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Abstract: *The paper studies the emergence of unknown domain of expertise in an established French technological firm with a strong organization of experts. The research is built on a quantitative and qualitative longitudinal research partnership with Renault (global car manufacturer). This research highlights 4 main results: Firstly, in the case of an industrial company like Renault, it took around 29 years to constitute the first domains of expertise, but since then, new domains have been formalized in just a decade. In the case of emergent domains of expertise, we do not yet know how long will be needed for them to be fully institutionalized. In this way (second result), external peer's community can acknowledge the expertise of a company, and not only of an expert. Thirdly, all the experts in industries are not strategic and exact & experimental scientific or technical expert, they can also be experts in social sciences, and strategic for the other experts instead of just for the company. Finally, research collaborations are a way to create and reinforce a domain of expertise, both for an expert and for the company.*

Introduction

The role of an expert is well established in the literature: it is either to decide or to define a strategy (Trépos, 2016). Thus, the knowledge and the skills of an expert are strategic for a firm. "Therefore, firms are constantly preoccupied with procuring required skills through recruitment or training,[…] to accelerate the renewal of products and markets." (Hatchuel and Weil 2011, 3). In the context of hyper competitiveness (Ilinitch et al., 1996), experts also contribute to the dynamic and strategic renewal of industrial expertise within their firm (Cabanes et al. 2016). This dynamic has intensified to face the modern challenges (energetic transition, pandemic, etc.), which require more scientific new knowledge and then more industrial explorations in the unknown (Le Masson and Weil 2020). To do so, some experts at Renault regularly work with external scholars, publish in specialized journals, or even supervise doctoral theses with university laboratories. Hence, the role of collaborations between experts in an industry and industrial management scholars, in the creation of knowledge for an expertise, imposes itself as a pertinent topic of research. As a result, the research question of the paper is the following: **How to better master scientific research to innovate? Understanding the emergence of unknown domains of expertise in established firms by analyzing their research collaborations projects between internal expert and scholars.** The paper starts with a literature review about the recognition of experts and

domains of expertise in industries. The second section presents the settings of the collaborative research and our data collection methods. In section 3, we present our longitudinal case study. Section 4 discusses these results and presents the main conclusion for research on expertise in industries.

1. Literature Review

1.1. Duration of construction of the knowledge of an individual expertise

For the purpose of this paper, we choose the definition of expert from the handbook of Expertise and Expert Performance (Ericsson et al. 2018, 3) which describes an ***Expert*** as "*someone widely recognized as a reliable source of knowledge, technique, or skill whose judgment is accorded authority and status by the public or his or her peers. Experts have prolonged or intense experience through practice and education in a particular field*". "*Ex**pertise** then refers to the characteristics, skills, and knowledge that distinguish experts from novices and less experienced people".* Thanks to their expertise, experts exhibit superior performances to less experienced people.

Thus, these definitions are focused on the appreciation of knowledge. Many studies focus on the knowledge acquisition of an expert, and agree that at least 10 years of experiences are required to become an expert (William G. Chase and Simon 1973; Ericsson 1996; Hayes 1989; Weisberg 2006). This "10 years rule" became the golden rule for designing an individual expertise. This long expertise acquisition process does not end after 10 years, instead it has to continue, to be dynamic, because an expert, as a reference in their field, must master the latest advances.

If we now consider an expertise through a group of individuals, who collectively embody that concentration of knowledge and skills in the organization, then that expertise can be relative: the most informed, educated, and competent individuals can be considered experts. Levels of individual competence, from novice to expert, can thus be defined according to criteria of level of diploma, experience, seniority in a field (Chi 2006; Hoffman 1998). **At least, this group embodies the expertise of their organization. If 10 years are needed to constitute an individual expertise, the time needed by an organization to constitute an expertise is unknown.**

1.2. Knowledge nature of industrial experts

The word expert finds its origin in the Latin "expertus", which served to designate a know-how acquired during experiments. However, the term "expertise" appears in the 19th century in the legal field and refers to the technical and scientific skills in the service of a jurisdiction, a public administration or a company (Calafat 2011). From that point on, experts appeared in many kinds of domains: professional domains like medicine, transportation, software design, writing; art, sport and games domain (Ericsson et al. 2018); thus, a domain of expertise appears when knowledge and content of a field can be accumulated and organized.

