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The Functional Economy

A Critical Review of the Model Based on Case Studies and a Consumer Survey

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Academic year 2020-2021

Abstract

Although the concept of functional economy, i.e. the idea of using a product as a service rather than owning it, has been around since the 1980s, the model still plays a marginal role in the overall economy today and a key question is to understand the reasons why. More specifically, the objective of this thesis is to derive a sound conceptual framework, to understand the underlying conditions for the model success or failure and finally, to examine the current attitude of consumers towards the environment and the functional economy concept. This is addressed by (i) presenting a review of the literature on the subject, (ii) an analysis of several case studies and (iii) the results of a consumer survey. The conclusions identify three main elements: (i) a lack of clear practical guidelines in the theoretical framework of the functional economy model, (ii) the existence of specific business characteristics that favor or not the model implementation and (iii) the current relative reluctance of many consumers to at least some of the model practical applications.

Foreword

Je tiens tout d'abord à remercier ma promotrice, Madame le Professeur Marie-Paule Kestemont, pour son temps et ses conseils avisés.

Je suis également extrêmement reconnaissant envers toutes les personnes qui ont consacré le temps nécessaire afin de répondre à l'enquête. Leur participation m'a été d'une grande aide dans la réalisation de ce mémoire.

Merci finalement à ma famille pour leur soutien inconditionnel tout au long de mes études.

Table of Contents

Introduction 1

Chapter 1: The concepts of circular economy, functional economy, Product-service system and industry 4.0.: A theoretical framework 3

1.1. Context of emergence 3

1.2. Introduction to the main concepts 3

1.3. Similarities and differences between CE & FSE 6

1.4. Similarities and differences between FSE & PSS 7

1.5. Objective of the model: the three pillars of sustainability 8

1.5.1. Environmental sustainability (“Planet”) 8

1.5.2. Economic sustainability (“Profit”) 9

1.5.3. Social sustainability (“People”) 10

1.6. Industry 4.0. as enabler of FSE 11

1.6.1. Industry 4.0 and economic sustainability 12

1.6.2. Industry 4.0 and social sustainability 12

1.6.3. Industry 4.0 and environmental sustainability 13

1.7. FSE stakeholders 13

1.7.1. The private sector and the adoption of a new business model 13

1.7.2. Not-for-profit sector and organizations 14

1.7.3. The public sector as supporter or disruptor of the model 14

1.7.4. The consumers and the adoption of a new consumption model 15

1.8. Exogeneous factors influencing the transition towards FSE 15

1.8.1. The geographical area 16

1.8.2. The sector or industry 17

1.8.3. The business type 17

1.8.4. The type of organization and the organizational structure 20

1.9. FSE-related indicators 21

1.9.1. Three metrics to measure performance 22

1.9.2. Micro, meso and macro-levels indicators 23

1.10. Opportunities versus barriers to the model 24

1.11. Summary, conclusions and next steps 26

Chapter 2: Functional economy: a case studies analysis 28

2.1. Introduction 28

2.2. Objective of the grid analysis 28

2.3. Methodology 29
2.3.1. Description of the grid analysis 29
2.3.2. Explanation of the scores assigned to the “FSE main criteria” grid 33
2.4. Limits of the method 36
2.5. In-depth description of some case studies 36
2.5.1. Bicycle sharing in China 37
2.5.2. Brazilian olive oil case 38
2.5.3. Caterpillar remanufacturing strategy 39
2.5.4. Decathlon renting service 42
2.5.5. Michelin Fleet Solutions : Truck tires 44
2.5.6. The failure of MU by Peugeot: vehicles renting service 45
2.5.7. Xerox asset management program: printer leasing 48
2.6. Results and interpretations 50
2.7. Conclusions 54
Chapter 3: Survey on the attitude of consumers towards the functional economy 56
3.1. Introduction and objective pursued by the survey and the model analysis 56
3.2. Methodology followed to conduct the survey: five steps 57
3.2.1. Questionnaire structure 57
3.2.2. Questions development 58
3.2.3. Choice of the respondents/sampling 58
3.2.4. Sending of the questionnaire and follow-up 59
3.2.5. Data check, collection and processing 59
3.3. Limits of the survey methodology 59
3.4. Short presentation of the questionnaire 60
3.5. Results of the survey, analysis and conclusions 61
3.5.1. The socio-demographic variables 61
3.5.2. Attitude and opinion about environmental issues 62
3.5.3. Attitude and opinion about the functional economy 64
3.5.4. Some possible market offers: four case studies 67
3.5.5. A cluster analysis of the data 72
3.5.6. Summary of the key results and interpretations 74
3.6. Some general conclusions, remarks and comments 76
Conclusion 77
Appendix 81

Appendix: chapter 2 82
Appendix: chapter 3 87
Bibliography 115

The Functional Economy:

A Critical Review of the Model Based on Case Studies and a Consumer Survey

Introduction

Nowadays, there is an ever-growing awareness and concern worldwide about the shortcomings of our current global economic system and its sustainability. As a matter of fact, our present-day production and consumption patterns that emerged progressively from the first industrial revolution in the 19th century and their evolution since then are more and more questioned by an increasing share of the population, especially the youngest, with the support of some well-known non-governmental organizations. They urge governments to take appropriate actions and companies to change their business model. In the meantime, themes such as limit to growth and decreased resource consumption are more prevalent than ever in public debates along with related social issues.

This encouraged many scholars and others to look for and propose alternative economic solutions aimed at addressing those environmental issues. Among the myriad of theories frequently put forward, the "functional economy" concept appears undeniably as one of the most promising approaches. In a nutshell, this theory developed since the 1980s advocates for the implementation on a large scale of a viable economic model based on product use as a service rather than purchase and ownership. This aims primarily to optimize the consumption of resources by moving away from our current production and consumption habits in favor of new concepts such of product life extension and sharing for instance. Later, the social dimension became an integral part of the model framework as well.

The concept is obviously not new since businesses all over the world have already proposed solutions such as leasing or rental contracts in various contexts for a long time now. However, the functional economy model still seems to represent a marginal share of the overall economy today and one of the main objective of this thesis is to understand the reasons why. Is it due to the attitude of businesses, governments, consumers or maybe a combination of them all or intrinsic difficulties inherent to the model?

Keeping those questions in mind, I think that a first major step is to get acquainted with the current theoretical framework offered by the functional economy as well as assess its links, similarities and differences with other closely related concepts such as the circular economy or the product-service system. This leads me first to present a broad review of the existing literature on the subject in order to define its underlying principles, objectives, methodology, implications for stakeholders, key success factors and limits. In the end, the most important

question to answer is whether the model proposed can really be sustainable not only from an environmental, but also from an economic and social perspective.

I also strongly believe that it is essential to get a more practical understanding of the functional economy model which is why I decided to analyze a broad range of case studies and to conduct a consumer survey.

Firstly, I want to figure out in a practical way the underlying conditions for success and reasons for failure in implementing the functional economy model. Indeed, I think this is essential in order to better understand the actual development stage of the model. For that purpose, I decided to apply a grid analysis to various case studies that are potentially in line with the concept. I thus start by assessing their performance on a set of predetermined dimensions/criteria drawn from my previous theoretical learnings and my review of the cases. I then classify the cases according to some of their specific characteristics that I consider relevant in this context. As a result, this approach aims to identify which cases are more likely (in relative terms) to implement the functional economy model in a successful way.

Secondly, I focus more specifically on consumers as I do think that they can act as a main driver of the transition towards this model provided that they overcome some barriers. This led me to conduct a survey on the subject in June 2020 and to perform a statistical analysis of its results. This way, I first want to assess the general interest and attitude of respondents regarding environmental issues. In a second step, I try to evaluate their familiarity with the concept of functional economy as well as their attitude towards it. Thirdly, I test their degree of interest in some practical solutions applying the model as well as their readiness to adopt them on the basis of four market applications. My objective is to establish potential (statistical) relationships among each of those aspects and stress the underlying factors shaping their perception and attitude. Finally, I perform a cluster analysis to identify the profile of the respondents who are the most likely to be interested in the functional economy.

Therefore, this thesis pursues a dual objective: theoretical and practical. By means of a literature review, it first aims to provide a sound conceptual framework in order to better understand the functional economy principles. On this basis, it then seeks to assess some practical aspects of the model by adopting two different but related angles. Ultimately, the empirical results of the study can be confronted to the theory and some practical lessons can be drawn. I hope this exploratory work on the functional economy model can bring some relevant insights to further address our current environmental challenges.

Chapter 1: The concepts of circular economy, functional economy, Product-service system and industry 4.0.: A theoretical framework

1.1. Context of emergence

In 1986, Walter Stahel, a Swiss architect, wrote about the context at the time in his book "The Functional Economy: Cultural and Organizational Change". He claimed that back then, we experienced increasing natural resources scarcity resulting in high price volatility, growing population along with the rise of the middle-class (hence increasing global consumption), strong inequalities regarding the distribution of resources (at the expense of the developing world) and lastly, saturated goods markets in industrialized countries generating overcapacity (Stahel W. R., 1986). Most of his statements are still in line with the current situation and some trends have even been hastened since then. As an example, according to the 1998 UN Development Program report, 20% of the world population consumes more than 80% of the world resources. All of this leads to increasing struggle and competition to acquire resources at the business and national level, and can often be a source of (political) tensions, or even turning into war (Maxwell, 2000). On the other hand, we are experiencing tremendous technological progress and R&D advances which give room for improvements and bring hope for humanity to thrive in the future. Indeed, this provides many opportunities to build a brighter and more sustainable world for the upcoming generations, despite the environmental challenges and issues we face today, notably due to our human activity.

This is why many scholars stemming from various fields and areas are rethinking our current economic model and contemplating/proposing new, more sustainable solutions to be implemented for businesses and organizations worldwide. The topic has also gained attention in public opinion since more and more individuals feel concerned and eager to act at their level as well. The main purpose of this chapter is to introduce, in a theoretical way first, one fundamental approach (along with other important related notions) to build a sustainable future on: The Functional Service Economy.

1.2. Introduction to the main concepts

Since the beginning of the first industrial revolution at the end of the 18th century, our world has grown in line with a so-called "linear economy". This economy is based on a logic of mass production supported by large amounts of resources (e.g. raw materials, energy, etc.) along with maximization of sales and discard of goods at the end of their life according to the

controversial principle of "planned obsolescence[1]". This was long considered as the best means to create value while increasing global wealthiness and has largely contributed to the emergence of the world we experience today. Given the current environmental (e.g. limited natural resources, climate change, etc.) and social (e.g. growing population) issues though, this model obviously encounters huge problems which make it unstainable for the future.

Therefore, an increasing number of theories have arisen since the 1970s and until recently in order to address those significant challenges and rethink our economy by shifting towards a new, more sustainable model. I show graphically[2] the emergence and evolution in time of each of those concepts below in figure 1.1.

First, the circular economy (CE), which was first introduced by Walter Stahel who coined the term "cradle-to-cradle" back to the 1970s, is one of the most prevalent one (Ellen MacArthur Foundation, Schools of Thought, 2013). The CE model was pioneered in striving to mitigate the environmental burden of human activity on our planet and has inspired many other theories that have been developed in the aftermath to tackle similar issues and can be encapsulated under the term of "Servitization[3]". Some examples following this trend towards providing a higher degree of services in the economy are the sharing economy, the collaborative economy or the eco-design, to name only a few.

Moreover, among those theories the functional service economy (FSE or FE) or performance economy (PE) has emerged in the 1980s once again driven by the works of W.Stahel (see graphs[4] of figure 1.1. above) and has gained momentum since then. This concept shares the same theoretical principles as the circular economy while proposing a more practical solution

[1] Planned obsolescence describes a strategy of deliberately ensuring that the current version of a given product will become out of date or useless within a known time period. This proactive move guarantees that consumers will seek replacements in the future, thus bolstering demand. (Investopedia, 2020)

[2] In this section, I will make use of both the Google Books Ngram Viewer and Google Trends to characterize the period of emergence and the evolution in terms of prominence over time of each key concept I allude to. Those two distinctive Google tools provide graphs in such regard by relying respectively on books for the Ngram Viewer and web research for Google Trends to spot the word or set of words in question. The time frame offered by the former allows however to go back further than the latter. Google Ngram and Google Trends yield the same general conclusions and I only report here the data from Google Ngram.

