyper-connectivité,...) fait progressivement disparaître les cas de stabilité environnementale et expose de plus en plus les entreprises à un contexte de haute volatilité.

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Appendix II
The history of GALACTIC

In this Appendix, we narrate each of the four main phases (epochs) in the company's development with some level of detail in order to reconstruct its history and identify the internal and external changes that have paved its evolution until now.

For confidentiality reasons, the text of this Appendix is not displayed in this version of the dissertation but can be requested from the author at jcbo@lactic.com.

Appendix III

Program for the calculation of the largest Lyapunov exponent

In this appendix, we present the program of the algorithm used in Section 3.2.2. to measure the Lyapunov exponent. This algorithm was designed by Wolf et al. (1985) and slightly modified to improve its lisibility. A very clear explanation of the logical approach followed by this algorithm can be found in Cheng & Van de Ven (1996).

```
Program fet1

integer dim,tau,evolv

dimension x(16384),pt1(12),pt2(12)

character*5 txt5

character*12 txt12

z(i,j)=x(i+(j-1)*tau)

type *, 'DIM,tau,dt,scalmx,scalmn,evolv ?'

! accept*,DIM,tau,dt,scalmx,scalmn,evolv

dim=2

tau=1

dt=1

scalmx=0.0001

scalmn=0.3

evolv=1

open (unit=11,file='output_story.txt')

open (unit=1,file='parameters_input.txt')

do k=1,12

    txt12(k:k)=" "

end do

read (1,'(a12)')txt12
```

```

lgtxt=len(txt12)
do k=1,lgtxt
    if (txt12(k:k).eq.",")txt12(k:k)="."
end do

nval=1
nvla_from=0
do k=1,lgtxt
    if (txt12(k:k).eq." ".and.nval.eq.1) then
        nval=0
        nvla_from=k
    end if
end do

do k=nvla_from+1,12
    txt12(k:k)=" "
end do

continue
read (txt12,'(i5)')dim

do k=1,12
    txt12(k:k)=" "
end do

read (1,'(a12)')txt12
lgtxt=len(txt12)
do k=1,lgtxt
    if (txt12(k:k).eq.",")txt12(k:k)="."
end do

nval=1
nvla_from=0
do k=1,lgtxt

```

```

        if (txt12(k:k).eq." ".and.nval.eq.1) then
            nval=0
            nvla_from=k
        end if
    end do
do k=nvla_from+1,12
    txt12(k:k)=" "
end do
read (txt12,'(i5)')tau

do k=1,12
    txt12(k:k)=" "
end do
read (1,'(a12)')txt12
lgtxt=len(txt12)
do k=1,lgtxt
    if (txt12(k:k).eq.",")txt12(k:k)="."
end do
nval=1
nvla_from=0
do k=1,lgtxt
    if (txt12(k:k).eq." ".and.nval.eq.1) then
        nval=0
        nvla_from=k
    end if
end do
do k=nvla_from+1,12
    txt12(k:k)=" "
end do
read (txt12,'(f10.4)')dt

```

```

do k=1,12
    txt12(k:k)=" "
end do

read (1,'(a12)')txt12
lgtxt=len(txt12)
do k=1,lgtxt
    if (txt12(k:k).eq.",")txt12(k:k)="."
end do

nval=1
nvla_from=0
do k=1,lgtxt
    if (txt12(k:k).eq." ".and.nval.eq.1) then
        nval=0
        nvla_from=k
    end if
end do

do k=nvla_from+1,12
    txt12(k:k)=" "
end do

read (txt12,'(f10.4)')scalmx

do k=1,12
    txt12(k:k)=" "
end do

read (1,'(a12)')txt12
lgtxt=len(txt12)
do k=1,lgtxt
    if (txt12(k:k).eq.",")txt12(k:k)="."
end do

```

```

nval=1
nvla_from=0
do k=1,lgtxt
  if (txt12(k:k).eq." ".and.nval.eq.1) then
    nval=0
    nvla_from=k
  end if
end do

do k=nvla_from+1,12
  txt12(k:k)=" "
end do

read (txt12,'(f10.4)')scalnm

do k=1,12
  txt12(k:k)=" "
end do

read (1,'(a12)')txt12
lgtxt=len(txt12)
do k=1,lgtxt
  if (txt12(k:k).eq.",")txt12(k:k)="."
end do

nval=1
nvla_from=0
do k=1,lgtxt
  if (txt12(k:k).eq." ".and.nval.eq.1) then
    nval=0
    nvla_from=k
  end if
end do

do k=nvla_from+1,12