Expert in industries appeared in the 1940s-50s in the United States. In the 50's, to be competitive, science-based firms were dependent on technological innovations as instruments of competition (Shepard 1958). Shepard (1958, 177) highlights that *"within the individual firm, power tends to shift to those who possess the skills most needed for survival and growth. Over the past half-century, this distinction has passed from manufacturing to sales and thence to research and development*." However, the R&D presented a weakness in its skills organization: with its growth, the R&D department presented problems of "coordination, control, evaluation, program formulation, personnel maintenance, decision-

making" (Shepard 1958, 178). Thus, a new managerial class emerged to exercise control over the scientific and engineering activities. By this way, all the technical men entering the managerial class were no longer devoted to technical topics. *"When a good scientist is made a manager, a good scientist is lost"* (Shepard 1958, 179). Simultaneously, having a high degree of technical competence in the laboratory is recognized as assuring better results. Hence, to remedy that loss, recognize the expertise of some scientists and engineers, and propose an alternative to the managerial career path, a dual ladder was developed to offer a technical career path (Shepard 1958). Thus, the technical and scientific experts appeared, and they aimed to secure a pool of technical and scientific talents for science-based organizations.
Since that time, "*firms are constantly preoccupied with procuring required skills through recruitment or training,[…] to accelerate the renewal of products and markets."* (Hatchuel and Weil 2011, 3). This dynamic has been accelerated to face the modern challenges (energetic transition, pandemic, etc.), which needs more breakthrough R&D for radical innovation and thus more explorations to unveil the unknown (Le Masson and Weil, 2020, O'connor, 2018).
The amount of knowledge of an expert is not useful if the knowledge is not applied in the organization. Blackler (1995) insists on the principle of "**knowing and doing**", that is, putting into action the knowledge that the expert conveys through relations with others in an activity.
Thus, to face the hyper competitiveness (Ilinitch, D'Aveni, and Lewin 1996), technical and scientific experts contribute to the dynamic and strategic renewal of industrial domains of expertise within their firm (Cabanes et al. 2016; Maniak et al. 2014), and to foster the innovation capability of the firm (Cabanes, Masson, and Weil 2020; Lelebina 2013; Trépos 2016).
So, since the 1950's the knowledge of industrial experts is scientific or technical and strategic. However, few scholars focused on the evolution of the domain, or the evolution of nature of the knowledge contained in industrial domains of expertise.

1.3. Expertise acknowledgment

The role of an expert in industrial firms described in the literature for decades is not to design but to organize knowledge per strategic area. They make decisions or define the strategy (Trépos, 2014), by mobilizing their knowledge (Blaker, 1996) based on their 10 years of experience (William G. Chase & Simon, 1973, Ericsson 1996, Weisberg 2006), and with the acknowledgement by peers (Shepard 1958; Shanteau 1992; Hoffman 1998; Ericsson 2006; Lelebina 2013; Cabanes et al. 2016; Ericsson et al. 2018).
"The identification of an expert implies a definition of the relationship between the validity of expertise and its acceptability in collective action." (Hatchuel and Weil 2011, 64). To validate an expertise, academic qualifications (such as graduate students vs. undergraduates), seniority or years performing the task, or consensus among peers are considered (Chi 2006, 23). By "consensus among peers", peers are understood as an institutionalized community in a scientific field. Institutionalization serves also to define who has access to these places where scientific expertise is developed and negotiated (Shappin and Schaffer 2011; Evetts, Mieg, and Felt 2006). These community of peers is constituted by scientists who write empirical or theorical considerations, and by colleagues working in similar domains involved in the validation of the scientist character of these considerations to be published in specialized journals (Ericsson 1996; Evetts, Mieg, and Felt 2006, 115). Thus, experts can validate their expertise and knowledge through scientific publications validated by the peers. The scientific publication is also a way to create and spread new knowledge.

In addition, the exploration of the unknown plays a role in the constitution of new knowledge (Le Masson and Weil 2020). It appears that the experts' activities can't be limited to strategic decisions. They must incorporate activities to explore the unknown, which can later reinforce the emergence of new expertise. But the literature on exploration of the unknown and experts does not offer such understanding.

Then, the question of the emergence of unknown expertise through scientific exploration activities seems to be relevant. More specifically, the research question is "**How to better master scientific research to innovate? Understanding the emergence of unknown domains of expertise in established firms by analyzing their research collaborations projects between internal expert and scholars."**

2. RESEARCH METHODS

2.1. Collaborative management research with two firms

This study is based on a collaborative management research (Shani et al. 2008), with Renault, an established French technological firm with a strong organization of experts. The partnership has been led since 2019 by the first author, a PhD candidate who is both a researcher in design and innovation capability and an employee of Renault, and it has been supported by senior researchers in innovation management, as well as members of industrial expert organizations specialized in radical innovation management.

2.2. Data collection process and research material

This article is based on two longitudinal (Menard 2002; Pettigrew 1990) case studies (Yin 2011), that mixed the quantitative method of collecting data and the qualitative methods of the exploration and theory-building process with practitioners (Eisenhardt and Graebner 2007). This combination of qualitative and quantitative methods follows the process of mixed methods research or MMR (Venkatesh, Brown, and Bala 2013).