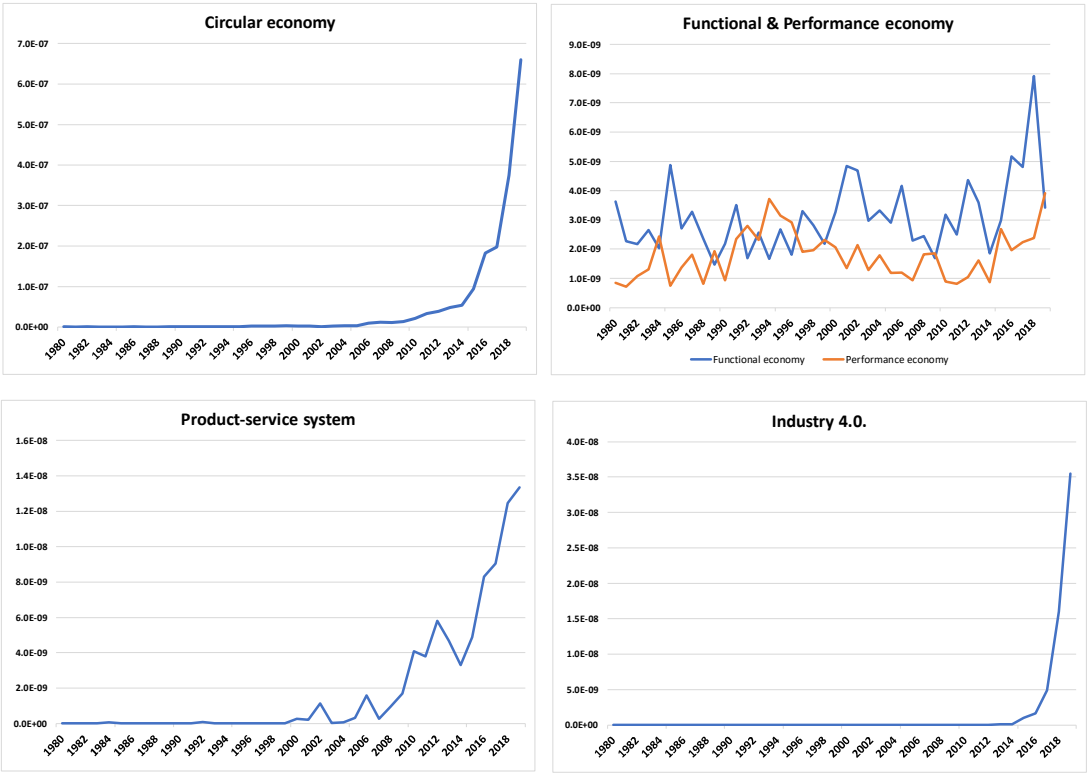
[3] A process of building revenue streams for manufacturers from services. (Baines et al., 2009)

[4] Those two graphs referring respectively to the terms of "functional economy" (FE) and "performance economy" (PE) which are synonymous in this context, follow ambivalent trend curves. This can probably be explained by the fact that those terms refer concurrently to other trends which have nothing to do with the background of this thesis but are mixed up with it by both above-mentioned Google tools.

for the economy based on services. In other words, the FSE is considered as one of the possible means to ensure the shifts towards a CE (Mont, 2002). To do so, the FSE draws on another closely related concept called Product-Service System (PSS) that I will also develop at length later on. Finally, this transition is supported by the Industry 4.0, associated with the advent of the fourth Industrial Revolution[5]. It refers to a recent trend dating back to about 2014 and draws on the growth of digital technologies. Initially, it sprang up for industrial purpose before spreading to every aspect of society (Epicor, 2020).

Figure 1.1. Graphs showing the emergence of the functional economy and closely related concepts based on Google Book Ngram Viewer:

Source: Google Books Ngram Viewer English (2019) smoothing of 0



For the sake of this work, the scope covered will primarily revolve around the Functional Economy model while I will also consider all the interrelated concepts relevant to its

[5] The Fourth Industrial Revolution can be described as the advent of "cyber-physical systems" involving entirely new capabilities for people and machines. While these capabilities are reliant on the technologies and infrastructure of the Third Industrial Revolution, the Fourth Industrial Revolution represents entirely new ways in which technology becomes embedded within societies and even our human bodies. (Schwab, 2016)

existence. In that regard, it is also worth noting that the terms “performance economy”, which constitutes the title of probably one of the most prominent and complete publication of W.Stahel (Stahel W. R., 2006) on the subject, and “Functional Economy” will be used interchangeably due to reasons emphasized by the author himself. In turn, the overarching goal of this first chapter is to provide the reader with a thorough understanding of the existing literature on the subject.

1.3. Similarities and differences between CE & FSE

As mentioned below the CE and the FSE share mostly the same principles, partly due to the prominent figure, W.Stahel, they have in common. Thus, two of the most fundamental concepts of CE are the “closed loop” and the “3R[6]’s” models that aim to limit the amount of resources spent and energy used. In this respect, it proposes basically that end-of-life products which were usually discarded in the previous linear model are rather reused as much as possible by means of various sustainable product management techniques including recycling, remanufacturing and repair. Subsequently, the product can be remarketed and resold to another consumer. This way, it contributes to reduce waste and pollution (i.e. negative externalities) discharged into the environment (Sidoli, 2013). At that point, a clear symbolic analogy can be made with the mass conservation principle established by Lavoisier in the 18th century who stated: “nothing is lost, nothing is created, all is transformed” (Lavoisier, 18th).

Similarly, the FSE also aims at reducing the environmental impact weighing in on resources while embracing a more advanced economic dimension in its reasoning. Indeed, the environmental sustainability should not be guaranteed at the expense of economic growth and profit according to the vision of FSE. In line thus with the growing trend of “servitization” it belongs to, FSE puts forward the notion of providing services beyond selling only the good itself. In that respect, it proposes a model based on the use or function of the product[7] rather than its purchase by consumers. Put differently, the goal of FSE is to provide users with the expected result or performance derived from offered services, hence the synonymous designation “performance economy”. For instance, it may take the form of either a renting or leasing service proposed by a company for its products in exchange for a fixed fee (e.g. monthly). This transaction could be eased by the implementation of a “sharing platform” (e.g.

[6] the “three R's” of sustainability: reduce, reuse and recycle (O'Gorman, 2013)
[7] A product as defined in marketing is any good, service, or idea that can be offered to a market to satisfy a want or need. (Lumen, 2020)

bike-sharing, car-sharing, etc.) aiming to facilitate the transfer of the product from one user to the next one, but it is not necessarily the case. Indeed, it could also consist in the deposit of the product back to the owner (intermediary) at the end of its use and its subsequent provision to another user after check and potential refurbishment. Whatever the solution chosen, it is only a matter of autonomy level let to the user. Taken to its logical extreme, it entails the simultaneous usage of products by several users at once (e.g. shared vehicles).

It then questions and dismiss the actual model based on product ownership and mass production while rather fostering businesses to extend the product lifecycle for the longest possible period (Stahel W. R., 1986). Therefore, the producer keeps the ownership of its product through the whole lifecycle according to the principle of Extended Producer Responsibility (EPR). This way, it is incentivized to offer sufficient maintenance services to its customers and to deal with the end-of-life of its products appropriately. Moreover, the producer can then share the responsibility born for the risk and waste with the other actors of the supply chain in way they deem fair. A direct consequence of this approach-by-services is the resulting reduction of potential negative externalities on the entire supply side. Though, it implies a major shift to occur in businesses' mind regarding their perception of value creation: from increasing quantities produced through scale economies to improving quality of products through scope economies and rather maximizing the number of users (Fahy, 2020).

1.4. Similarities and differences between FSE & PSS

Another important term that popped up in the 1990s and has developed along with FSE since then relates to the notion of Product-Service System (PSS). Although FSE and PSS appear as being close to each other as the names suggest, and both draw on the same theoretical framework set up earlier by the CE, they should not be confused however since they consist in complementary and intertwined but distinctive approaches.

Indeed, PSS is defined as "an integrated offering of products (tangibles) and services (intangibles) that deliver value in use" (Baines et al., 2009). From there we note that PSS captures the notion of using a product rather than selling it while providing quite a few extra services as well. In practice, the implications of both models on the way to conduct business seems similar. Conceptually though, PSS is characterized by the fact it is centered around satisfying consumer's needs besides merely *environmental* (CE) and *economic* (FSE) concerns encountered until now. PSS brings thus the social dimension to the fore which comes along with the two others to form the so-called three interdependent pillars of

sustainability[8]. I will come back more deeply to that point at a later stage. Another important point is that PSS, as opposed to FSE, should not be considered as sustainable "by nature" but should rather be designed for that purpose (Dal Lago, 2017). This is notably due to the potential "rebound effects" when an increase in resource efficiency does not necessarily involve a reduction in resource use since stakeholders tend to overuse them because of their greater abundance (Binswanger, 2001). From a more technical perspective, PSSs can be classified under 3 types: Product-oriented PSS, use-oriented PSS and result-oriented PSS (Lingegård, 2019). However, it turns out that the FSE encompasses only the last two items mentioned above since the first one is not assimilated with sufficient level of services to meet FSE principles. In that sense, I can thus claim that PSS refers to a wider notion than FSE (Van Niel, 2014). Though, other actors regard PSS merely as a support to FSE such as in the framework of "TURAS", a forward-looking project on urbanism, where it is stated that PSS "integrates the various strategies aimed at moving towards a functional economy" (Van Den Abeele, 2014).

1.5. Objective of the model: the three pillars of sustainability

The overarching objective of FSE is to bring about sustainability regarding what it considers as its three fundamental and interrelated dimensions (environmental, economic & social), the so-called "three pillars of sustainability". Indeed, the presence of each of those 3 interrelated dimensions is key for the FSE model to be considered as potentially successful. It means that if one of them is missing the model cannot be considered as viable (University of Wisconsin, 2020). In the following part I will develop more at length each of those three aspects separately before explaining the links that can be established among them.

1.5.1. Environmental sustainability ("Planet")

Since FSE is based on principles drawn from the CE, it seems obvious that the environmental aspect makes naturally part of FSE agenda. Indeed, one of the fundamental building blocks of FSE according to the definition given by W.Stahel is to optimize the use of resources and existing wealth through appropriate lifecycle management, from the production phase to the product end-of-life (Stahel W. R., 1986). The induced goal is to mitigate the potential negative externalities on the environment stemming from business activities (e.g. pollution, CO2 emission, waste, etc.). This last point is only made possible as long as the producer

[8] From that point, the term "sustainability" is understood as encompassing the environmental, economic and social dimensions together. In order to distinguish the first dimension from the two others, I will name it the "environmental sustainability".

keeps ownership of its product and hence "internalizes" the responsibility and risks related to its consumption. According to this theory, another important condition to protect the environment would be the decentralization of the value chain[9] which would be much more localized compared to the former linear economy. This sustainable strategy where economic growth happens to be decoupled from increasing resource consumption has been called "eco-efficiency" by the World Business Council for Sustainable Development (WBCSD) which introduced the term in the early 1990s.