```

```

        txt12(k:k)=" "
    end do
    read (txt12,'(i5)')evol

close (1)

ind=1
sum=0.0
its=01

npt=0
i=0

open (unit=1,file='data_input.csv')

109 continue
    i=i+1
    read (1,'(a12)',err=99,end=99)txt12
    lgtxt=len(txt12)
    do k=1,lgtxt
        if (txt12(k:k).eq.",")txt12(k:k)="."
    end do

    read (txt12,'(f10.4)')x(i)

    npt=npt+1
    goto 109
99 continue

close (1)

```



```

write (*,*) "npts =",npt

npt=npt - dim*tau - evolv

di=1.e38

do i=11,npt
  d=0.0
  do j=1,dim
    d=d+(z(ind,j)-z(i,j))**2
  end do
  d=sqrt(d)
  if (d.gt.di.or.d.lt.scalmn) goto 30
  di=d
  ind2=i
30 continue
end do

40 do j=1,dim
  pt1(j)=z(ind+evolv,j)
  pt2(j)=z(ind2+evolv,j)
end do

df=0.0
do j=1,dim
  df=df+(pt1(j)-pt2(j))**2
end do

df=sqrt(df)

```

```

its=its+1
sum=sum+alog(df/di)/((1.0*evolv)*dt*alog(2.))
zlyap=sum/float(its)

do k=1,12
    txt12(k:k)=" "
end do

write (txt12,'(f12.5)')zlyap
lgtxt=len(txt12)
do i=1,lgtxt
    if (txt12(i:i).eq.".")txt12(i:i)=","
end do

write (11,*) txt12

indold=ind2
zmult=1.0
anglmx=0.3
70 thmin=3.14

do i=1,npt
    iii=iabs(i-(ind+evolv))
    if (iii.lt.10) goto 100
    dnew=0.0
    do j=1,dim
        dnew=dnew+(pt1(j)-z(i,j))**2
    end do
    dnew=sqrt(dnew)

```

```

if (dnew.gt.zmult*scalmx.or.dnew.lt.sclmn) goto 100

dot=0.0
do j=1,dim
    dot=dot+(pt1(j)-z(i,j))*(pt1(j)-pt2(j))
end do

crh=abs(dot/dnew*df)
if (cth.gt.1.0)cth=1.0
th=acos(cth)

if (th.gt.thmin) goto 100

thmin=th
dii=dnw
ind2=1
100 continue
end do

if (thmin.lt.anglmx)goto 110

zmult=zmult+1.
if(zmult.le.5.) goto 70
zmult=1.0
anglmx=2.*anglmx
if (anglmx.lt.3.14) goto 70
ind2=indold+evolv
dii=df
110 continue
ind=ind+evolv

```

```

if (ind.ge.npt) goto 120

di=dii

goto 40

120 continue

open (unit=1,file='results_output.txt')
write (*,*) "zlyap=",zlyap
write (*,*) "evolv*its=",evolv*its
write (*,*) "di=",di
write (*,*) "df=",df

do k=1,12
    txt12(k:k)=" "
end do
write (txt12,'(f12.5)')zlyap
lgtxt=len(txt12)
do i=1,lgtxt
    if (txt12(i:i).eq.".")txt12(i:i)=","
end do
write (1,*) "zlyap=",txt12

do k=1,12
    txt12(k:k)=" "
end do
write (txt12,'(f12.5)')evolv*its
lgtxt=len(txt12)
do i=1,lgtxt
    if (txt12(i:i).eq.".")txt12(i:i)=","

```

```

end do

write (1,*) "evolv*its=",txt12

do k=1,12
    txt12(k:k)=" "
end do

write (txt12,'(f12.5)')di
lgtxt=len(txt12)
do i=1,lgtxt
    if (txt12(i:i).eq.".")txt12(i:i)=","
end do

write (1,*) "di=",txt12

do k=1,12
    txt12(k:k)=" "
end do

write (txt12,'(f12.5)')df
lgtxt=len(txt12)
do i=1,lgtxt
    if (txt12(i:i).eq.".")txt12(i:i)=","
end do

write (1,*) "df=",txt12

close (1)
close (11)

write (*,*) "END"
read (*,*)

call exit

end