First, the authors reconstituted the history of the all the domains of expertise at Renault, with the creation date, all the expert-leaders nominated and sometime the cessation date of each domain. This set of data is essentially constituted by 57 semi-directive interviews (1 with a former human resource director dedicated to the experts in 2008, 2 with the expert-fellow in charge of all the experts, 1 with his executive secretary, 10 with expert-leaders in charge of a domain, 43 exchanges by Microsoft Teams or by e-mail with other expert-leaders), as well as by compiling relevant internal and historical documents since the creation of the domains of expertise (the nomination letter of the expert leader, some missions letters, and some PowerPoint presentations fromm 2008, as well as profiles searches on Linkedin).

The second and central set of data on collaborations between Renault and industrial management scholars, is collected through 1 academic search engine. We put "Renault" as institution and got 2 589 results. We realized after, that we didn't get papers on Renault published by other institutions. However, among these 2 589 publications, some have been published with external institutions, from which we obtained the first 19 names. We also collected the name of the 20 more important authors at Renault.

2.3. Data analyses

For the history of the domains, we classified these 66 domains in 7 major themes and 21 minor themes. Then, we analyzed the apparition of these 66 domains in a matrix by minor themes, by major themes, and by the time of apparition.

To analyze the papers, we first deleted the papers without publication year, those published in 2021, and those related to medicine / healthcare. We classified the remaining 2 449 papers according to the 7 major and 21 minor themes, and the 66 domains. We created an analytic matrix with the time of the publication, the major and minor themes, and the related domain. We then compared the tow matrices and identified correlations. We also looked into the 20 most important authors at Renault, who were also experts.

3. Data

3.1. Historical strategic expertise domains creation at Renault

Before 2009, there was no formalized expert system at Renault, even if some experts already existed. Renault structured and formalized its expertise organization in 2009 and, in the process, also acknowledged the previously existing experts. The aim of such organization was and is still to make these experts innovate by proposing and promoting disruptive solutions, by promoting standards and by being actors in the development of the Expertise sector (coach, trainer, etc.). From 2009 to 2021, 66 strategic domains of expertise were created, and 6 disappeared. 779 experts were labelled as “Expert Leader”, “Experts” or “Specialists” of the domain they are charged with, organized into 7 major and 21 minor themes.

Table 1 - Major and minor themes of the total strategic domains at Renault

Major	Minor	Total
Electronics, Electrical Energy, Automatic	ADAS	3
	Engineering	1
	Quality	2
	Safety	1
Manufacturing & Supply Chain	Industrial system	4
	Process Quality	3
	Tests & Simulations	1
Materials	Quality	3
Markets & Customer	Business model	14
	Safety	1
	Quality	4
Operational Effectiveness	Business model	2
	Engineering	4
	Safety	1
	Tests & Simulations	3
Powertrain	Business model	1
	e-Powertrain	4
	ICE	7
Vehicle Performance	Engineering	1
	Quality	4
	Safety	2
Total of strategic domains		66

In 2009, Renault analyzed the domains of expertise at Nissan, choose among them 57 strategic expertise area to internally formalized and could nominate only 36 experts between 2010 and 2012. Indeed, Renault did not have the 57 corresponding experts in house. At that

time the strategic expertise domains were essentially in Manufacturing & Supply Chain, Powertrain, and Vehicle Performance.
From 2013 to 2021, 27 other domains of expertise have been created. We can identify 3 tendances in the creation of these domains: a huge increase in Market & Customer a stability in Electronics, Electrical Energy, Automatic (EEEA) Materials, and Operational Effectiveness, and a decrease in the Manufacturing & Supply Chain, Powertrain and Vehicle Performance.

Table 2 – Phases of appearance of the strategic domains at Renault, organized by major themes

	2010 - 2011 - 2012	after 2013
Electronics, Electrical Energy, Automatic	4	3
Manufacturing & supply chain	5	2
Materials	1	2
Markets & customer	6	13
Operational Effectiveness	5	5
Powertrain	9	3
Vehicle Performance	6	0

Table 3 -Number of strategic domains created at Renault per major and minor themes and per year

Major	Minor	Total	2010 - 2011 - 2012	After 2013
Electronics, Electrical Energy, Automatic	ADAS	3	2	1
	Engineering	1	1	
	Quality	2	1	1
	Safety	1		1
Manufacturing & Supply Chain	Industrial system	4	2	2
	Process Quality	3	2	1
	Tests & Simulations	1		1
Materials	Quality	3	1	2
Markets & Customer	Business model	14	5	9
	Safety	1	1	
	Quality	4		4
Operational Effectiveness	Business model	2	1	1
	Engineering	4	1	3
	Safety	1	1	
	Tests & Simulations	3	2	1
Powertrain	Business model	1	1	
	e-Powertrain	4	1	3
	Internal Combustion Engine	7	7	
Vehicle Performance	Engineering	1	1	
	Quality	4	4	
	Safety	2	2	
Total of strategic domains		66		

