Contractualizing functionality

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1. Introduction

The transition to a more sustainable society - otherwise known as ecological transition - is now at the top of numerous political agendas. Here, we use the term "*ecological transition*" to refer to the *decoupling* the satisfaction of human needs from the pressures on natural and social systems generated during the economic activities required to satisfy these needs. This ecological transition must therefore be joined by an economic transition from an industrial economy to a functionality economy. It must also be supported by a sociological transition from the technical-economic approach to a socioeconomic approach of performance and value.

With a view to putting this concept of ecological transition into practice, models based on a functionality economy have been developed over the past few decades, since Giarini and Stahel published their work in 1990 (Giarini & Stahel 1990), up to the Product-Service Systems approach (Mont 2004). This work involves seeking to optimize use value above all, rather than constantly renewing the physical dimension of the capital.

The functional economy brings about a shift along four dimensions:

- production system - from focus on the technical object at the local level to the analysis of a socio-technical system integrated into the region;
- materiality - from valorization of material production to valorization of the service rendered;
- cost and benefit - from a sectoral and actuarial approach to cost and benefit to a cross-cutting, multi-criteria approach giving space also to the notion of historic cost;
- valorization structure - from bilateral transactions and financial accounting methods, to collective contractualization and analytic accounting methods suitable for incorporating the economic effects of the recognition of social and environmental values.

2. What is a service ecosystem?

Our approach attempts to strengthen the theoretical framework of the functionality economy with contributions from ecological economics. This transposition of the science of ecosystems into a service-based context makes it possible to develop the notion of a service ecosystem (Lauriol, 2007).

The service ecosystem must be distinguished first from the ecosystem service (Costanza 1998). Using the concept of an ecosystem enables consideration of a whole, rather than aiming to guarantee specific natural resources.

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The term "service ecosystem" as we intend it to be used is founded in the literature on business ecosystems which appeared for the first time in the work of Moore (Moore 1993). This analogy to the field of biology is meant to provide a better understanding of cooperation strategies in the business world. This approach illustrates the importance of both (Isckia 2011):

- Interactions (interdependence) between the companies that contribute to the innovation process, notably through the presence of the leader within the ecosystem who has the role of orchestrating the various contributions of other companies.

- Co-evolution strategies. Relationships within an ecosystem are complex and marked by the presence of both competition and cooperation, especially in terms of the distinctive relationship between the hub firm and the other connected companies. Tension is expressed by way of a certain rigidity concerning value - between shared creation of value and its harnessing.

The service or functional ecosystem appears for the first time in Lauriol, (in Heurgon & Landrieu, 2007), to confront the limit of the network concept which does not allow for sufficient consideration of the interactions of actors with the environment, but rather refers to more endogenous interactions. The notion of a service ecosystem requires consideration of new methods of transaction between the players involved.

If the functional economy is a decoupling strategy, and therefore implies dematerialization of the added value production process, then the service ecosystem is the framework of this dematerialization. The service ecosystem allows dematerialization strategy to be applied, i.e. to minimize the physical resources (materials, energy) that are consumed to provide a potential of functionalities, while maximizing the added value produced by contractualization of services rendered by these functionalities.

What differentiates a service ecosystem from a services market, in our view, is first and foremost its finality. The service ecosystem is oriented toward ecological transition by articulation of support functions that are to ensure decoupling. The influence of these support functions locally combines with that of regulations and the market. Formalizing a service ecosystem is therefore an approach of institutionalizing a process of dematerialization: the finality and the means implemented displace the concept of organization from the level of the industrial unit or its economic partners, to a more inclusive level, which is that of the service ecosystem. The relationships among actors within the service ecosystem and the rules of the law that apply to those relationships are then adapted to a more contributive rationality than that outside of the ecosystem, in the context of the local economy.