1.5.2. Economic sustainability ("Profit")

However, the model cannot be considered as sustainable unless it brings a certain level of competitiveness and profitability to companies since otherwise, they have no incentives to embrace it. So, FSE relies on basic principles which are similar to any other viable economic model: a demand or at least a need stemming from the market, the provision of a good or service with a value added that could arise from innovation or any competitive advantage, the aspiration to establish a strong customer relationship (CR) and/or customer loyalty which is even more essential than in the traditional model given the prevalence of services, an efficient cost management, etc. On top, businesses can also draw on specific features stemming from FSE: First, the idle capacity of production can be reduced, notably through an effective integration of the supply chain (i.e. upstream and downstream) and sharing of machines and infrastructures among a part of or the whole industry. This is of course easier to carry out in local markets (as preached by FSE) but it should also be achievable to some extent at a larger scale. Moreover, companies can more easily decrease the volatility and uncertainty regarding their revenue stream since the FSE proposes a model based on fixed fees paid per period by users in exchange for the services provided along with the good. Finally, as in every other model, FSE requires the implementation by businesses of relevant analytical tools in order to measure accurately their economic performance, perform the relevant analyses (e.g. Net Present Value analysis, etc.) and take the proper strategic decision if need be. From the existing literature and case studies, we find that FSE generally requires a significant initial investment, which is usually the main reason companies are reluctant to adopt the model (Reim & al., 2017). In the long-term though, FSE can lead to large profits, due to access to more advanced and efficient infrastructures as well as synergies coming out from fruitful

[9] At that point, the terms "value chain" and "supply chain" are understood indistinctly, whatever the external or internal features related to the notion. A distinction will be established in due time.

partnerships within or outside the industry[10]. Furthermore, companies can rely on economies of scope and (resulting) improved product quality to decrease their production costs and increase customer satisfaction at the same time (Dente, 2013). In the next section, I will come back to this last point more extensively, while emphasizing the social dimension this time.

1.5.3. Social sustainability ("People")

Lastly, the transition towards FSE also requires businesses to deeply reflect upon the potential effects this will have on people, besides merely customer's needs and satisfaction considerations naturally embedded in their vision. In other words, FSE businesses should endeavor to benefit the larger society in the sense of all communities surrounding them. So, it starts from its consumers and employees whom it should offer fair wage and suitable working conditions for instance and extends to every citizen that is impacted by its activity in one way or another. I consider two distinct types of impacts from a business on citizens: direct and indirect.

First, FSE allows businesses to bring a more complete offering to consumers through higher levels of customization and differentiation compared to high standardization in the linear model. It then provides more flexibility to answer individual customer needs which in turn can lead to higher customer satisfaction and loyalty. In addition, FSE can contribute to enhance CRM as a result of tighter bonds with customers. This is strongly eased by the alleged local, decentralized feature of the FSE model which tend to reduce geographic and psychological barriers faced by consumers.

Secondly, businesses in line with the FSE transition will have a direct impact on people they employ, especially in the traditional product-oriented sectors but not only. This will touch on their function as many jobs will be made redundant due to automation. Though, this should be partially offset by the need for new technologically-skilled workers, mostly at a local/regional level. In that sense, appropriate (online) trainings should be provided both by private and public sphere to allow people to redirect and master those new skills & competencies and hence conform to the new economic/business models (Umachandran, Jurčić, Della Corte, & Ferdinand-James, 2018).

Thirdly, every citizen as part of society will be indirectly impacted in some way. Indeed, the urbanization and transport sectors, the healthcare system or the energy industry are as many

[10] Sempels, (2016) cited in Tilmans & Bulpa (2017-2018).

examples of fields impacting our daily life and in which FSE and related businesses are trying to innovate and bring valuable progress for the future. In chapter 2, I elaborate on this idea by considering various related case studies.

1.6. Industry 4.0. as enabler of FSE

In order to achieve this transition, the FSE is supported by a broad phenomenon called "industry 4.0" which emerged around 2014. The industry 4.0 refers to "the rise of new digital industrial technology" as described by BCG, a leading consulting group, in a report published in 2015 (BCG, 2015). Following the third industrial revolution of telecommunication and computing (ICT) on which it is built, industry 4.0. is associated with the fourth industrial revolution of smart technologies such as the Internet of things (IoT), Big Data, Cloud computing, artificial intelligence (AI), machine learning, among others. It intends on keeping on with bridging physical, human and digital assets together through ever more automation and interconnectivity among them and what is called "cyber-physical systems" (i-scoop, 2020). The term was first unveiled in 2011 at the Hannover fair by the German Government[11] before spreading and becoming widely adopted abroad since then (Pfeiffer, 2017). Its scope of application was originally limited to the strict production process referred as the Industrial Internet of Things (IIOT) but then expanded to fit the entire value chain and every business function fulfilled or services provided by an organization (Rojko, 2017). This explains why today we hear about this concept in fields as varied as public transportation, urbanization or healthcare. This latter point forces us to be careful with the definition of industry 4.0. we use.

This significant shift already had and will certainly continue to have huge implications on the development of FSE in the future. Indeed, the advent of those new smart technologies is likely to influence the FSE model on every aspect, whether on the production side through major effects on the manufacturing process or more generally on the value chain, or on the service side or both together. What I will now try to demonstrate is how the FSE can draw on industry 4.0. to achieve its objective of sustainability. Indeed, it turns out that the issues they are both covering and try to address simultaneously touch on the same three fundamental and interrelated dimensions: economic, environmental and social. This means both concepts seek to achieve the same objectives although adopting distinctive approaches: industry 4.0 is based on technology while FSE on services. Nevertheless, it appears from that statement that their fate is inherently bound and there are strong interactions between those two trends. Industry

[11] It referred to the trend of making the German manufacturing industry more competitive.

4.0 can thus be considered as a fundamental enabler of the transition towards a sustainable service economy through a myriad of smart technologies linked to IoT, notably (Vrancken , 2019). In that sense, I will now assess to which extent those three pillars of sustainability can be related in each context and how one can support the others.

1.6.1. Industry 4.0 and economic sustainability

First, industry 4.0. obviously considers economic sustainability as a basic principle, so does FSE. Since industry 4.0. was initially designed with a view to enhance productivity, efficiency and flexibility of production processes and in turn, economic growth, it strongly complies with the intent of FSE to optimize the use/function of products through resource efficiency and lifecycle management (European Commission, 2017). This shared vision includes the important matter of integration and collaboration within the value chain, once again made possible through the panel of smart technologies provided by industry 4.0.

1.6.2. Industry 4.0 and social sustainability

From a social standpoint, industry 4.0. will clearly contribute to the transition towards FSE. First directly because the new skills and competences required will have a strong technological inclination, just as the whole society of the future. Most jobs will then require very complex skills to be acquired through advanced trainings, leaving few spaces available for unskilled workers. For those who are able to adapt though, it seems the balance will be favorable as shown in a study published in 2015 by BCG which forecast an increase of 6% in the German industrial employment within ten years due to the economic growth triggered by industry 4.0 (BCG, 2015). Industry 4.0 also comes along with the growing trend of decentralization and regionalization, notably by means of improved remote control and supervision enabled by smart technologies. In an indirect way now, it turns out industry 4.0 will exert a huge influence over numerous FSE application fields they share with each other. As an example, the transition on the verge of occurring in the urbanization and transport sectors will be largely carried out thanks to the concept of “smart cities” brought about by the IoT. The healthcare industry is also a good example to illustrate how FSE will be driven towards industry 4.0 and notably rely on its new technologies (e.g. tracking sensors, etc.) in order to remotely ensure a better follow-up and/or treatment for its patients. On a last note, industry 4.0 unveil new opportunities in terms of customization and hence differentiation for companies, which is strongly in line with the FSE logic and consumers’ interest.

1.6.3. Industry 4.0 and environmental sustainability

From an ecological perspective, industry 4.0. will serve as an enabler for FSE to increase resource efficiency and environmental protection through relevant advanced technologies and tools designed for that purpose (i-scoop, 2020).

As a conclusion, industry 4.0 undoubtedly helps FSE to move towards a new business model based on services while sharing the same economic, social and environmental objectives. In that regard, smart technologies represent a huge opportunity for FSE to seize and apply widely to the economy.

1.7. FSE stakeholders

Various stakeholders have a different role to play and can bring their own contribution to the transition towards FSE in many different ways. In my view there are at least four major categories stakeholders belong to that I have identified below: the private sector, the not-for-profit sector, the public sector and consumers.

1.7.1. The private sector and the adoption of a new business model

First, any private business would obviously be the first impacted by this transition and will have to drive this change by switching from its unsustainable product-oriented business model towards a sustainable service-oriented one. Though, it is worth noting that every industry will not be affected in the same way given its distinct nature. Some of them are clearly more suitable and will probably get a higher readiness to change since they can benefit from more opportunities. Either way, businesses of all sorts will have to conform to some extent if they want to be sustainable, not only economically but also environmentally and socially and in turn, credible from a society perspective. This will be of utmost importance, especially given the urging environmental pressures that we relentlessly face today. Moreover, a specific category of industries which has an important role to play involves the technology-based businesses still in line with the concept of industry 4.0. Those companies should both push themselves and the other businesses towards FSE through innovative, smart technologies built on IT as they have already started to do. Indeed, it turns out that in almost every application fields related to FSE, this phenomenon has had or will have a major impact. It is thus undeniable that FSE must leverage on those technologies in order to achieve its goals. Some examples of those technologies implemented in an ever-higher number of companies are the mobile applications, new payment methods, interactive sharing platforms (e.g. for bike or car

renting) and the likes. On a final note, I explore some practical implications and implementations of the ideas below in the case studies I analyze in chapter 2.

1.7.2. Not-for-profit sector and organizations

A similar reasoning can be applied to not-for-profit organizations, such as NGOs[12], with slightly different implications though, given the specificities regarding the nature and purpose of their activity. I develop this last idea further on when assessing the influencing factors of FSE (see section 1.8.). Moreover, we have recently seen the emergence of more and more organizations dedicated to the cause of a more sustainable world which endeavor to exert some influence on decision-makers, with limited result to this day though.

1.7.3. The public sector as supporter or disruptor of the model

Secondly, governments at every level (e.g. national, European, international, etc.) and policy-makers have a substantial role to play in promoting FSE model adoption among businesses and averting abuses. This means they should on the one hand support business willing to embrace such practices while, on the other hand, enforcing sanctions upon businesses not complying with it and hence, causing negative externalities[13] on the environment.

In practice though, there is no common agreement on the proper way to proceed yet. Therefore, some advocate for subsidies while others consider taxing the use of non-renewable resources as opposed to renewable ones, labor force included, as a better option (Stahel & Clift, 2016). Moreover, some governments keep supporting unsustainable practices by still privileging non-renewable resources over renewables ones, mainly for economic and political reasons, an issue that I address in chapter 2 in some of the cases studies I analyze.

Another way to be involved for governments is to establish special agreements with FSE-inclined businesses, commonly called “Business-to-Government” (B2G) agreements, which can take the form of public-private partnerships[14] (PPP), for instance (Stahel, 2006). In the

[12] A non-profit organization that operates independently of any government, typically one whose purpose is to address a social or political issue. (Oxford languages, 2020) I consider here that NGO are not-for-profit which in practice is most of the time but not always the case.

[13] Externalities occur “when the effect of production or consumption of goods and services imposes costs or benefits on others which are not reflected in the prices charged for the goods and services being provided”. (OECD, 2003)

[14] A Public-private partnership (PPP) is often defined as a long-term contract between a private party and a government agency for providing a public asset or service, in which the private party bears significant risk and management responsibility. (World Bank Group, 2012)

same vein, state-owned companies should be pioneers in embracing the model so as to lead the way towards FSE and exhibit its potential benefits.

Besides that, several important meetings initiated by public institutions, mostly international, have already taken place for the sake of discussing related issues and try to find and implement solutions in the form of regulatory frameworks, notably. To that extent, the Lisbon Treaty in 2010, the EU2020 Strategy for growth & jobs and the RIO+20 organized by the United Nations (UN) and attended by all the EU members are some examples to only mention a few of them. Though, the effective impact of the measures taken in the wake of those initiatives remains quite limited until now and generally tends to lack substance.

Ultimately, there are numerous advantages for the public sphere in following this path. One of the most remarkable one is the potential resulting decrease in dependence on foreign natural resources due to the achievement of a situation that W.Stahel calls "national resource autarky" (Stahel, 2010). I would dare to suggest this is merely in keeping with the inward-looking trend of deglobalization and decentralization the world is experiencing now. In chapter 2 I discuss further the role of the public sector in several case studies I analyze.