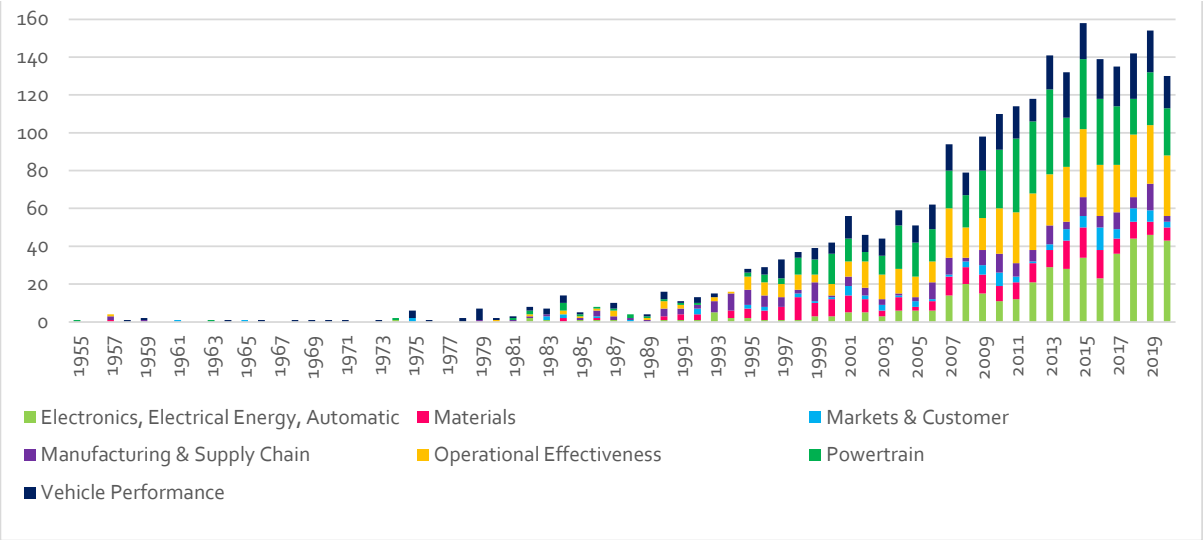
3.2. Renault's collaboration with industrial management scholars

3.2.1. Duration of construction of the knowledge of an individual expertise

By analyzing the scientific publication published from Renault's collaboration with industrial scholar since 1955, 4 periods were identified.

- From 1955 to 1980 is the period that sees the appearance of the first scientific publications. Most of them concerns the Vehicle Performance expertise domains.

- For the 80s to the 90s, the number of scientific publications slowly increased, essentially in Material, Manufacturing & Supply Chain, Operational Effectiveness and Powertrain. At that point, almost each minor theme already counts a publication, except for the Quality in EEEA.
- From 2000 to 2013, the period includes 10 years before the formalization of the experts' organization and the three first years of nominations. During this time, some minor themes see the number of publications hugely increased, such as Test & Simulation in Operational Effectiveness, Internal Combustion Engine in Powertrain, then ADAS in EEEA, Materials, and Quality in Vehicle Performance. The others showed no major increase or only slow growth in the number of publications. Over that time, we count 1311 publications in total.



- From 2013 to 2020, a new trend appears. The number of publications exploded in ADAS in EEEA, in Test & Simulation in Operational Effectiveness, other keep going slowly like in Quality in EEEA, Materials, e-Powertrain, and Quality in Vehicle Performance, and surprisingly, some decreased like in Internal Combustion Engine in Powertrain. At that time, we count 1131 publications in only 7 years.

Figure 1- Figure 1 - Scientific publications by Renault per year and major theme

Table 4 - Number of scientific publications from the Renault's collaboration with scholars per year and major and minor theme (the first publication is in red)

		1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Electronics, Electrical Energy, Automatic	ADAS																				1					
	Engineering																									
	Quality																									
	Safety																									
Manufacturing & Supply Chain	Industrial system			1		1																				
	Process Quality																									
	Tests & Simulations			1																						1
Materials	Quality			1																						
Markets & Customer	Business model											1										1				
	Safety																					1				
	Quality							1																		
Operational Effectiveness	Business model																									
	Engineering																									
	Safety																									
	Tests & Simulations			1																						
Powertrain	Business model																									
	e-Powertrain																									
	Internal Combustion	1								1											1					
Vehicle Performance	Engineering				1								1				1	1				1			1	
	Quality					1					1									1		1				2
	Safety														1	1						2	1		1	4