```

Appendix IV

*Data structure for the isolation of concepts and themes in designing the code-book for
Exploration and Exploitation*

Aspect: **EXPLORATION**

Empirical studies	Concepts - 1st Order (Gioia et al., 2012)	Themes - 2nd Order (Gioia et al., 2012)
Brion, Mothe & Sabatier, 2010	The firm encourages employees to locate partners to have access to new markets	Alliance to access new markets
Lavie & Rosenkopf, 2006 Lavie & Rosenkopf, 2006	The alliance involves a new partner The alliance involves a partner pretty different to the previous partners in terms of size (asset value), advertising intensity, financial strength (cash to long-term debt ratio) and industry focus (four-digit SIC code) Exploration index = Total of new alliance partners / Total of all alliance partners Alliances with new partners	Alliance with a new partner
Lin, Yang & Demirkan, 2007 Cummings, 2013	The firm looks for creative ways to satisfy its customers' needs The company frequently experiment with radical new ideas (or ways of doing things) Employees frequently come up with creative ideas that challenge conventional ideas	Creative solutions & new ideas
Lubatkin, Simsek, Lin & Veiga, 2006 Bierly & Daly, 2007	The business unit follows other companies' ideas within the same industry A "pioneering" strategy is pursued by the business unit Artistic decisions emphasize creating revolutionary new conceptual approaches Artistic decisions emphasize experimenting with radical new works Marketing decisions emphasize challenging ourselves to increase the number of first-time theatergoers The venture looks for creative ways to satisfy its customers' needs	Creative solutions & new ideas
Bierly & Daly, 2007	The firm actively targets new customer groups The unit regularly uses new distribution channels The firm sells to new customers in new markets Marketing decisions emphasize initiating programs designed to attract new audiences	Development of new customer groups
Morgan & Berthon, 2008 Morgan & Berthon, 2008 Voss & Voss, 2012 Voss & Voss, 2012 Voss & Voss, 2012	The venture actively targets new customer groups	Development of new customer groups
Patel, Messersmith & Lepak, 2013	An objective for undertaking innovation is to open up new markets Little information is gathered on product preferences of customer groups that we do not currently serve (demand-side information-acquisition scope) We are knowledgeable about all important opportunities in the geographic regions in which we operate (geographic information-acquisition scope) We are well informed about the price and quality aspects of products in neighbouring geographic regions (geographic information-acquisition scope) The firm aggressively ventures into new market segments The unit frequently utilizes new opportunities in new markets The firm sells to new customers in new markets The firm opens up new markets Marketing decisions emphasize seeking out audiences in new markets The venture aggressively ventures into new market segments	Development of new markets
Lubatkin, Simsek, Lin & Veiga, 2006 Jansen, Van den Bosch & Volberda, 2006 Brion, Mothe & Sabatier, 2010 Voss & Voss, 2012	The management systems encourage people to challenge out-moded traditions/practices/sacred cows	Development of new procedures
Patel, Messersmith & Lepak, 2013		
He & Wong, 2004 Sidhu, Volberda & Commandeur, 2004 Sidhu, Volberda & Commandeur, 2004 Sidhu, Volberda & Commandeur, 2004		
Lubatkin, Simsek, Lin & Veiga, 2006 Jansen, Van den Bosch & Volberda, 2006 Brion, Mothe & Sabatier, 2008 Cao, Gedajlovic & Zhang, 2009 Voss & Voss, 2012 Patel, Messersmith & Lepak, 2013		
Gibson & Birkinshaw, 2004		