1.7.4. The consumers and the adoption of a new consumption model

Thirdly, the transition is conditional upon a significant shift from the existing consumption pattern and in consumer's mindset and attitudes towards FSE. This implies strong psychological and emotional implications since it would require consumers to change their preferences and behaviors while distancing from the current prominent notion of product ownership in favor of product use. They should also be inclined to pay a fairer (higher or lower) price to access goods and services since the current price they pay only reflects the price set by the market but does not take into account the cost of externalities (e.g. pollution, etc.) at any point. In that sense, one of the goals set by FSE is to solve this problematic by inciting businesses to propose a price which reflects more accurately the actual cost of production of goods and services. In chapter 3 I explore further consumers' willingness to accept this new model on the basis of a market survey conducted in June 2020.

1.8. Exogeneous factors influencing the transition towards FSE

For any given business, various exogeneous[15] factors can potentially interfere with/play a part in its transition process towards FSE and the direction it eventually takes. I have identified

[15] Factors which are not controlled by/independent from FSE but can impact it though.

below four distinct aspects which, according to me, are likely to be conducive (or not) to this shift: the geographic area the business is located in, the sector/industry in which the company evolves, its business target and the type of organization it belongs to. The question is whether all businesses are likely to make the shift regardless of their specific features or if there are pre-conditions to the successful implementation of the model.

1.8.1. The geographical area

The first important element to point out is that the situation relative to FSE is drastically different in industrialized/developed, emerging, and developing countries.

In industrialized countries, some markets tend to be mature, especially when it comes to durable goods and infrastructure, which means that businesses experience rising operation and maintenance costs (Stahel W. R., 1986). Consequently, this calls out for some restructurings which bring challenges but also opportunities.

In the developing world, which is confronted to scarcity, whether it is in terms of goods, skills or food, the best option for them is to stick to a linear economic model. Indeed, for those countries which have not reached the basic standards of living and education yet, it is crucial to keep on with the mass production of cheap standardized goods in order to bridge the gap and accumulate wealth (The circular economy: interview with Walter Stahel, 2013). Nevertheless, it is by adopting the FSE model based on resource efficiency that industrialized countries can give room to developing countries to pursue their economic development that way (Stahel W. R., 1986). Ironically, developing countries have already started to implement closed-loop models on their own on account of poverty. Though, they are sometimes doing it in a manner very detrimental to the environment and people. Indeed, their remanufactured and repaired goods are often of very poor quality, which is potentially dangerous, and their recycling process can be very polluting (e.g. burning) (Stahel, 2019).

The last category concerns emerging countries which, once they have accumulated a sufficient level of stocks in terms of infrastructure, goods and public services, can start to move towards a FSE model while implementing the proper operation and maintenance processes (Making It, 2013).

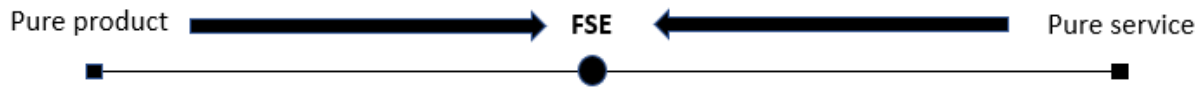
Based on the reasoning described above, W.Stahel argues the closed-loop model will never become global (Making It, 2013). In chapter 2, I explore case studies involved in developed, emerging and developing countries.

1.8.2. The sector or industry

The type of sector/industry in which the business operates can have a huge impact on the transition since certain businesses tend to be more suitable to the model than others for reasons related to costs forecast, expected benefits or merely the nature of the activity. In that regard, I could for instance distinguish service from manufacturing-related companies, labour-intensive from capital-intensive companies, or technology-based companies from others. It seems obvious that companies coming from those different kinds of industry might have different features and thus be more or less inclined to transition towards FSE given their natural fit.

As an example, labor-intensive companies could more easily benefit from skilled workforce, considered as a renewable resource, and thus increase the labour-input-per-weight ratio while capital-intensive companies might be tempted to turn to automation. Meaningfully, it is worth noting that FSE dismisses none of those approaches but rather see skilled workers and automated technologies as complements for higher resources efficiency (Ellen MacArthur Foundation, 2013). In the same vein, it seems clear that companies stemming from service-based industries will have to embrace a totally different approach than companies from product-based industries to reach a FE model, as illustrated in figure 1.2. below.

Figure 1.2. Illustration of the contrast existing between service-based and product-based companies on their way towards FE:



Lastly, it seems likely that technology-based companies are well predisposed to transition towards FSE since they already own the tools and knowledge to innovate with new sustainable practices simultaneously for them and the others. Finally, the period for those different types of companies to reach the break-even point will be sometimes highly variable.

1.8.3. The business type

FSE can apply to three main types of markets: Business-to-Business (B2B), Business-to-consumers (B2C) and Business-to-Governments (B2G). Next to that, some businesses can develop a mixed strategy including elements derived from more than one type. I will call them “hybrid” organizations, but I will not discuss this category further since there are no

specific principles applying to them. In each of the three settings, most of the FSE principles that have been previously introduced come into effect.

First, business-to-business (B2B) “refers to business that is conducted between companies, rather than between a company and individual consumer” (Investopedia, 2020). Then, it can either imply a transaction between a manufacturer and a wholesaler or retailer, between a wholesaler and a retailer, or between two manufacturers in the case of intermediate goods. In the FSE context, this involves the access to the good and its use for a fixed period in line with the approach based on services. A central notion that appears in this first setting and that we have already slightly discussed as one of the FSE principles beforehand is the full integration of the value chain (VC). This encompasses all the steps a product or service will go through, from its conception to its distribution. A strong implication of FSE though revolves around the after-sale services which are emphasized in a substantial way. Moreover, this concept of VC incorporates two separate aspects: On one side, it implies that every activities/departments internal to the company are embedded, notably thanks to advanced technological means related to IT, IoT, and so forth. This is true for every sphere of the company; purchasing, production, finance & accounting, R&D, marketing, logistics or (after-)sales to name only a few, all of which being impacted in their role and nature by this transition (e.g. “performance chain”). On the other side, a special focus should be given to the “supply chain” (SC) as a sub-part of the VC strictly referring to activities that involve a relationship with third party businesses. In that regard, the FSE aims also at ensuring a close integration and cooperation between all the actors/stakeholders of the supply chain, such as producers/manufacturers, suppliers or customers. As a result, this could have major implications on how firm boundaries are defined in the future. The objective is basically to find the most effective way to work together, so as to serve the interests of the industry as a whole. A concrete example illustrating this idea is discussed in chapter 2. This way, companies could maximize the aggregate production and, in turn, revenue while in the meantime benefiting each separately from the numerous economic advantages provided by this model (e.g. synergies). Beyond that, this would also allow to limit the use of natural resources and contribute to enhance the living standards and welfare of the local communities, notably by creating new jobs. From that perspective, it would fulfill the three pillars of sustainability (Homrich & al., 2017). On a last note, we will find this notion of integrated VC and SC coming back to some extent in the two following settings as well.

Secondly, the term business-to-consumer (B2C) refers to the process of selling products and services directly from a business to consumers who are the end-users of its products or services (Investopedia, 2020). In chapter 2, I assess a number of case studies covering B2C industries.

Thirdly, business-to-government (B2G) is the sale and marketing of goods and services to federal, state, or local agencies (Investopedia, 2020). This setting is strongly in line with FSE development since one of its basic principles is built on the interactions and support received from the public sector. In that respect, I will take the case of public-private partnership (PPP) as an example to illustrate that point, although many other types of partnerships exist. PPP arise from a deal contracted between a private company and a public authority such as a government. It has experienced a very positive evolution in the past decades, notably in the EU where it grew significantly, despite encountering a relative downswing since the economic and financial crisis of 2008[16] (Cour des Comptes Européenne, 2018). Thus, many applications of PPP have emerged in various industries such as highways, airports, energy or railways, to name a few (Venkatachalam & Jootae, 2016).

The reason I dwell on that in the context of this thesis is that PPPs also represent a huge opportunity for every business willing to thrive in the FSE frame, as explained in the course of the "Interreg" report published in 2018 on the subject (Interreg, 2018). Indeed, if CE principles can be incorporated into PPP frameworks, it might be a great way to finance sustainable FSE projects. For instance, Finland has been a pioneer in the setup of CE-PPP partnership with the adoption of a national roadmap (UNECE, 2018). In developing countries, this also could have major social implications, notably regarding the way to meet the basic needs (water, energy, food, etc.) of populations living in those areas, as highlighted in a 2018 P4G[17] report on PPP (P4G partnerships, 2018). On the other hand, I would assume that if numerous successful FSE-PPP associations take shape, this could also act as tangible evidence in favor of the financial resilience of the FSE model. Up to now, many studies have covered the subject of the FSE-PPP congruence, but few tangible results have arisen yet. In

[16] Indeed, this same trend was also outlined in a financial and economic report published in 2010 which aimed to assess the impact of the crisis on PPP. It turns out the overall value attributable to PPP nearly decreased by half/halved in Europe between 2007 and 2009. Nevertheless, this comes along with an expansion of the practice into additional countries and a wide range of sectors. (Kappeler & Nemoz, 2010)

[17] Partnership for Green Growth and Global Goals 2030.

the course of chapter 2, I also focus on several cases where both topics are simultaneously addressed.

1.8.4. The type of organization and the organizational structure

Two additional exogeneous factors to FSE which can have an influence on the transition of any given business towards the new model are the type of organization it belongs to and its organizational structure. The first one considers if the company is public, private or not-for-profit, in this context. The second is determined by the management structure in place, that is how the rules, roles and responsibilities are distributed and the information flows (Investopedia, 2020).

Firstly, the shift could be impacted differently whether the business belongs to the public or private sector, or whether it is a not-for-profit organization, because the stakes are not the same in each situation.

First, public institutions are assigned roles and missions that are radically distinct from private organizations. Indeed, two out of the six main functions[18] pursued by governments in our market economies are to "provide the legal and social framework" and "correct for externalities" (Council for Economic Education, 2020). In other words, they need to enforce rules which prevent abuse (e.g. negative externalities), notably arising from the private sector, and to ensure a minimum level of social welfare which is especially true in social democracies. In that sense, interests can converge or not as they try to cooperate and find a compromise. Either way, this implies both the private and the public sector should examine FSE at least as a potential viable solution to achieve their respective objectives. On the other hand, private businesses need stronger incentives to transition towards FSE as they are typically bound by fewer social and/or environmental constraints.

The essence of the company, whether it is a for-profit or not-for-profit organization, can matter as well. Indeed, while for-profit organizations come straight from the linear economic model and capitalism which promotes primarily economic profits, not-for-profit organizations have a different vision (Sherman, 2019). It means they have by nature closer ties with the social and/or environmental dimensions of sustainability. It doesn't mean they lose sight with their economic objectives which are also essential for them to keep thriving over time, but

[18] The six functions are 1. Maintaining Legal and Social Framework; 2. Maintaining Competition; 3. Providing Public Goods and Services; 4. Redistributing Income; 5. Correcting for Externalities; 6. Stabilizing the Economy. (Council of Economic Education, 2020)

they generally intend to serve a broader vision. This implies that not-for-profit organizations could in that sense be more naturally inclined to find an acceptable balance between the three pillars, in order not to hinder their raison d'être. Moreover, some organizations considered as influential in the sustainability debate such as the Ellen MacArthur Foundation or the Product Life Institute in Geneva are themselves not-for-profit organizations aiming at incentivizing private companies to transition to a FSE model.

Another element to consider is the organizational structure of the company, which is determined by factors such as its size, goals, skills and number of employees, among others (Nouri, 2019). Indeed, different types of management organization will react differently to change. For example, let us compare the case of pyramidal and flat structures. I will deliberately overstate the discrepancies between both for the sake of understanding. Therefore, it does not necessarily reflect the reality from an empirical perspective. So, theoretically pyramidal structures tend to be more resilient and less responsive to change because of heavy bureaucracy (Dontigney, 2019). Indeed, the decision process is viewed as being more complex and time consuming in those companies (Bhasin , 2019). Moreover, innovation is more limited because the ideas of only a few are listened to, at the expense of lower-ranking workers which stand closer from the field yet (Gaille, 2018). On the other hand, flat structures are often considered as being more reactive to change, notably due to higher communication speed (Meehan, 2019). Lastly, pyramidal structures would be favored in bigger-size companies with a large number of employees and vice versa (Nouri, 2019). If we strictly apply those assumptions to the FSE context, it clearly appears that flat structures would tend to favour the transition to this new economic model over pyramidal ones. In the end though, this analysis could of course turn out to be untrue or at least inaccurate in practice, and the opposite result is likely to occur as well. This last point would constitute an interesting topic to discuss in chapter 2.