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Electronics, Electrical Energy, Automatic	ADAS			1			1	1	1				1	1	5	1		1	1		
	Engineering			1	1							1				1	2			1	1
	Quality																				
	Safety																				2
Manufacturing & Supply Chain	Industrial system			1	1		1	2	1			1	1				1				1
	Process Quality											1					1				1
	Tests & Simulations		1					1	1	1	1	2	2	2	6	9	6	6	5	2	8
Materials	Quality					2		1				2	3	3		4	5	5	7	12	7
Markets & Customer	Business model				1	2		1						2			2	1		2	1
	Safety				1					1				1							
	Quality																	1			
Operational Effectiveness	Business model	1																1		2	
	Engineering							1	1			2					2	2	2	2	
	Safety																4				
	Tests & Simulations			1		2	1		2		1	2	2		2	1	1	4	5	4	4
Powertrain	Business model					1											1	1		1	
	e-Powertrain		1	1		2				1										2	
	Internal Combustion			1		1	1	1	1	1	1	1	1	1			1	3	3	6	8
Vehicle Performance	Engineering	1				1													3		1
	Quality				1		1		2		1	4			1		1	2	3	1	4
	Safety		1	2	2	3			1				1	3	1		1	2	4	2	1

		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Electronics, Electrical Energy, Automatic	ADAS	3	4	3	1	2	3	5	10	13	10	6	7	8	12	10	16	11	18	22	33	30
	Engineering			1	2	2	1		1	3	2	1	3	4	7	7	7	4	3	8	2	3
	Quality		1			2	2		3	3	3	4	2	6	7	9	7	6	9	9	8	5
	Safety			1				1		1				3	3	2	4	2	6	5	3	5
Manufacturing & Supply Chain	Industrial system		1		1			2	1		1	2	1	3	5	1	6	2	3	1	5	1
	Process Quality		1					1	4		3	1	1		2		1	1	5	2	1	1
	Tests & Simulations	1	3	4	2	1	2	6	4	2	4	7	5	3	3	3	3	3	1	3	8	1
Materials	Quality	9	9	7	3	7	2	5	10	9	10	8	9	10	9	15	16	15	8	9	7	7
Markets & Customer	Business model	1	3	2	3	1		1	1	2	3	5	2	1	1	4	5	7	4	3	4	
	Safety		2				1			1	1					2				4	1	1
	Quality						2				1	2	1		2		1	5	1		1	2
Operational Effectiveness	Business model	1	1			1	1					1				3		1		2	1	2
	Engineering	4	2	4	2	2	2	5	3	5	1	4	5	4	8	7	7	6	3	4	6	4
	Safety		1	2		1		1	1		2		1	3		1	1	3		4	2	2
	Tests & Simulations	1	4	8	11	9	8	5	22	11	14	19	21	23	19	18	28	17	22	23	22	24
Powertrain	Business model	1	3	1		2		3	2	1		3	3	3	2	1	6	5	2	1	1	2
	e-Powertrain	1				2	3	3	3	1	4	8	4	5	11	10	11	14	16	7	8	9
	Internal Combustion	14	9	4	10	19	15	11	15	15	21	20	32	30	32	15	20	16	13	11	19	14
Vehicle Performance	Engineering	2	1		2	1		1	1	1			2		2	1	1		1	1		
	Quality	4	5	8	5	6	7	11	12	10	17	15	12	8	15	19	14	16	15	17	18	8
	Safety		6	1	2	1	2	1	1	1	1	4	3	4	1	4	4	5	5	6	4	9

3.2.1. Nature of knowledge : strategic, scientific, or technic ?

Among the 66 strategic domains created, we consider that those in the minor themes of "Safety", "Business model" and "Tests & Simulations" are not totally dedicated to "hard «scientific or technical area, but to management sciences. Thus, 30 domains of expertise are dedicated to management fields.