He & Wong, 2004

He & Wong, 2004

Sidhu, Volberda & Commandeur, 2004

Lubatkin, Simsek, Lin & Veiga, 2006

Jansen, Van den Bosch & Volberda, 2006

Jansen, Van den Bosch & Volberda, 2006

Jansen, Van den Bosch & Volberda, 2006

Jansen, Van den Bosch & Volberda, 2006

Bierly & Daly, 2007

Morgan & Berthon, 2008

Morgan & Berthon, 2008

Morgan & Berthon, 2008

Brion, Mothe & Sabatier, 2008

Brion, Mothe & Sabatier, 2008

Mom, Van den Bosch & Volberda, 2009

Mom, Van den Bosch & Volberda, 2009

Mom, Van den Bosch & Volberda, 2009

Cao, Gedajlovic & Zhang, 2009

Cao, Gedajlovic & Zhang, 2009

Brion, Mothe & Sabatier, 2010

Brion, Mothe & Sabatier, 2010

Patel, Messersmith & Lepak, 2013

Ming, 2014

Kyriakopoulos & Moorman, 2004

Atuahene-Gima, 2005

Atuahene-Gima, 2005

Atuahene-Gima, 2005

Atuahene-Gima, 2005

Mom, Van den Bosch & Volberda, 2009

Brion, Mothe & Sabatier, 2010

Voss & Voss, 2012

An objective for undertaking innovation is to introduce new generation of products

An objective for undertaking innovation is to extend product range

We know well the product and process innovation efforts of our customers (demand-side information-acquisition scope)

The firm creates products or services that are innovative to the firm

The unit accepts demands that go beyond existing products and services

The unit invents new products and services

The unit experiments with new products and services in its local market

The unit commercializes products and services that are completely new to the unit

Compared to competitors, a high percentage of the company sales come from new products launched with the last 3 years

Product innovation is "offensive" (as opposed to "defensive")

The products offer unique features not available from competitors' offerings

The products are innovative

The firm introduces new generation products

The firm proposes products which are totally new to the market

The manager searches for new possibilities with respect to products/services, processes, or markets

The manager evaluates diverse options with respect to products/services, processes, or markets

The manager focuses on strong renewal of products/services or processes

The firm introduces new generations of products

The firm extends its product range

The firm introduces new product generations

The firm offer totally new products for the market

The venture creates products or services that are innovative to the firm

Number of designs for new form factors that are first introduced in a year

Development of new products

During the project, prior thinking was challenged and/or changed with respect to targeting & segmentation, product positioning & differentiation, product distribution, product design, product quality, pricing and promotion

The firm learns product development skills and processes (such as product design, prototyping new products, timing of new product introductions, and customizing products for local markets) entirely new to the industry

The firm acquires new managerial and organizational skills that are important for innovation (such as forecasting technological and customer trends, identifying emerging markets and technologies, coordinating and integrating R&D, marketing, manufacturing, and other functions, managing the product development process)

The firm learned new skills in areas such as funding new technology, staffing R&D function, training and development of R&D, and engineering personnel for the first time