1.9. FSE-related indicators

The two sets of indicators described hereafter provide meaningful metrics on some key dimensions of the FSE model that are likely to be important to guide the various stakeholders involved in their (future) strategic decisions.

1.9.1. Three metrics to measure performance

In his book entitled “The performance economy” (2006), W.Stahel proposes three metrics in order to “decouple” sustainability indicators: the value-per-weight ratio, the labour-input-per-weight ratio and the value-from-renewable-resources ratio.

1) The value-per-weight ratio

The value-per-weight ratio aims at measuring the increase in wealth and growth that can be produced while consuming the minimal level of resources and energy. Therefore, this metric also called “euro-per-kilogram” ratio links an economic variable to an environmental one (Misra et al., 2008). From a business perspective, this means a company should endeavor to reach a higher level of competitivity and corporate revenues by following the same environmental logic as previously mentioned. Concretely, a higher value-per-weight ratio indicates more value resulting from the consumption of one kilogram of resources. Of course, this ratio can vary significantly according to the industry (e.g. capital vs labour-intensive) and business offering (e.g. goods vs services) which is why a relevant benchmark is needed for the sake of comparison. This could notably be achieved by hiring knowledge workers (Stahel, 2010). In that sense, an important aspect lies in innovation since new products should have a higher value-per-weight than old ones (Cooper, 2010).

2) The labour-input-per-weight ratio

The labour-input-per-weight ratio measures the number of local, skilled jobs created by using a minimal quantity of non-renewable resources (Misra et al., 2008). This metric, also called “man-hours-per-kilogram” ratio, links then a social variable (labour) with an environmental one (amount of resources consumed). Value preservation, largely induced by extended product-life through reuse, remanufacturing and technological updating, is thus the key to get this ratio at a higher level (Stahel, 2010). Besides requiring a higher number of workers to fill the additional phase of the product-life management process, the ratio is increased due to limited economies of scale carried out from a geographic and volume perspective (Stahel, 2012).

3) The value-from-renewable-resources ratio

Finally, the value-from-renewable-resources ratio measures the variation in competitiveness and profit (expected to be positive) the business can reach through the internalization of the total cost of ownership over the full product life-cycle (Stahel, 2010). This implies a prior transfer of responsibility for risks and waste from the consumer/end-user of the product to its

producer/manufacturer. It also induces a shift of focus from production to quality. As for the value-per-weight ratio, it relates an environmental to an economic variable.

These three ratios encompass then the three main dimensions of sustainability: social, economic and environmental. According to Stahel, the model proposed here allows to reach higher levels of value-per-weight and labour-input-per-weight ratios than in the traditional linear model (Stahel, 2010). According to some researchers, those sustainable indicators should in turn even replace current economic indicators such as GDP (Stahel, 2016). Each of these metrics can be applied either at a micro, meso or macro-scale (Stahel, 2006). This is discussed in the following paragraph.

1.9.2. Micro, meso and macro-levels indicators

The last important external factor is the scale the business operates at, which is comprised of three levels: Micro (local), meso (regional) and macro (national/international) levels. These three indicators are useful to measure the sustainable performance at different levels of the economy, as well as the effects of new policies and trends. The larger the scale, the lower the degree of detail on information you get, and vice-versa.

First, the micro-level allows to measure the sustainable performance of a city, a product or a company. It then supports the decision processes at the business or local level or regarding single products (Vercalsteren , Christis , & Van Hoof , 2017). It is notably at this level that individual manufacturing companies need to cooperate with each other to achieve an efficient supply chain management (Winkler, 2011).

Second, the meso-level measure the same sustainable performance for a region, a product/consumption category or an industry (Vercalsteren , Christis , & Van Hoof , 2017). An example is the industrial parks gathering a number of factories in a defined zone. At this level, firms need to cooperate among each other, notably by sharing the utilization of infrastructure and services in order to reduce resources consumption (Banaité , 2016). Some of the case studies analyzed in chapter 2 refer to this last idea.

Third, the macro-level indicates the performance of a country or larger region (e.g. Europe), given its interactions with the rest of the world mostly regarding international trade. It then doesn’t look inside an economy, but beyond it (Vercalsteren , Christis , & Van Hoof , 2017).

If well developed, those indicators can be very helpful in achieving the sustainable goal of FSE. Indeed, they can contribute to give the tools and information in order to mitigate

environmental pollution and ensure a better waste management. However, social and economic dimensions shouldn't be omitted either in order to cover the full objective sought by FSE.

1.10. Opportunities versus barriers to the model

According to its staunch supporters, FSE offers many opportunities to the various stakeholders that are ripe for embracing it, but it is also undeniably subject to some barriers and challenges that could (considerably) limit/hinder its further implementation in the (global) economy.

First, FSE presents a huge market opportunity in the eyes of its proponents. In their opinion, it constitutes a new major twist which, after having reached a certain scale, will leave laggards behind. They argue a tangible, conclusive evidence for that is the exponential growth in interest given to the (broad) subject and its prominence today in every aspect of life. Here are some of the main arguments put forward by those who advocate for the model: First, moving to services and keeping ownership of products has many advantages as it allows businesses to enjoy a stable stream of revenue and offers some protection against economic cycles by entailing a decrease in market volatility along with more stable prices. Moreover, businesses can take advantage of the momentum around services and try to differentiate themselves through new offers (Oliva & Kallenberg, 2003), which is less likely to be the case in mature, linear markets. Secondly, cost-efficiency can be achieved due to optimized product life-cycle and enhanced resource (e.g. raw materials), water and energy management which would substantially decrease production costs. Thirdly, on top of the environmental benefits (e.g. fewer negative externalities), this would also contribute to decrease resource reliance on foreign procurements while ensuring "national autarky". Incidentally, these cost savings can in turn trigger the creation of new jobs for local and skilled workers (European Economic and Social Committee, 2016). The decentralization of the economy means less people need to move towards cities, either as resident or daily commuter, partly solving the concern of urban congestion. To be effective, it is worth noting that this closed-loop model should be carried out at the local/regional level, notably to avoid double transport costs (Ellen MacArthur Foundation, 2013).

Nevertheless, in the wake of those statements, an important question that should be raised is whether the shift in competition from a global to a regional/local level is effectively an opportunity in the short and longer run or not. I will attempt to discuss this further in chapter

2. Moreover, the concept encounters sizeable obstacles to its roll-out since many businesses still struggle to implement FSE principles within their offer (Adams, 2019). Some of the barriers experienced lie in the following aspects: First, the financial costs to bear are significant for no visible short-term results. Indeed, substantial investments are often required in terms of infrastructures, … and it will take some time before reaching the break-even point, although after that substantial profits can be achieved. Moreover, other expenses to consider include operational (e.g. labour) and logistical costs which are higher in remanufacturing than in traditional manufacturing. Those incurred costs should be outweighed through lower capital costs when assessing the return on investment of the company though (Stahel & Clift, 2016). Secondly, the organizational structure of the company can be an issue making the transition harder for some businesses than others as previously emphasized (see section 1.8.4.). On another note, technology obviously represents an impediment since not everyone has access to it evenly, given their budget, location, sector, etc. Yet, transitioning to FSE requires a complete "organizational and technological redesign" from businesses (Sidoli, 2013). What is more, on the consumer side there is a strong attitudinal/emotional barrier as of shifting away from product ownership for its use (Sidoli, 2013). W.Stahel and R.Clift refer to it as the "teddy bear" effect[19] in their book entitled "Taking Stock of Industrial Ecology" and mentioned above. To counter this, they propose to set up contracts that allow consumers to be able to switch regularly from one good to the other (Stahel, 2010). Furthermore, there is also an environmental aspect that can limit the prospects since environmental benefits are not guaranteed, because of the potential "Rebound effect" that can arise from resources consumption (see section 1.3.). Besides, policy-makers also constitute sometimes a barrier since some of them continue to prone taxation on renewable resources such as labour, rather than non-renewable ones (see 1.6.2. section). Finally, a last barrier is cultural since countries, and even sometimes regions in the case of federal states, will probably not be able to set aside their differences and agree on universal regulations on the matter, notably with regards to the transfer of innovations (Stahel, 2010). Some of these aspects are discussed yet again in chapter 2 through the analysis of some case studies.

[19] The "teddy bear" effect leads individuals to keep personal souvenirs such as watches or pens, or family heritage objects such as paintings or vintage cars (Stahel & Clift, 2016).

As a result, there are both opportunities and barriers in shifting from a linear to a functional economy. Though, status quo seems unthinkable given the unsustainability of the current economic model in place. It is thus a matter for all stakeholders to find the best solution in every aspect: social, environmental and economic.

1.11. Summary, conclusions and next steps

To conclude this chapter, quite a few findings and conclusions can be highlighted in the wake of the literature review presented above. Indeed, we saw that FSE is an economic model linked to the notion of sustainability as well as some other related concepts with which it shares both similarities and differences (see section 1.2). Moreover, each related concept exerts in some way a significant specific influence on the development of the functional economy as explained earlier.

What is more, we could also introduce the three fundamental entangled dimensions (i.e. the 3 pillars of sustainability) the functional economy model relies on in order to achieve its objectives. Indeed, I have explained that the model needs to conform with each of those three aspects simultaneously in order to reach the state of sustainability (in the sense defined in this chapter).

After that, we introduced the four main stakeholders that are likely to drive the transition towards the model: the private sector, the not-for-profit sector, the public sector, and consumers. In line with that, I have put forward four possibly influential exogeneous factors along with their expected specific effects on the transition towards the model: the geographical area, the industry/sector, the business segment and the organizational structure.

I have also pointed out two sets of indicators related to the functional economy which allow to measure both the performance and the scale of the model.

Finally, we have seen that the functional economy model involves many opportunities for businesses and organizations alike, but that some important barriers to its implementation still persist.

To sum up, it appears from the literature on the subject that even though the functional economy model has been around for a long time now (since the term was first introduced by Walter Stahel in the 1980s), its theoretical framework still seems to be work in progress as evidenced by the numerous discrepancies among authors. The theoretical debate is still ongoing today. Moreover, despite its great potential alleged by its proponents, its theoretical

basis still has a number of (theoretical) gaps it needs to fill before being truly considered as a sound and viable model. If it manages to do so though, the functional economy model could potentially represent a viable economic option to some extent for future, on the way towards sustainability.

In that regard, I think it is now essential to adopt a more practical perspective in order to understand the underlying conditions for the effective implementation of the functional economy model. In chapter 2 I concentrate on the analysis of a number of case studies based on the ideas developed in this chapter.

Chapter 2: Functional economy: a case studies analysis

2.1. Introduction

This chapter investigates more practical aspects of the FSE model and concepts by looking at a sample of case studies covering a variety of industries, geographical areas and business types. The objective is to get a better understanding of the practical implications underlying the transition to this economic model as well as the (pre)conditions to its successful implementation in the economy. This is achieved by developing a thorough methodology based on the theoretical framework exposed in chapter 1 as well as additional dimensions emerging from the review of the case studies themselves. The result is the elaboration of multiple grids each comprising a set of associated dimensions/criteria aiming to analyze and characterize the cases in line with the FSE principles. Consequently, this enables me to make sound comparisons among cases based on different aspects and in turn, derive some general conclusions.

Hence, through this chapter I first describe the objective pursued by this analytical approach. I then explain precisely the methodology devised to perform this analysis along with the limits this entails. Next, I describe extensively some case studies analyzed through this process. Furthermore, I present the results of the analysis and their interpretation that I that should be considered cautiously. Eventually, I give an overall conclusion and provide the key takeaways to keep in mind.

In total, 26 case studies from which I derived 31 sub-cases/models are analyzed and compared with the FSE model. Indeed, one case study sometimes covers more than one business/model/industry. In contrast, one business/model/industry is associated with one single potential FSE proposition.