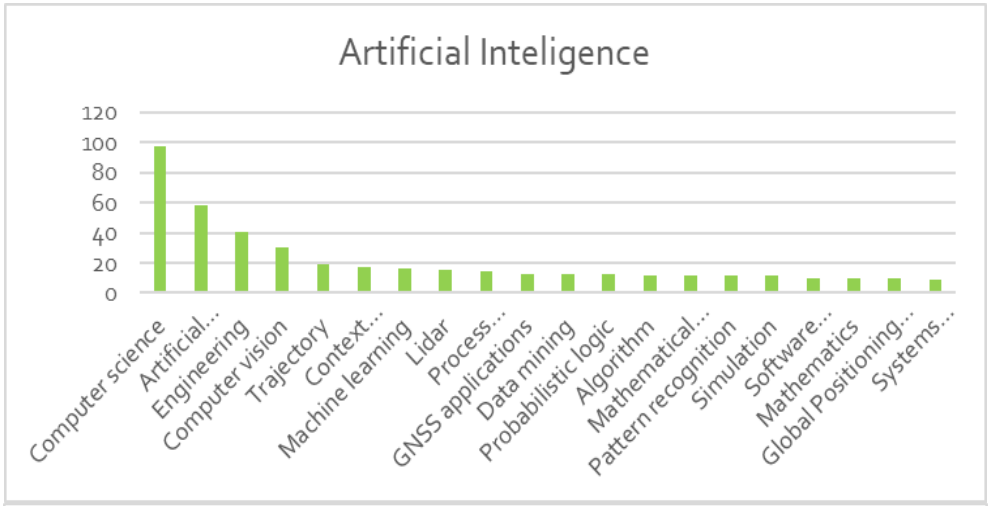
However, for all these fields, we count in total 2 442 scientific publications, which means validated by peers following a scientific review process. Thus, knowledge in these fields are recognized to be scientific enough to constitute an expertise for Renault.

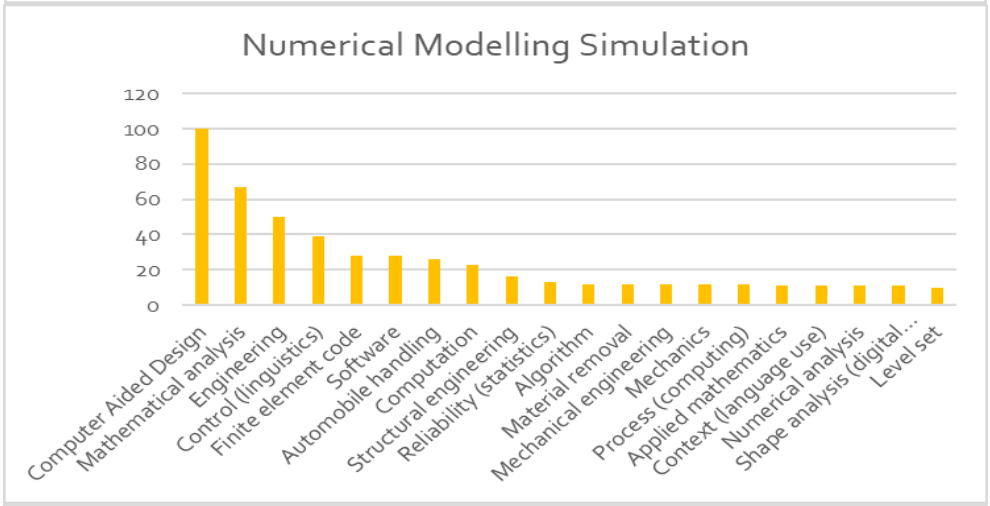
While attributing one domain of expertise to each paper was straightforward in most cases, 18 papers required a second domain of expertise, to fully encompass the scope of the themes. Many papers in "Numerical Modeling Simulation" deals with the numerical modelling of other domains, as if the "Numerical Modeling Simulation" domain was strategic for the other domains, and not directly for Renault. Others could not be link to one domain, as if they pre-exist the creation of the domain. Indeed, 12 papers were dedicated to Data management , and we know that some experts at Renault are working on this topic and considering the creation of a dedicated domain.

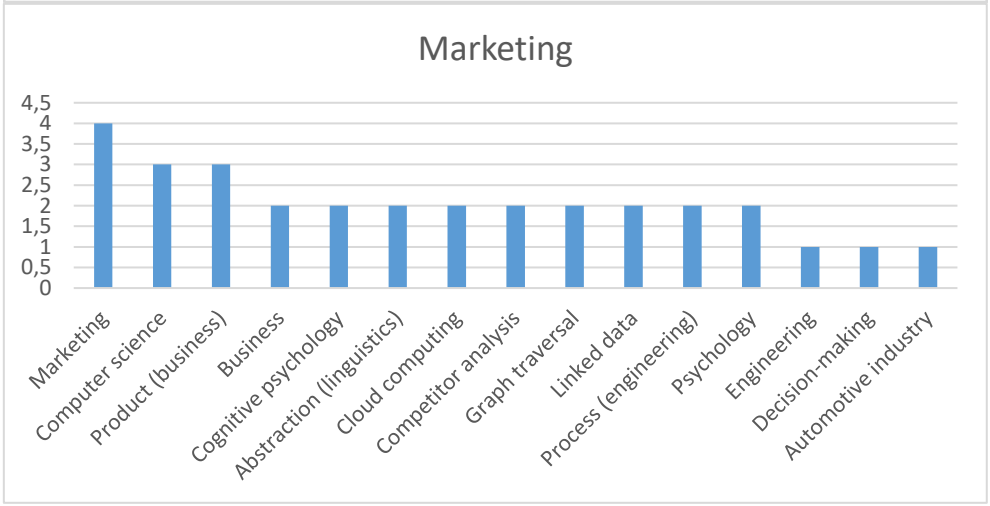
By linking these 2 442 publications to the 66 domains of expertise, the keywords of the publication became the keywords of the domains of expertise. As a keyword describes one topic in a publication, by gathering all the keywords of the publications linked to the same fields, all the topics of the field can be identified. Counting how many times a keyword appeared helps to identify the main topics of the field. Thus, the knowledge of all expertise fields at Renault can be identified, described, and analyzed. As example, the 20 most