The firm strengthens innovation skills in areas where it has no prior experience

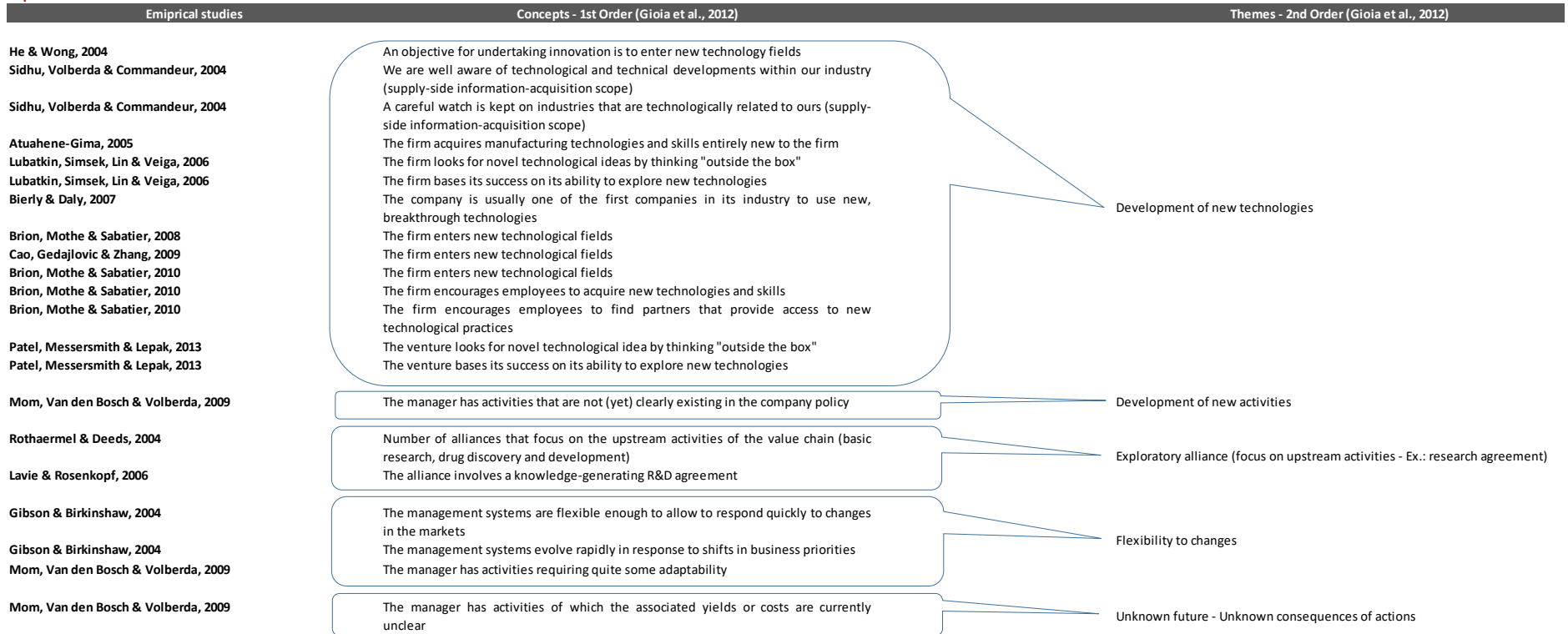
The manager has activities requiring to learn new skills or knowledge

The firm encourages employees to adopt new managerial and organizational skills that are important for innovation

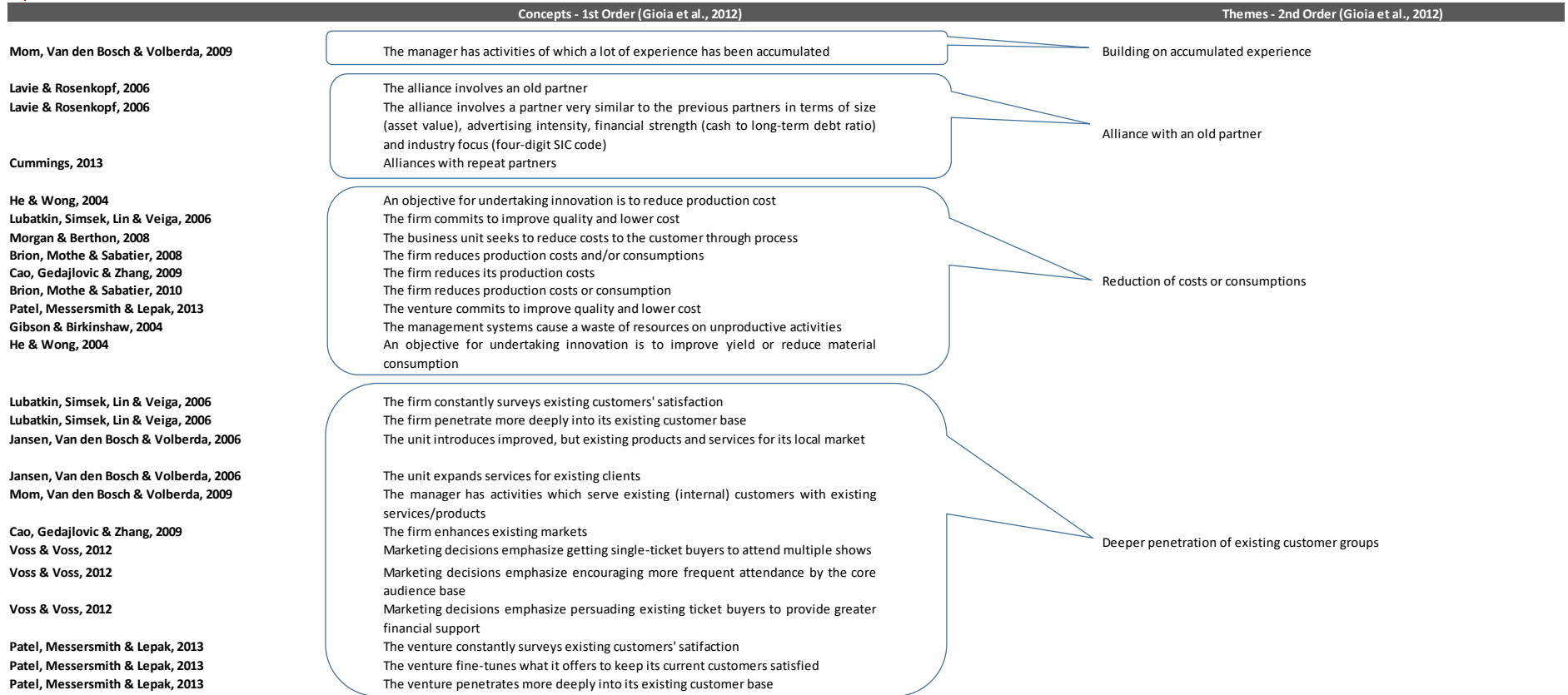
Artistic decisions emphasize challenging traditional artistic boundaries