2.2. Objective of the grid analysis

The objective of this grid is to determine to which extent each case effectively fits with the FSE principles discussed previously by following a systematic approach based on the existing literature. In other words, it aims to compare the FSE framework as described in the academic literature with practical cases studies selected among the empirical literature on the subject. In that sense, each case is confronted to a defined set of criteria and its fit with FSE is assessed. The next step consists then in an attempt to draw relevant conclusions based on the results obtained. This process is obviously subject to a number of limits I also discuss.

This grid analysis enables me to provide some insights on the current status of FSE and its implementation up to now. Moreover, it allows the identification of the kind of businesses which is more likely to embrace the model based on multiple factors. As a matter of fact, a number of organizations[20] have already started implementing practically FSE principles at various levels in their business model, sometimes totally not or barely aware of it, and often for reasons specific to their business or environment. Although some cases seem to be very successful, others turn out to be complete or partial failures as we will see later. In this chapter, it is thus natural to seek to understand the reasons behind. On the other hand, many organizations are still at a conceptual or very marginal implementation phase, not to mention the ones that are still fully anchored in the linear model, which constitutes another important point to reflect upon. In that sense, this grid serves as a guide to determine whether the principles of FSE can be applied to any organization regardless of its intrinsic characteristics or its field, or if some preconditions have to be fulfilled to improve the likelihood of success.

2.3. Methodology

2.3.1. Description of the grid analysis

This grid analysis has been applied to 26 case studies covering a large variety of distinctive situations and is made up of a broad set of criteria that I now review.

First of all, I have identified five FSE main criteria that refer to specific principles I consider as essential to FSE successful implementation based on the literature review presented in chapter 1. Therefore, all analyzed cases should comply to a certain extent with those principles in order to be considered as part of this model. Some of the selected cases were referred to in the literature on the subject while others were found via other sources such as journal articles, reports, newspapers and so forth. The five main FSE criteria I have elaborated are: (i) The “FSE fundamental principles” criterion which assesses the compliance of the case with the fundamental principles of FSE, (ii) the “three pillars fulfillment” criterion assessing the fit of the case with the three dimensions of sustainability, (iii) the “environmental” criterion assessing the fit of the case with the environmental dimension of FSE, (iv) the “economic” criterion assessing the fit of the case with the economic dimension of FSE and (v) the “social” criterion assessing the fit of the case with the social dimension of FSE. Each criterion is composed of “sub-criteria” I will elaborate on at a later stage.

[20] The term “organization” can refer to actors from the private, public or not-for-profit sector.

In addition to that, I have defined six "FSE evaluation criteria" which offer a broader evaluation of each case development stage with regard to FSE. The six FSE evaluation criteria I introduce are: (i) The implementation date, if relevant, of the FSE-related model (ii) the current implementation level of FSE, (iii) the expected evolution of FSE, (iv) the applicability of the model to other industries, (v) the market and/or stakeholders feedback regarding the model and (vi) a personal appraisal of the case. I provide additional information on each of those aspects later on.

Finally, I have clustered the 26 case studies successively according to three different "independent classification criteria" derived from inherent characteristics to each case that are not directly related to the FSE framework. Those three criteria are the business type, the industry type and the geography. I will also explain each criterion in more detail later on.

a) Elaboration of a grid based on the FSE main criteria

I have defined two main FSE criteria: the "FSE fundamental principles" criterion and the "three pillars fulfillment" criterion. The "FSE fundamental principles" criterion is according to me best defined by the five following sub-criteria: (i) a combined set of products (tangible) and services (intangible) according to the definition of Goedkoop et al (1999), (ii) the use of the product function rather than product ownership, (iii) the existence of a sharing platform to ease the transfer and use of the product among several users, (iv) a technological component that influences significantly the model (implementation) and (v) the role played by governments (or public institutions) to promote or hinder the model. The "three pillars fulfillment" criterion[21] on the other hand, is best defined by the three fundamental dimensions of sustainability (sub-criteria). Moreover, for some of those sub-criteria, I went further by developing a third layer of criteria associated to those specific FSE-related notions.

Regarding the role played by government for the model implementation, I assess it by looking at two separate aspects: (i) the possible provision of stimuli, such as subsidies or tax exemptions, granted to boost FSE practices or the enforcement of sanctions, such as fines or tax increases to discourage some linear economy practices and (ii) the potential set-up of partnerships with governments, such as Public-Private Partnerships (PPP).

[21] I separate this criterion from the "FSE fundamental principles" criterion since the three pillars of sustainability is not a concept inherent to FSE but FSE rather make use of it to achieve its (sustainability) goal.

The three pillars of sustainability discussed above are further broken down into a set of third-layer criteria to get more granularity.

Firstly, I assess the environmental dimensions by checking the 10 following aspects: (i) the effect of the model on gas emission and pollution, (ii) the potential enhancement of the product life-cycle (in terms of environmental sustainability), (iii) the reduced use of resources through the design and production phase of the product, (iv) the reduced use of resources through the usage phase of the product, especially through appropriate maintenance, (v) the compliance with the 3R strategies associated with the product after-life phase, (vi) the resulting reduction in terms of waste due to the model, (vii) the internalization of risks and waste by the producer who keeps ownership of the product, (viii) the set-up of a decentralized/local supply chain, (ix) the effective integration of the supply chain and (x) the producer model acceptance (based on the current implementation of the model in the industry considered). This way, I am able to systematically assess the degree of environmental sustainability for each case.

Secondly, the economic assessment is based on three distinct dimensions each further broken down into sub-criteria. The demand side is measured through (i) the existence of a market opportunity or a need, (ii) the acceptance of the model by customers, (iii) the provision of a new and innovative product offering in line with the FSE model, (iv) the creation of added value arising from the product use and (v) an enhanced Customer relation (CR) resulting from the new offer. The level of efficiency (supply side) reached by the organization is assessed as follows: (i) the effective integration of the value chain (VC), (ii) the existence of economies of scale, (iii) the existence of economies of scope and (iv) the reduction of idle capacity in the production phase. Finally, the profit and growth dimension is assessed by the variation of (i) short-term profits of the organization, (ii) long-term profits of the organization and (iii) price and/or revenue.

Thirdly, the “social dimension” criterion is defined as follows: (i) the creation of new job opportunities, (ii) the provision of adequate trainings required by those new jobs and (iii) the potential positive impact of social externalities.

In summary, I consider 2 main FSE criteria, 8 FSE sub-criteria and 31 third-layer criteria. All the FSE criteria described above are presented in table 2.1 in the appendix[22].

[22] All the tables not shown in the main text are available in the appendix to this chapter.

b) Elaboration of a grid based on the evaluation criteria

The six evaluation criteria I define here aim at drawing some conclusions on each case study individually first, and then more generally speaking. The first criterion introduces a time frame by identifying the date the FSE model has been implemented, if so. The second criterion assesses the current implementation level of the model for each case and/or industry considered. This ranges from "conceptual" if the model has not been implemented yet or "marginal" if it has only been implemented at a local/community level or is still in an emerging phase to "advanced" if it has already been set up at a higher scale (e.g. global). Thirdly, I give a forecast regarding the expected evolution of the proposed model based on the reading of case studies: "favorable" if the model is set to flourish and develop further; "unfavorable" if it is expected to keep limited to low-scale level or is even doomed to fail for some reasons; "balanced" in case of nuanced/undecided opinion. Fourthly, I try to determine if the model presented in each case study is rather "specific" to the industry considered or "generalizable" to others. Sometimes, it can be undetermined, and, in this case, I just fill the cell with "no answer". Fifthly, I give an overall feedback (scored from 1 to 10) for each case based on the market and stakeholders' perception. If no feedback has been provided (yet), I grant a score based on my subjective perception regarding the case. Finally, I give a more personal judgment (scored from 1 to 10) in line with my own appreciation of the case at large and based on the level of quality I attach to it. All the results assigned to each case with regard to the "FSE evaluation" criteria are exhibited and summarized in table 2.2 in appendix.

c) Elaboration of grids based on three independent classification criteria

I then classify each case based on the three independent classification criteria I have chosen, one at a time. The purpose of this approach is to bring relevant insights related to each criterion by looking at the results obtained through the grid analysis. Subsequently, this also allows to draw general conclusions and identify global trends for the cases. Table 2.3 below exhibits the specific category each case belongs to for each of the three independent classification criteria.

The first independent classification criterion used to differentiate the cases is the business type they belong to. By this, I mean the kind of (commercial) relation they establish and nurture with their customers on a daily basis. In that respect, I have identified three main categories among the myriad[23] existing: Business to Business B2B, Business to consumer B2C and a

[23] In reality, there are multiple business categories that exist: B2C, B2B, & B2G, C2C, C2B, G2B, G2C, C2G, etc. Though, in the frame of thesis I have decided to focus only on a few of them.

third category I have called “hybrid” which gathers cases involving both B2B and B2C relations. Among the 31 sub-case studies, I identify 11 B2B cases, 12 B2C cases and 3 hybrid cases. The assumption (H0a) I want to test is the following: the business type cases belong to has an influence on their pathway towards the FSE and in turn, their probability of success or failure, in the sense that B2B and, to a lesser extent hybrid cases, are favored over B2C cases due to their higher suitability for the implementation of such a model.

The second independent classification criterion concerns the type of industry the case belongs to. This defines if the case has a dominant[24] inclination towards product, service or a natural combination of both (which is independent from FSE at this stage). Among the 31 sub-case studies, I identify 21 product-oriented cases, 5 service-oriented cases and 5 product-service-oriented cases. The assumption (H0b) I want to test is the following: the type of industry the cases belong to has an influence on their pathway towards FSE and in turn, their probability of success or failure, in such a way that product&service-oriented industries and, to a lesser extent service-oriented industries, are favored over product-oriented industries due to their higher suitability for the implementation such a model.

The last independent classification criterion used to distinguish among case studies is the geography where they take place. In that respect, I have differentiated between the cases settled in developing/emerging countries, developed countries and both at the same time. Among the 31 sub-case studies considered, I record 17 cases in developed countries, 9 cases in developing/emerging countries and 5 cases in both at the same time. The assumption (H0c) I want to test is the following: The geographical area of the cases has an influence on their pathway towards the FSE and in turn, their probability of success or failure, in such a way that the cases taking place in developed countries and, to a lesser extent in both developed and developing/emerging countries, are favored over those taking place in developing/emerging countries due to the higher suitability for the implementation of such a model.

2.3.2. Explanation of the scores assigned to the “FSE main criteria” grid

Having completed my grid with the data collected from the case studies, I decided to primarily only retain the variables that could be answered easily by “yes”, “no” or “no clear answer”. This reasoning brought me to reduce the number of sub-criteria from 37 to 33 by eliminating those for which quite specific answers were needed. Then, for the sake of

[24] Of course, few business activities can be regarded as purely product or purely service but rather a certain combination of both. Though, in the frame of this classification I have decided to only look at the dominant aspect.

facilitating the analysis, I made the choice to convert the inputs of each variable into an integer ranging from -1 (i.e. not applicable the criterion) to 1 (i.e. strongly applicable to the criterion). The number 0 is assigned to the criterion when the data is either missing or ambivalent. Though, the exact meaning of the assigned number can slightly vary among variables and I will give additional comments later in the chapter. The outcome of this process is presented in table 2.4 in appendix which shows the raw data set used to carry out the analysis. This scoring approach allows me to compute some basic statistics (e.g. average, maximum, minimum) and derive some interesting results. In the following paragraph, I explain in more detail the scoring method. It includes the rules I used to assign a score (-1, 0 or 1) to each (sub-)criterion which of course must be consistent across all cases, as well as the scores aggregation method.