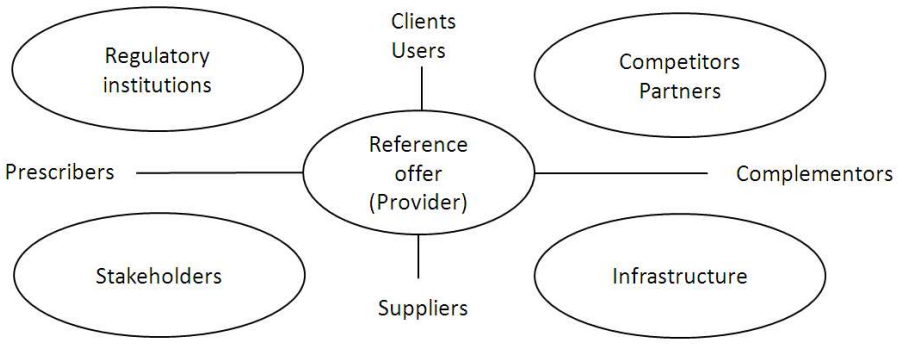

Figure 1: the service or functional ecosystem according to Lauriol, (in Heurgon & Landrieu 2007)

The service ecosystem is therefore, in our view, the objectivation of a socio-technical system of functional solution production. It encompasses industrial ecosystems and actors in a single production system characterized by socioeconomic dynamics, specific contexts and a consistency among actors' positions.

While the functional economy is an economy of intangibles, it does not extract itself from structures, equipment, management tools' hardware, etc. These elements constitute the physical dimension of the service ecosystem. A service ecosystem can therefore not be separated from what is at stake in terms of resource management (energy and materials), nor from waste concerns. Another aspect that concerns decoupling through dematerialization is related to the "rebound effect" issue. The Rebound effects accompanie dematerialization all too often, thus turning some service approaches into tools which have only relative decoupling consequences.

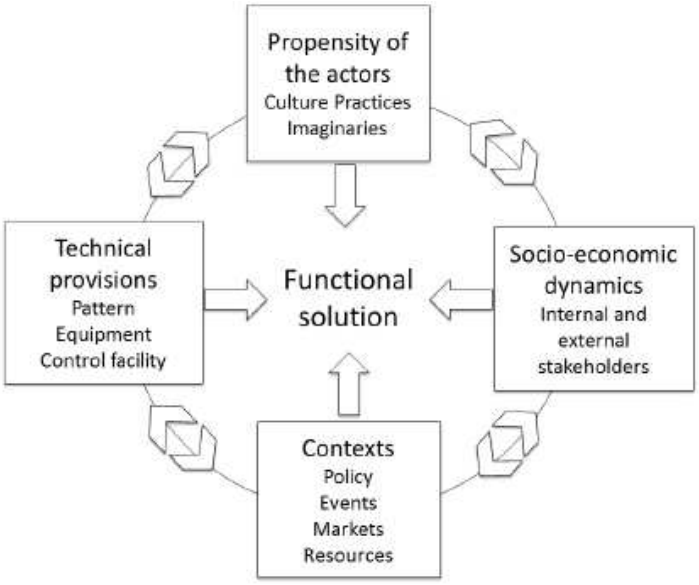

Figure 2: Functional solution in service eco-system approach

3. What is performance in a functionality economy?

Functionality production oriented solely toward added value creation is not a suitable "functional solution" if decoupling is the aim. Nor is reduction of material and energy resource consumption (a response to decoupling requirements) sufficient for qualifying functionality production of "functional solutions." There are two degrees at which the expression "functional solution" can be understood: it can be an "economic solution based on functionality," but it may also refer to an "economic solution that functions" (if you consider it as a slight play on words). Therefore a solution that is part of a sustainable service ecosystem and that is consistent with the purpose of the ecosystem. In our opinion, the term "functional solution" applies when the structuring of the service ecosystem is resilient as a whole (1), enables decoupling (2), and production of the functionalities and of added value (3)

Measuring the performance of a functionality economy must therefore be based on the analysis of these 3 hierarchical dimensions of objectives without any substitutability among

them. If one of these three conditions is not met, the solution does not qualify as "functional" according to our definition. The simultaneous achievement of such objectives enables functionality production solutions to be "found" despite the limitations of a physical world under the pressure of a dissipative economy.

For this reason, contractualization of a functional solution does not only cover the link between functionality and utility. It also applies to the structuring of the service ecosystem in its entirety. This structuring requires the consideration of shifts in cultural, sociological and organizational dimensions of the service ecosystem's performance[2].