Development of new skills or knowledge

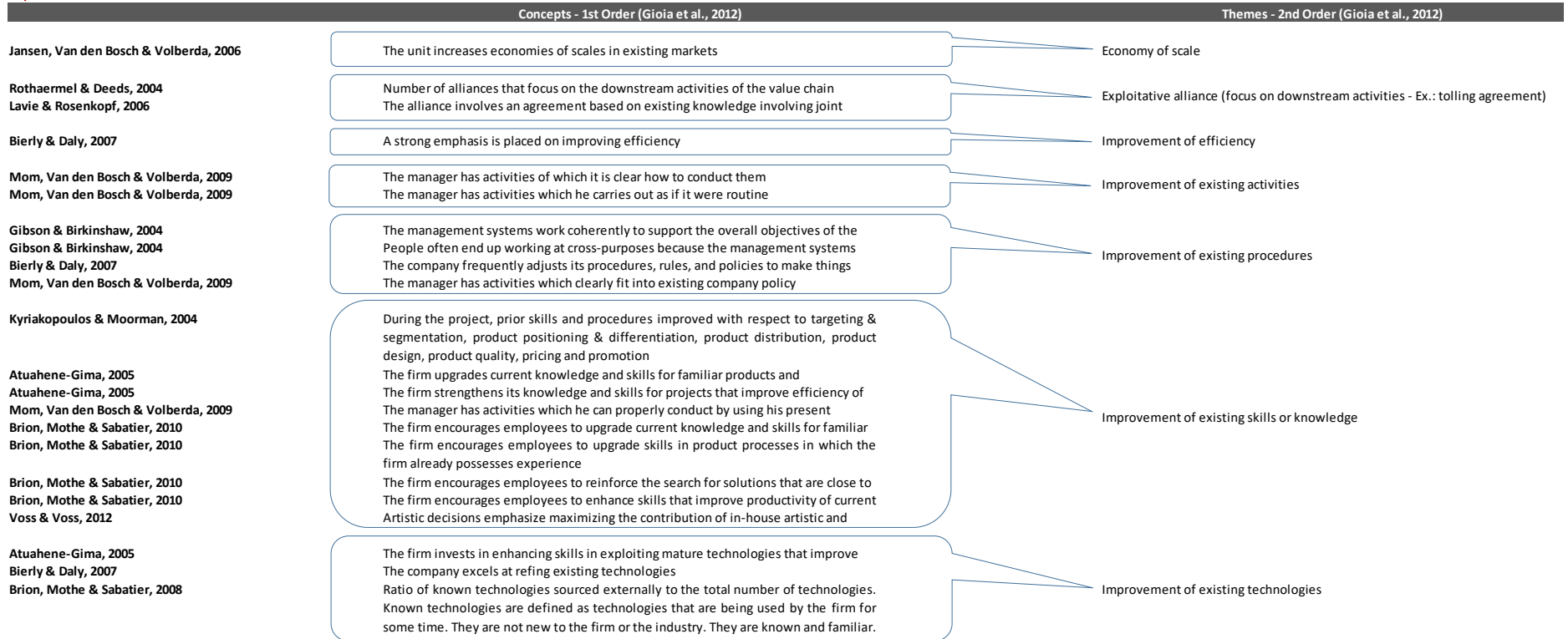
Aspect: **EXPLORATION**



Aspect: EXPLOITATION



Aspect: **EXPLOITATION**



Aspect: EXPLOITATION

Concepts - 1st Order (Gioia et al., 2012)