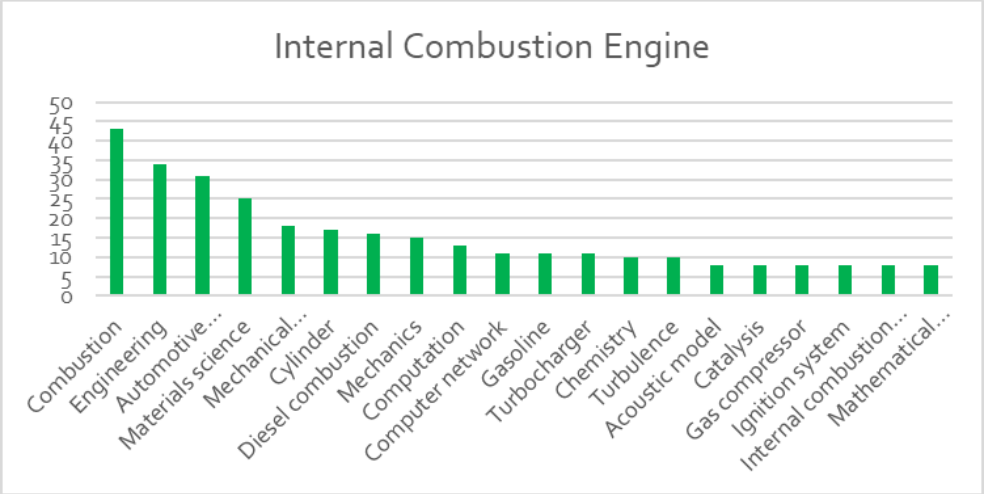
important keywords of the Artificial Intelligence, Internal Combustion Engine, Marketing and Numerical Modelling are presented in the next tables.

Table 5, 6, 7 & 8 - 20 most important keywords in the following domain of expertise at Renault









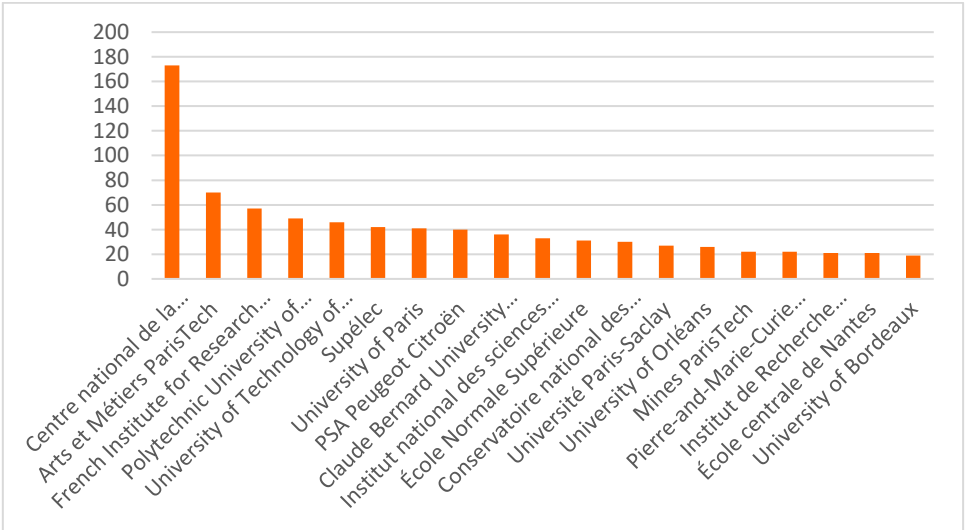
3.2.2. External acknowledgment of expert or domain of expertise

Thanks to the scientific publication, experts at Renault can be recognized by different internal and external communities of peers.