- The performance of the service ecosystem then depends on (a) its capacity to articulate the material and cognitive means required for the joining of a functionality potential and of a demand potential related to the expression of actor needs.
- But it depends more fundamentally still on (b) its capacity to reinforce the functionality potential by a support function providing the service ecosystem with an intrinsic and autonomous capacity of qualification and documentation of the economic, social and environmental aspects linked to each facet of a produced functionality.

This capacity is needed to produce functional solutions and to valorize services provided to actors by these solutions. If negative impacts on (b) are significant, then the capacity of the service ecosystem is deteriorated and there are fewer means available to ensure (a).Contractualizing the functionality is thus contractualization within the service ecosystem of a multi-faceted performance of which the keystone is the sociocultural and organizational support function (b) guaranteeing *ex ante*, preservation of functionality production potential, i.e. ensuring resource availability by compliance with natural, social and economic system capacities.

4. What is contractualization of a functional solution?

The functional economy is founded on a non-dissipative strategy because each functionality can interest different actors for different reasons. Therefore, each functionality is a complex economic object of which each different facet should be valorized (in view of dematerialization) by identifying which actor may perceive the utility it provides as a service.

But to imagine a non-dissipative functionality economy is not only improvement of valorization of services rendered by the functional solutions, it is also improvement to the financing of service ecosystem structuring. Degradation of support functions of this structuring is intrinsically a dissipation in value which directly translates into a loss of added value and/or less-effective decoupling.

While contractualizing functionality (i.e. contractualizing a functional solution), it is necessary that in the same contract, each stakeholder commits to contributing to the simultaneous co-production of each of the 3 dimensions of service ecosystem performance (added value, decoupling, resilience).

The objective of this contractualization is to align the price allocated to the service provided due to the utility that an actor perceives in a functionality, the fees for maintaining support

[2] These shifts accompany those presented above, point 1.

functions in condition (especially documentation of advantages and impacts), and production costs for functionalities compatible with the decoupling strategy.

The functionality economy is therefore founded less on the purchase of services (exchange value) than it is on a contributive and collaborative economy aiming to ensure sustainability of functionalities that enable services (use value).

Here we propose modification of contractual polarization. The service ecosystem - formalized and therefore institutionalized - is, in our view, both the framework and the core of a collective contractualization of services provided by the stakeholders. The service ecosystem is the framework of this contractualization because socio-cultural and organizational support function that are specifically produced inside of this framework allow collaborative economy strategies that generate less competitive rationalities within. The service ecosystem is the subject of this contractualization because the contracted contributions provided by the actors to the service ecosystem aim to structure it in a resilient way, consistent with decoupling.

From there, the question of price fixing gives way to that of contribution negotiation, which leads to the question of monetary evaluation of consented efforts.

5. Representation function of money and economy of functionality

Using money to represent and give meaning to a multi-faceted value is problematic. As a consequence, and as indicated in figure 2 from Frame & O'Connor, 2011, the monetary costs and prices do not make it possible to account for the non-market and non-monetary advantages included in the use value.