Themes - 2nd Order (Gioia et al., 2012)

He & Wong, 2004
Atuahene-Gima, 2005

Lubatkin, Simsek, Lin & Veiga, 2006
Morgan & Berthon, 2008
Morgan & Berthon, 2008

Morgan & Berthon, 2008

Brion, Mothe & Sabatier, 2008
Brion, Mothe & Sabatier, 2010
Patel, Messersmith & Lepak, 2013

He & Wong, 2004
Lubatkin, Simsek, Lin & Veiga, 2006
Lubatkin, Simsek, Lin & Veiga, 2006
Jansen, Van den Bosch & Volberda, 2006
Jansen, Van den Bosch & Volberda, 2006
Jansen, Van den Bosch & Volberda, 2006
Morgan & Berthon, 2008
Brion, Mothe & Sabatier, 2008
Brion, Mothe & Sabatier, 2008
Cao, Gedajlovic & Zhang, 2009
Cao, Gedajlovic & Zhang, 2009
Brion, Mothe & Sabatier, 2010
Brion, Mothe & Sabatier, 2010
Voss & Voss, 2012
Voss & Voss, 2012

Patel, Messersmith & Lepak, 2013
Ming, 2014

Atuahene-Gima, 2005

Mom, Van den Bosch & Volberda, 2009

An objective for undertaking innovation is to improve production flexibility
The firm upgrades skills in product development processes in which it already possesses significant experience
The firm increases the level of automation in its operations
The business unit seeks to improve processes to reduce costs
The business unit seeks to improve processes to reduce the time taken for unit production
The business unit aims to add value to its products and/or services through process improvements
The firm improves the flexibility of production process
The firm makes production processes more flexible
The venture increases the levels of automation in its operations

Improvement of production processes

An objective for undertaking innovation is to improve existing product quality
The firm continuously improves the reliability of its products and services
The firm fine-tunes what it offers to keep its current customers satisfied
The unit frequently refines the provision of existing products and services
The unit regularly implement small adaptations to existing products and services
The unit improves its provision's efficiency of products and services
Product and/or processes are analysed to search for improvements
The firm improves the quality of its existing products
The firm introduces products that are slightly different
The firm improves existing products
The firm improves its products' flexibility
The firm enhances existing product quality
The firm introduces slightly different products
Artistic decisions emphasize offering shows that stay close to own strengths
Artistic decisions emphasize producing shows similar to those that have done well in the past
The venture continuously improves the reliability of its products and services
Number of designs for existing form factors that are produced in a year

Improvement of existing products

The firm enhances competencies in searching for solutions to customer problems that

Providing existing solutions to customers

The manager has activities primarily focused on achieving short-term goals

Short-term goals

Appendix V

*Data structure for the isolation of concepts and themes in designing the code-book for
Causation and Effectuation*

Aspect: **CAUSATION**

Reference	1st Order (Gioia et al., 2012) - Concepts	2nd Order (Gioia et al., 2012) - Themes
Sarasvathy, 2001 Chandler et al., 2011	Decision based on expected return Analysis of long run opportunities and selection of what was thought to provide the best returns	Analysis to provide expected return ("gain more")
Chandler et al., 2011 Chandler et al., 2007	The decision making is largely driven by expected returns We analyzed the long-run opportunities and selected what we thought would provide the best returns.	
Chandler et al., 2011 Chandler et al., 2007	Implementation of control processes to make sure objectives are met We organized and implemented control processes to make sure we met objectives.	
Chandler et al., 2011 Chandler et al., 2011 Chandler et al., 2011 Chandler et al., 2011 Chandler et al., 2007	Design and planning of business strategies Clear and consistent vision for what we want to do and where we want to end up Planning of production and marketing efforts Development of a strategy to best take advantage of resources and capabilities We designed and planned business strategies.	Design of strategy - Planification
Sarasvathy, 2001	Exploiting preexisting knowledge	Exploitation of preexisting knowledge
Sarasvathy, 2001	Need to choose between means to achieve the given effect	Selection of resources needed
Chandler et al., 2011	The product that we now provide is quite similar to the original conception	Improvement of existing products
Chandler et al., 2011 Chandler et al., 2007	Research and selection of target markets with the help of meaningful competitive analysis We researched and selected target markets and did meaningful competitive analysis.	Definition of targets (market surveys)
Sarasvathy, 2001	Effect is given	
Sarasvathy, 2001 Sarasvathy, 2001	Focus on the predictable aspects of an uncertain future Aims at predicting an uncertain future	Prediction of an uncertain future