First all the papers are from the institution “Renault”. It means that at least one author per paper was/is an employee at Renault. By publishing their new knowledge, the authors at Renault wanted their expertise to be validated by external peers. This helps them first to internally make their expertise validated by performing in scientific publications, and then by other internal peers. Today, among the 10 most important authors at Renault, 6 are at the level of Expert-Leader or Expert. These scientific publications also help them to build the Renault expertise as a whole, by turning the empirical or theorical considerations into standardized knowledge

Among the 2 442 papers, some papers have a second institutional attachment. It means that some of the Renault authors worked with external authors, from other institutions. The following table shows the 19 most active institutions co-publishing with Renault. Among them 18 are universities, engineering, or business schools, and 1 is another car manufacturer: PSA Peugeot-Citroën. Thus, this external community of peers is composed as well by employees of concurrent companies, as by different kind of high education scholars.

Table 9 - The 19 most important co-publishers with Renault



In this same database, around 2 700 other papers focus on Renault's activities, without being attached to the Renault Institution, but to other institutions. Among these scientific publications, they are PhD theses. Indeed, since the creation in France of the CIFRE (Industrial Training Agreement Through Research, in French "*Conventions Industrielles de Formation par la Recherche"*) in 2000, Renault supervises around 100 theses per year with many academic laboratories, which lead to numerous scientifical publications being attached to these laboratories, while also being supervised by Renault's employees. Thus, research partnerships attached to external laboratories contribute to acknowledge the expertise of some experts. But it can also contribute to the construction and validation of the knowledge of a domain of expertise without any attached expert. In other words, external peers acknowledge that Renault have domains of expertise, sometime without necessarily a dedicated expert.

4. Discussion of the results

4.1. Duration of construction of the knowledge of an industrial expertise

10 years are required to become an expert, but how long does an organization need to construct its domains of expertise? In this case of study, between the first publication and the year of its dedicated domain of expertise formalization, the average time is 29 years. But we can also observe that it depends on the domain. Indeed, in our case study, the first publications deal with Vehicle Performance, and in 2010, 6 domains of expertise were created, which means that 55 years were needed to construct the expertise of the industry. On the contrary the first publication on Quality in EEEA appeared only in 2001, and one domain was created in 2011, which is only 10 years.

Moreover, we observe that for the most recent domain of expertise, this database counts very few dedicated publications. But we also know that some papers are missing. Indeed, for the domain Innovation Pattern, created in 2018, we count only 7 papers, and we know that at least 9 other papers are missing.

4.2. Acknowledgement of an organization's expertise

When an expert builds their expertise with scientific publications, he also builds the expertise of their company. However, we have seen that the company can also build its expertise without any dedicated experts. This is underlines by all the scientific publication focusing on Renault without being written by a Renault employee. But it means that external peers wrote these publications, which were in turn validated by other external peers. So, a double external peers validation of the knowledge occurred, which acknowledged Renault's expertise. Thus, external peers can acknowledge an expertise to an organization, without any dedicated expert.

4.3. New knowledge nature of industrial experts

Among the 66 domains of expertise at Renault, around 30 are dedicated to management. It means that the knowledge of an expertise can be other than scientific or technical. By scientific we mean not exact & experimental sciences, as these 30 domains of expertise have scientific publications, so their contents are also scientific, but related to social science.

Moreover, one of the 66 domains of expertise is cross disciplinary, as if it were more strategic for the other domains than for the company. In a paper to come, we also observe that the Innovation Pattern domain was dedicated to the other experts, and not directly for the strategy of Renault. It seems that a new kind of expertise is emerging, and then a new kind of knowledge.

Finally, we are now able to precisely model the knowledge of an expertise, and to study the past evolution through the years, by studding the keywords of the past publications.

4.4. Emergence of an unknown expertise

At Renault, the experts are in charge of promoting standard and developing the Expertise sector. The peer-reviewed scientific publications act as validated new knowledge, which then become standards, and allow to develop the expertise. In this way, after 2010, the number of scientific publications doubled: only 980 before 2010 vs 1500 after. Therefore, collaborations with industrial management scholars resulting in a scientific publication are a way to construct and develop an unknown domain of expertise, for an expert as well as for an organization.

5. Conclusion

This research highlights 4 main results: Firstly, in the case of an industrial company like Renault, it took around 29 years to constitute the first domains of expertise, but since then, new domains have been formalized in just a decade. In the case of emergent domains of expertise, we do not yet know how long will be needed for them to be fully institutionalized. In this way (second result), external peer's community can acknowledge the expertise of a company, and not only of an expert. Thirdly, all the experts in industries are not strategic and exact & experimental scientific or technical expert, they can also be expert in social sciences, and strategic for the other experts instead of just for the company. Finally, research collaborations are a way to create and reinforce a domain of expertise, both for an expert and for the company.

However, more researches must be pursued to add the missing papers, and the papers on Renault but attached to other institutions, in order to reinforce these results. Another interesting point should be to focus on how experts or external researchers bring out a research study: what kind of unknown are they facing, how do their research work is a form of exploration of this unknown, and how publication formalizes an innovant solution to respond to this unknown.

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