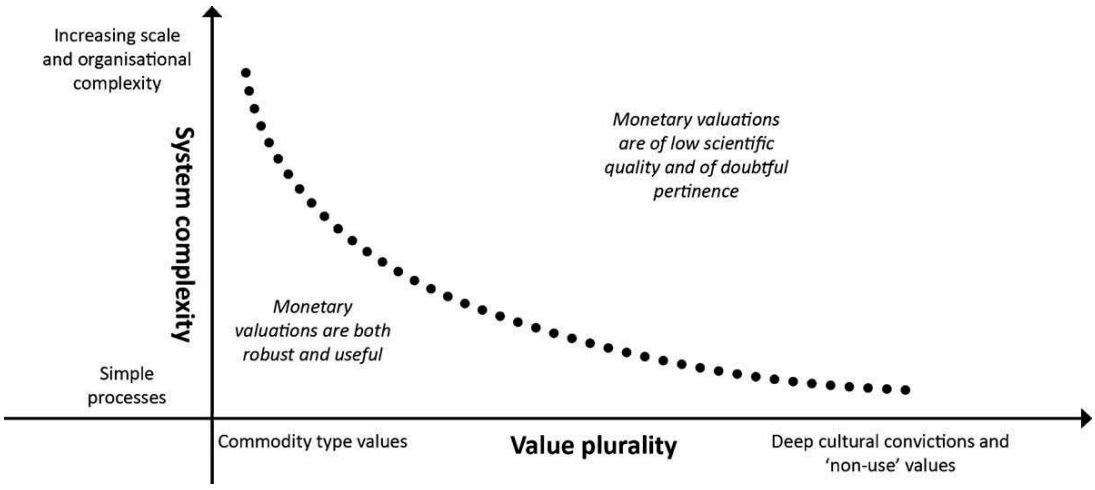

Figure 3: System complexity and value plurality, Frame & O'Connor, 2011

Monetary aggregation, considered alone, does not enable conservation of the strategic information related to the formation of the 3 dimensions of a functional solution performance that we aim to valorize.

Money allows neither signification of specific perceptions that actors have of the many uses of one single functionality, nor accounting for the diversity of the dimensions of performance

related to *ex-ante* preservation of support functions, nor does it give meaning to contractualization by informing multiple finalities of decoupling and of the ecological transition in general.

And yet, a multi-criteria approach describing the value systems at the foundation of these performances alone cannot justify a method for apportioning added value within the service ecosystem. It is even less capable of assigning a price to a functionality (which of course, is not the goal)!

Pricing the performance of a service ecosystem implies quantification of the effects in order to produce "augmented" economic information by integrating performance data in a multi-criteria economic information that is connected to, but not aggregated with monetary artifacts.

Two phases must therefore be distinguished (Morlat & Mougenot, 2014) and a contractualization associated with each:

- A monetarization, which contractualizes an agreement concerning production costs and operational means: the stakeholders of the service ecosystem agree among themselves to assign an internal cost corresponding to the formation of the service ecosystem (no intrinsic valorization of the functionalities produced);

A monetization, which can be considered the accounting trace of the contractualization of contributions (financial, organisational or operational service) made by the actors invested in the service ecosystem for the construction of a functional solution, namely the provision of functionalities from which they may draw utility while respecting the principles of the ecological transition. Contractualizing the service rendered to the service ecosystem by actors indeed results in *monetization*. The actors show in their accounts the expenses granted for the purpose of contributing to the implementation of a functional solution. The corresponding products are recorded in an accounting system that must be specifically established for the service ecosystem. And they must then agree to use the resources generated in this way to implement actions in favour of improving their own performance. There is therefore a contractual link between a co-produced functional solution, a performance target at the service ecosystem level and a physical accounting practice shown both in actors' accounts and in the accounts of the service ecosystem.

Upon monetarization, a use value was evaluated by the actors, taking into consideration the potential appearance of external effects during the functionality production process. And this monetarization will later be leading to monetization via contractualization and accounting of a contribution provided to the service ecosystem by the actors..

While there is a form of monetization following the evaluation of services furnished to the actors by functional solutions, the link is not transitive and direct. Monetization applies to operational means associated to a service rendered. And the economic advantage that the actors receive from this service can not be considered as an externality, as this service is determined *ex ante*, following a contractual agreement resulting from a negotiation, which itself is founded on a multi-criteria analysis of the use value of the functionality considered, and of the existence value of the service ecosystem as a whole. Contractualising the contribution to the service ecosystem does not begin with monetization. It leads to monetization.

Each stakeholder, in his contract with the service ecosystem, orients the contribution he consents to provide towards the service ecosystem as a whole. Even if the stakeholder’s

interest in the framework of his own economic activity only contributes to the availability of a use provided by one of the dimensions of the functional solution, the service ecosystem needs to insure its resilience as a whole to produce this solution.

6. Use value andcontractualization: a need for mediating artifacts

The first consequence of this role given to money is an increase in the position of use value in relation to a non-formalized market of services: in the framework of a service ecosystem, economic information formally integrates use value and even exceeds it. If societal contextualization data and data related to the structure of the ecosystem itself are added to the economic information, it becomes strategic information, oriented toward a specific finality, which in this case is the improvement of contractualization for decoupling capacities.