Table 2.3. Category each case belongs to for each of the three independent classification criteria

	Case studies	Type of industry	Category	Geography
1	Bergamo's Bike-sharing PSS	Product	B2C	Developed
2.1	Bicycle-sharing based on PSS-EPR in China: Mobike	Product	B2C	Emerging
2.2	Bicycle-sharing based on PSS-EPR in China: Ofo	Product	B2C	Emerging
2.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	Product	B2C	Emerging
3	Brazilian Olive Oil Case	Product	B2B	Developing
4	Brazilian Road transport	Service	B2B	Developing
5.1	Brazilian vs Italian companies: Brazil	Product	Hybrid	Developing
5.2	Brazilian vs Italian companies: Italia	Product	Hybrid	Developed
6	Caterpillar remanufacturing strategy	Product	B2B	Developed
7	Colombian cake shop (SME)	Service	B2B	Developing
8	Decathlon renting service	Product	B2C	Developed
9	Distributed Renewable Energy (DRE)	Product-service	B2B	Developing
10	E-mobility case	Product	B2C	Developed
11	Function-based transportation system	Service	B2C	Developed/ing
12.1	Heavy machinery manufacturer	Product	B2B	Developed/ing
12.2	Telecommunication infrastructure provider	Product-service	B2B	Developed/ing
13	Household appliances	Product	B2C	Developed/ing
14	Michelin Fleet Solutions: Truck tires	Product	B2B	Developed
15	The failure of Mu by Peugeot	Product	B2C	Developed
16	New logistics and freight transportation model	Service	B2B	Developed
17	Plastic extrusion pipes	Product-service	B2B	Developed
18	PSS applied to healthcare industry	Service	B2C	Developed/ing
19	Reshaping washing machine	Product	B2C	Developed
20.1	Service-oriented electricity system: community-based	Product-service	B2B	Developed
20.2	Service-oriented electricity system: third-party service	Product-service	B2B	Developed
21	Small Household Equipment Manufacturer (SHEM)	Product	B2C	Developed
22	Smartphone Case	Product	B2C	Developed
23	The future of WM as a service in CE	Product	B2C	Developed
24	The washing machine case	Product	Hybrid	Developed/ing
25	WhiteGoods manufacturer	Product	Hybrid	Developing
26	Xerox asset management program: printer leasing	Product	B2B	Developed

Firstly, regarding the 5 “FSE fundamental principles”, the following scores were assigned: For the first criteria, 1 if the business offer involves a combination of product(s) and service(s), -1 if not, 0 if unknown or ambivalent. For the second criteria, 1 if the product’s use prevails over product ownership, -1 if not, 0 if unknown or ambivalent. For the third criteria, 1 if a (physical or online) sharing platform has been implemented, -1 if not, 0 if unknown or ambivalent. For the fourth criteria, 1 if a technological component is involved, -1 if not, 0 if unknown or ambivalent. For the fifth criteria including two aspect: On the one hand, 1 if the government (or public institutions) has a positive role in the transition, -1 if he has no role or a negative role in the transition, 0 if unknown or ambivalent. On the other hand, 1 if a partnership such as PPP has been agreed upon between private and public sphere, -1 if not, 0 if unknown or ambivalent.

Secondly, I set the “3 pillars fulfillment” criterion apart for the sake of analysis, even though I consider it as part of the FSE main criteria. Then I naturally split it into 3 by defining one environmental, one economic and one social variable (even though once again they are all interconnected in practice). For each sub-criterion belonging to the 3 variables respectively, I assign the value of 1, 0 or -1 following the same reasoning as mentioned above. I then aggregate the score for each variable and express the result on a scale from 0 to 10. This last step is intended to ease comparison among each criteria. I eventually add up the score of each variable and, as a result, get an aggregated score for the 3 dimensions (from 0 to 30). I call it the “fulfillment of the three pillars” criterion.

Thirdly, I compile the numbers relative to the “FSE fundamental principles” criterion and convert the overall score to a similar scale from 0 of 10. I then add up the “FSE fundamental principles” and “3 pillars fulfillment” criteria and obtain a final score in line with FSE for the case (from 0 to 40).

As a last step, I sort each case based on the three independent criteria presented above. In other words, I build successively three different grids; one based on the business type, one based on the industry type and one based on the geography; and then classify each time all the cases accordingly. Those tables are shown in table 2.6 below and tables 2.7 and 2.8 in appendix.

2.4. Limits of the method

It is first worth noting this grid analysis is possibly somewhat impacted by my own interpretation of the information I collected on the subject, despite my attempt to adopt an approach as objective and impartial as possible.

Secondly, the method I use which is based on assigning scores ranging from -1 to 1 to each (sub-)criteria is obviously simplistic as it does not leave much room for nuances. It is only implemented in this way to facilitate the discussion but does not provide a high degree of accuracy. I still do think however that some relevant insights and significant trends can be highlighted based on this approach.

Thirdly, the selection process of the 26 case studies has been carried out based on the existing literature on FSE but without applying any rigorous selection method. This means I have tried to identify the more relevant case studies to be analyzed in line with FSE based on my own perception and judgment. I did it regardless of the specific characteristics of each case (e.g. business type, industry, geography, etc.) and without seeking to reach a certain proportion of cases for each category. As a consequence, most of the cases reviewed are in the developed world and belong to traditionally product-oriented industries. Therefore, the sample of case studies selected should in no way be assumed representative and does not allow to draw very general conclusions for the economy overall.

2.5. In-depth description of some case studies

In this section, I describe in-depth seven cases out of the 26 I have studied to complete the grid analysis. I decided to retain only the cases I consider the most insightful, relevant or representative. This can be either because of the richer and/or higher amount of available information, or because I think the case in question brings to light some important aspects, whether bad or good, of the functional economy. In that sense, it is as important to show cases of success as well as of failure when trying to understand the practical implications of this model.

What is more, each case presented follows a similar structure. Firstly, I give some information on the context of the study as well as on the specific business and/or industry. Secondly, I elaborate more on the previously discussed FSE principles that can be outlined through the case. Finally, I make a conclusive comment and give an appreciation based on what I have learned from the case along with my own judgment.

2.5.1. Bicycle sharing in China

This case (Wu & Zhu, 2017) depicts three distinct business model applied to three different bike-sharing systems. 'Yong jiu' company provides a pile station bicycle sharing solution, while 'Ofo' and 'Mobike' companies offers respectively a pile free and an all-around bicycle sharing solution. All three models differ at some points from each other and I will attempt to describe these discrepancies thereafter. But first let us focus on some commonalties they all share: Firstly, bicycle sharing is considered in each case as a substantial transport alternative to solve current urban mobility issues (e.g. "last kilometer" problem, traffic congestion, …). They all rely on a(n) (online) bicycle-sharing platform enabled by the large panel of information technologies available (e.g. mobile apps) to optimize the use of their bikes while reducing downtimes. Each of them contributes in its way to the achievement of a better public space management in its covered geographic area. Ecologically speaking, they all indirectly participate to the reduction of gas emission through the mitigation of polluting transport modes (e.g. cars) and the resulting fossil fuels. It is also induced that every producer keeps responsibility for bike usage and try to minimize material resources consumption and wastes throughout the whole lifecycle. For example, Ofo use reclaimed bikes to produce new ones.

Secondly, it is worth noting that Yong Jiu model is considered as less relevant and hence less information is provided by the authors about its features. Indeed, Yong Jiu is based on traditional pile stations which means that users retrieve and return the bikes only from specific station locations. It is then way less flexible and convenient for the users compared to pile free systems where bikes can be dropped at any desired place on the pavement. The payment model also differs from the two pile free models since you need to get hold of a specific inconvenient rechargeable card rather than online payment via smartphones. The time use is also limited (2 to 4 hours) in this model preventing them from reaching long time users, what is not the case in pile free system. All these reasons tend to explain while Mobike and Ofo models are seen as more appealing for customers.

Finally, each model does not cover the same geographical area which then impacts customer target: Young Jui builds its stations outside cities traffic hub or large resident communities. Ofo is focused on university campus and targets only young educated people. Mobike is geared towards the entire population in big cities such as Beijing and Shangaï. It means that Mobike can reach a wider range of users and then exploit more market opportunities than its competitors. Moreover, a core distinction between Mobike and Ofo is that the former takes charge of its bike's manufacturing while the latter is only involved in platform management

of its bikes whereas manufacturing is outsourced. It means that on top of coming forth with a unique design for its bikes, Mobike can benefit from a significant cost advantage in terms of maintenance to offset its high manufacturing expenses. On the contrary, Ofo is subject to suppliers conditions and standards and can only propose a poor value added for its bikes while facing higher maintenance costs.

To conclude, despite the upward trend for bicycle sharing nowadays, Mobike is currently the only viable model from the three PSS systems described in the case. The main explanatory factor stems from its integrated value chain including design, manufacturing and maintenance activities which results in differentiation and cost efficiency for Mobike. The firm has some room for improvement yet but seem to head in the right direction as witnessed by its plans to extend further in China and even abroad. Moreover, the model could be potentially applied to other industries such as automotive, for instance. Ofo, for its part, can still become sustainable if it takes steps to switch towards Mobike's model. For Yong Jiu it sounds too late as the model enjoyed its heydays about 10 years ago but is now out of date.

2.5.2. Brazilian olive oil case

This case (Homrich & al., 2017) takes place in the Mantiqueira Community in an inland part of Brazil and is about the olive processing model developed in that specific region. Indeed, the model was introduced in 2012 and allows large producers to sell the olive oil extraction as a service through the rental of their processing equipment to smaller producers. Those can then use the production machines during a determined period of time without having to buy one, something they could probably not afford otherwise. In exchange, the machine owner can request either a percentage of the oil production or a fixed amount of money from the user.

This model provides many advantages for both types of producers as it enables the former to reduce machine idle time while offering new opportunities for farmers with less capacities to enter the market. Firstly, the important role played by the government in the development of the model must be highlighted, notably through public-private partnerships (PPP). Secondly, technological progress is stimulated in line with improved machines development, as automation can increase production efficiency for instance.

From an environmental perspective, the model is implemented in a local frame, implying a supply chain more localized too. Nevertheless, the supply chain is not integrated among producers as everyone keeps responsibility of its own production and supply. Since large

producers keep ownership of the machine they rent, they have an incentive to maintain it in sound condition and extend its lifecycle as long as possible through maintenance and so forth. Moreover, renting the machine rather than buying it allows to reduce resource consumption.

From an economic perspective, renting the machine during idle capacity periods allows large producers to get additional and steady revenues, thus decreasing the volatility related to their activity. At the same time, the model can bring added value to the products of smaller producer since the goods can be sold at a higher price than if they had not been processed. More broadly, it allows higher expectations in terms of market growth through a more intensive aggregated production and the creation of synergies between both types of producers which increases efficiency.

From a social perspective, the model allows the creation of new jobs locally, increasing then the living standards and purchase power in the region. Similarly, it enables the acquisition of new skills and competences by community members, partly thanks to remote labor training.

In conclusion, the model seems beneficial for every market player involved in the local economy. Indeed, large & small producers as well as the Mantiqueira Community as a whole and even the government through PPP can take advantage of closer relationships in that locally-based Olive Oil market. Despite its current marginal implementation, we could thus expect the further application of this model on a larger scale and in other industries. The question is now whether it can effectively be achieved on a broader scale or if it only fits with a narrow one. Furthermore, the importance of the context regarding the development of the model should not be overlooked. Indeed, it turns out that the climate experienced by the region over the past few years was really conducive to its successful implementation which supports the assumption that such a model is only viable under certain conditions.

2.5.3. Caterpillar remanufacturing strategy

Over the past years, Caterpillar (Caterpillar, 2020) has developed a strategy strongly in line with Functional Economy principles. Indeed, the company provides now its customers with a service of maintenance, repair and replacement for a wide variety of its products. This strategy involves then many different fields (e.g. building, mining…) in which the company operates, as well as different brands it owns (e.g. Cat Reman, Yellowmark…) which I will detail later on. The objective of this sustainable strategy is to improve lifecycle management for their products in order to ensure the maximization of their use/availability and extend their lifecycle while minimizing the lifecycle costs for customers. This can be achieved through

close partnerships with Caterpillar dealerships around the world with which they share Caterpillar expertise and know-how. Another essential element is the implementation of digital technologies able to monitor and manage remotely products performance throughout the whole lifecycle, from sale to end-of-life.