Aspect: **EFFECTUATION**

Reference	1st Order (Gioia et al., 2012) - Concepts	2nd Order (Gioia et al., 2012) - Themes
Sarasvathy, 2001 Chandler et al., 2011	Decision based on affordable loss or acceptable risk The decision making is largely driven by how much the organization can afford to lose	Assessment of affordable loss / acceptable risk ("lose less")
Chandler et al., 2011	The management is careful not to risk so much money that the company would be in real trouble financially if things don't work out	
Chandler et al., 2007 Chandler et al., 2007	We were careful not to commit more resources than we could afford to We were careful not to risk more money than we were willing to lose with our initial idea.	
Chandler et al., 2007	We were careful not to risk so much money that the company would be in real trouble financially if things didn't work out.	
Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007	We used agreements with other people and organizations to help deal with changes in our business environment. Friends, family, and other network contacts provided services that we otherwise would have had to pay for We were able to use family, friends, and other network contacts to provide low cost resources.	Alliance - Partnership
Chandler et al., 2011 Chandler et al., 2011 Chandler et al., 2011 Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007 Chandler et al., 2007 Sarasvathy, 2001	Evaluation of the set of resources and means available, and of the different options The organization adapts what it is doing to the available resources The organization avoids courses of action that restricts its flexibility and adaptability We adapted what we were doing to the resources we had We avoided courses of action that restricted our flexibility and We have focused on taking advantage of our resources and capabilities Our first consideration when selecting among business options was our knowledge and resources. Our decision making has been based on the knowledge and resources we When we started the business we carefully looked at our knowledge and resources before thinking about different alternatives for When selecting opportunities our decision-making is focused more strongly on what we know how to do well than on external factors. Means or tools are given	Definition of resources available

Aspect: **EFFECTUATION**

Reference	1st Order (Gioia et al., 2012) - Concepts	2nd Order (Gioia et al., 2012) - Themes
Sarasvathy, 2001 Chandler et al., 2011	Need to choose between possible effects that can be created with given The organization tried a number of different approaches until it found a business model that worked It is possible to see from the beginning where we want to end	Choice of possible targets
Chandler et al., 2011		
Sarasvathy, 2001 Sarasvathy, 2001	Focus on the controllable aspects of an unpredictable future Aims at controlling an unpredictable future	Control of an unpredictable future
Chandler et al., 2007	We tried a number of different approaches until we found a business model that worked.	Development of new business models
Chandler et al., 2011	The product that we now provide is substantially different from the original conception Experimentation of different products and business models We experimented with different products and/or business models. The product/service that we now provide is substantially different than we first imagined.	Development of new product
Chandler et al., 2011 Chandler et al., 2011	Use of substantial number of agreements with customers, suppliers and other organizations and people to reduce the amount of uncertainty The organization uses pre-commitments from customers and suppliers as often as possible	Seeking pre-commitments from customers
Chandler et al., 2007 Chandler et al., 2007	We used a substantial number of agreements with customers, suppliers and other organizations and people to reduce the amount of uncertainty. We used pre-commitments from customers and suppliers as often as	
Sarasvathy, 2001 Chandler et al., 2011 Chandler et al., 2011	Exploiting contingencies We allow the business to evolve as opportunities emerge The organization is flexible and tries to take advantage of unexpected opportunities as they arise	Seizing opportunities - Exploiting contingencies
Chandler et al., 2007 Chandler et al., 2007	We allowed the business to evolve as opportunities emerged. We were flexible and took advantage of opportunities as they arose.	