The second consequence of this role given to money is that it changes the representation of productive capital. By orienting the construction of economic information toward finality, and by giving it three strategic dimensions of performance (resilience, decoupling, added value), the cognitive capacity to understand this information takes on a productive dimension. Yet it is necessary to be able to integrate data to contracts so that services can be positioned within the different dimensions of service ecosystem performance. Since the service ecosystem is institutionalized, and it generates functionalities, a productive value may be assigned to it. And since the resilience of the service ecosystem depends on contractualization of services and contributions, a contractualization capability may be formalized within the productive valuation process. The contractualization capability also requires objectivation in order to be preserved.

This contractualization capability comprises demand asset knowledge, functionality asset knowledge, knowledge of support functions ensuring preservation, resilience of decoupling as well. It also demands experiential content that makes it possible to link these different facets into one efficient contractualization. This experiential content includes recognition and practice of mediating artifacts (Zacklad 2007) around which the dialog constructs an economic rationality specific to the functionality whose production we wish to catalyze. We understand the concept of a mediating artifact to mean a group of physical vectors and mental representations that enables the spreading of advantages created by functionality to all stakeholders of the service ecosystem.

As an example, the sale of transport services by an enterprise may correspond to an intermediate producer consumption, to a remuneration in kind paid by an employer, to social benefits in kind provided by a government, and purchases by a household does not receive a refund. The artifact used here illustrates the relationships among stakeholders, qualifying it using a recognized economic terminology. Another artifact used may be qualification of the physical dimensions that enable the transport function. And other artifacts aiming to problematize the decoupling logic and make it visible may be associated with this artifact.

The accounting mentioned above is also a mediating artifact because it enables association of an expense with preservation of a set of performances. Financial and extra-financial accounting benchmarks enable a meta-representation of the patterns and flows of collaborative valorization, as well as of the criticality points inherent to the various dimensions of a project (Morlat, 2014).

But objectivation of a contractualization capability is temporary by definition: because a single functional solution can interest various actors for different reasons, its use value is therefore always relative. And for one single reason of interest - i.e. a single perceived utility - the singularities of actor perceptions and their relationship to the return on investment time make each service ecosystem a unique valorization framework in perpetual evolution.

Another category of artifacts must therefore come into play in order to help contractualize in this complexity. Since each service ecosystem is unique, functionality valorization should not be considered using a normative approach of values and performance. However, evaluation practices could be normalized. The multi-criteria tools designed to assist decision-making by promoting shared representation of the issues (Frame & O'Connor 2011) are intrinsically mediating artifacts, and their use has the specificity of generating new mediating artifacts (shared representation of the issues).

The same logic applies to the methodological distinction between monetarization and monetization proposed above. This distinction is in itself a mediating artifact and it uses negotiation to generate augmented economic information which is intrinsically a mediating artifact if it is recognized as necessary for contractualization.

7. Conclusion

The functional economy is inspired by the ecological economy. A focused, transitive and direct evaluation of the utility of a functional solution for an actor is not enough for contractualization of a functionality.

To us, "use value" can not be perceived without tangible representation of support functions that ensure a contractualization capability of the three dimensions of performance (resilience, decoupling, added value) that are needed to insure the production of functional solutions within a service ecosystem. Those dimensions of performance must be reached simultaneously, and without any possible substitution among them. That could support the idea that a weak notion of sustainability is akin to a loss of financial profitability!

Functional economy therefore represents incredible breeding grounds for contractual eco-innovation. While these perspectives bode well for equipping decoupling in a material sense, they are even more promising when it comes to encouraging a culture of decoupling, or at least we hope this to be the case.

The functional economy includes fundamental principles of the ecological economy, such as the systemic approach, the non-substitutability requirement of production factors and notions of non-linearity, criticality and therefore of thresholds whose consideration encourages resilience of the support functions. Development and understanding of the functionality economy can inspire all spheres of the economy and society. The functional economy is also intrinsically one of the mediating artifacts that could facilitate the spreading of new representations of the world, which are necessary for ecological transition.

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