Then, through its numerous Cat dealerships, Caterpillar take charge of its components lifecycle management throughout the whole lifecycle to ensure the reliability of its equipment and extend their lifespan. In order to do so, the company realizes preventive maintenance on its machines through advanced monitoring technologies. For example, they proceed to fluid analysis on machines after having collected oil, fuel and other kinds of liquid samples. This notably allows to prevent machines from rapid deterioration and mitigate repair times due to breakdowns, by intervening even before technical defaults arise. Moreover, Cat components are designed in such a way that they can be reused and remanufactured almost to original state. The customer can then benefit from a similar components quality and performance as if new ones but at a lower price while supporting sustainable practices. For example, since 2015 Caterpillar has proposed to provide its customers with the maintenance and renovation of their Caterpillar motor by outsourcing it to their dealership, either on-site or in the workshop.

Whenever components need to be replaced, Caterpillar has created a brand entirely dedicated to this field, called “Cat Reman”. This company retrieves materials from worn out equipment by means of a specific technology and then remanufactures them. Indeed, through this process machine components are entirely dismantled, cleaned and controlled in Cat factories before being made available for further use again. In line with its commitment to social and environmental sustainability, this practice allows to decrease the use of raw materials and new components while extending products lifecycle. The Cat Reman model is based on exchange, meaning that customers must provide Caterpillar with their own end-of-life components in order to benefit from the advantages of those remanufactured parts (i.e. similar quality for a lower price). Those remanufactured parts are available directly on-demand and intended for a wide variety of applications (e.g. powertrain…) linked to various fields (e.g. automotive, industry…). This way, the customer can in turn reduce its operating cost and cost of ownership.

Furthermore, in 2017 Caterpillar announced the launch of a new brand of spare part/repair patches called Yellowmark. This extended maintenance and remanufacturing strategy is enabled by the same technologies as previously mentioned (e.g. online platform, connectivity tools for monitoring…) and has directly been spread globally among its numerous dealership partners as well. The Yellowmark parts are aiming at providing solutions to the various needs in the construction sector, either for small or medium equipment. Once again, customers can optimize their operating costs while enhancing the quality-price ratio of their purchases. In that sense, a high level of component standardization is essential for Caterpillar to ensure efficiency and interoperability of its products.

Finally, Equipment Management Services (EMS) consist of service contracts including consulting, follow-up and/or total maintenance provision. The contract implies notably annual visits by technical experts or after-sale inspectors. It offers a wide range of expertise to partners such as mechanical, hydraulic, electrical… The resulting effects are extended product life for machines and better management of used consumables, among others, supporting the way to a more sustainable industry.

From a social perspective, Caterpillar encourages responsible management of its products through the whole life cycle. That way, the company intends to mitigate all the negative externalities that could arise from its activity regarding health, security and society notably (Caterpillar, 2020). This applies to any person involved in its processes anywhere in the world, from suppliers and customers to communities, regardless of their size. Caterpillar overarching goal is in turn to address the fundamental human needs in terms of housing, clean water or reliable electricity in order to ensure the proper functioning of any society regarding essential issues such as education, etc. (Caterpillar, 2020). A first step towards this vision is then taken with the provision of adequate working conditions for employees as well as of products and services in that respect.

To conclude, the new maintenance and repair strategy undertaken by Caterpillar for the last decade seems to pay off while nicely aligning environmental, economic and social issues. Indeed, all those environmentally-friendly practices, brands and programs regarding product management involved in many different fields and enabled by advanced technologies are in line with reducing costs both for Caterpillar and its customers while enhancing social responsibility as well. The current global scope reached by Caterpillar with

this strategy is a strong element in support of this sustainable model and in favor of its continuity. An interesting point to underline comes from the fact that Caterpillar still considers it is selling products to customers. Though, it seems that in practice it does not differ from FSE principle related to usage rather than ownership since the component maintenance is performed by Caterpillar throughout its whole lifecycle and then can be transferred to a different customer after it has been retrieved from the previous one and remanufactured. In that sense, the only divergence between Caterpillar and the FSE model would stem from the name given to the transaction, rather than a substantial one.

2.5.4. Decathlon renting service

In 2020, Decathlon (Decathlon, 2020) has started proposing to its customers a new renting service based on CE/FSE principles. This model will take the form of a subscription allowing customers to borrow materials from every sport category over a short to long period. This way, the consumer does not need to purchase the product to get access to it and can then benefit from more flexibility and opportunities to practice new sports. This model brings many advantages regarding the 3 main dimensions: economic, ecological and social.

Firstly, the sustainable aspect of the model allows Decathlon to make its products last longer and hence rent them over an increasingly longer period thanks to appropriate design and conception as well as timely repair. This achievement allows the company to increase its gain in profitability and thrive economically. It also enables the industry at large to thrive economically since Decathlon is willing to engage with suppliers and share part of its profits with them in exchange for their commitment to switch towards more sustainable production in return. Evidently, one pre-condition for the model to keep going is that consumers get economic incentives as well, meaning that the total price of renting/borrowing a product over time must remain lower than the price to purchase it. We will come back to that important point in the following part.

From a social perspective, there are numerous advantages as well. Firstly, Decathlon is committed to use its gain in profitability in order to decrease the price borne by consumers to access the material while increasing the quality of the products meanwhile. In other words, the equation is the following: increased quality means lower price at the same time (Decathlon, Prêts pour une consommation "durable" du sport ?, 2020). Of course, it is a win-win relationship because if access to sport material is cheaper consumers will rent more frequently products or over a longer period, creating hence a virtuous circle and supporting

Decathlon economic profitability as well. Secondly, it has potentially great positive impacts on society as it promotes the practice of sports which is proven to be highly beneficial in terms of health. Moreover, it gives access to sport for a wider part of the population by lifting related financial (and cultural) barriers and promotes diversity and openness to new sport activities.

Now let's point out what the model enables from an ecological point of view: It turns out the model would result in a drastic decrease in waste creation, notably by removing the use of unnecessary plastic materials through a significant reduction in the quantity of products manufactured offset by a more systematic refurbishment policy, either by Decathlon or by the users themselves. This way, Decathlon wants to encourage its customers to become active contributors to the process of sustainability by taking care of the product Lifecyle by themselves. In that sense, it could be interesting for them to provide the appropriate trainings in line with this project.

Besides that, and also in line with the CE/FSE principles, Decathlon has launched since May 2020 a new program aiming at reclaiming worn, not necessarily Decathlon products (bikes, weights, etc.). They only condition to fulfill is the product needs to belong to a certain "return grid". Then, people bring their worn, unused products and get a fixed amount of money back in the form of gift cards in return. Those products are then refurbished and put back on sale with the label of "used product". This initiative has first been implemented within five channel stores all located in Liège (Belgium) and will certainly be extended more broadly if it turns out to be successful. Though, it is worth noting Decathlon already started to implement such practices some time ago. Indeed, the Trocathlon was launched in 1986 and allows private individuals to resell their old fitness products twice a year. In that sense, Decathlon is by far ahead of its time.

To conclude, the new renting model launched by Decathlon in 2020 as a market test so far brings many advantages, economically, socially or ecologically. We will see if the model will be able to thrive as it still is at a very early stage of development. Though, we would tend to think the potential is large. The example of Decathlon shows a case where the company got inspired by the existing CE/FSE theory and started to rigorously build its new business model on it. We could also outline that one of the main elements which is likely to have eased the implementation of this new model is the hierarchical structure proposed within Decathlon, known as quite smooth and flat. It means the decision-makers are open to ideas coming from

any level of the company and every Decathlon collaborator can then bring inputs freely and be listened to. This model also holds potential for being generalized to many more commercial activities, beyond sport products merely.

2.5.5. Michelin Fleet Solutions : Truck tires

Michelin operates in the tire sector and has since 2001 developed a new offer geared towards road transport companies which is closely in line with FE principles. Through its Michelin Fleet Solution, it proposes the outsourcing of tire management by offering a full-set of services including maintenance to its customers (B2B). Therefore, Michelin provides them with tire usage (rather than sale) and charges them based on kilometers travelled. This is made possible because Michelin keeps ownership of its products and incurs the associated risks, which constitutes a fundamental prerequisite for the model viability. Another important success factor is Michelin reliance on advanced technologies, a point that will be more fully elaborated in the next section.

One of Michelin main objectives is to reduce fuel consumption thanks to innovative tire conception and maintenance services. For example, Michelin offers two different ranges of pneumatic products: Energy and X-One tires. The first one generates a 6% decrease in fuel consumption while the second is responsible for a 5% reduction due to lighter vehicle weight. Moreover, maintenance also allows to reduce tire production and waste by keeping tires in good condition for longer and extending their lifecycle. For instance, retreating and regrooving strategy implies a product life extension of 2.5 times, enabling a 36% saving related to tire replacement that can be avoided or at least delayed. Put differently, only 20 tires instead of 64 are used compared to the same period. In that sense, it is opposed to the old model where margins are driven by increased production and sales as well as rapid disposal. As previously mentioned, Michelin must keep tire ownership through the whole lifecycle and only sells tire use to reap those benefits. Furthermore, another key success factor was that Michelin has constantly demonstrated great knowledge of its products (e.g. proper tire inflation implying reduced fuel consumption and tire wear) thanks to advanced technologies with a view to follow-up and monitor its tires at any time of their lifecycle.

Thanks to all of that, the solution has positive environmental implications, even if the objective pursued by Michelin is mostly economic. For the record, Michelin was at that time not even aware it was transitioning towards a FE model and the underlying reason for it is mainly because its previous model was not considered attractive enough by its customers.

Indeed, Michelin first started to propose a similar offer with the same implications in terms of fuel reduction and based on its technology but relying on product sale. As a result, customers were not willing to pay a higher price for it even though they acknowledged Michelin products value added. Today, FE principles applied to its tire offering have made it attractive to both parties. The economic incentives for customers come mainly from reduction achieved in organizational costs due to the transfer of internal management to Michelin and optimization of budget allocated to tires. On the other hand, appropriate maintenance allows Michelin to optimize costs as well, in a consistent way with its innovative and conception strategy. On top of that, the reduction in the number of tires produced and used (i.e. 44 for the same reference period) implies Michelin can increase its margin due to reduced electricity and raw materials costs. This higher margin can in turn be shared with customers which explain the reduction in their own cost. Eventually, the pay-per-kilometer model allows Michelin to provide its customers with a lower price compared to the traditional revenue model based on sales.

Socially and environmentally, the model contributes to alleviate some negative externalities. Firstly, the decrease in fuel and material consumption leads to reduced emissions (e.g. CO2), fostering a clearer air and mitigating pollution for human beings. Moreover, better maintenance ensures higher reliability of trucks, resulting in increased road safety along with improved vehicles mobility. Finally, the immediate support provided to truck drivers in case of need helps enhance work conditions.

To conclude, the Michelin Fleet Solution seems to constitute a viable option for the pneumatic industry and offers many opportunities for businesses. This is evidenced by its relatively high implementation level up to now since half of large European heavy goods vehicles fleets, that means 8% of the total market, have already decided to embrace it. There are also numerous opportunities for market expansion since the Fleet solution has recently been introduced in North America, which obviously constitutes a highly significant market. Though, it still must be demonstrated if this model could be further applied in this market and beyond it, since Michelin case emphasized the specific technological skills needed to build a sustainable competitive advantage.

2.5.6. The failure of MU by Peugeot: vehicles renting service

In 2009, Peugeot (Auto Europe, 2020) launched a new urban mobility solution called Mu by Peugeot. However, in 2016 the company announced the redesign of its offering and its

replacement by a simpler and more restricted one called Peugeot Rent. In the following sections, I will first describe Mu by Peugeot offering more deeply, highlight the underlying reasons behind its emergence and discuss its purported benefits. Then, we will try to understand why the initial model failed to reach its objectives and what are the implications of the new offering.

The Mu by Peugeot concept consisted in a multimodal and prepaid renting model intended for its customers: Firstly, it offered access to a wide range of vehicles (car, utility vehicle, scooter & bike…) and accessories (house moving kit, roof rack & box, GPS…) for a short-term period going from a single day or week-end, to the whole week. The car company kept ownership of its products and ensured maintenance after their retrieval. Secondly, the access to this offer was conditional to the creation of an account on Peugeot website which then had to be (re)loaded with payment units directly converted from euro and deducted from your bank card. Thus, one unit meant 20 euros cents inducing a ratio "euro/unit" of 1/5. (e.g. renting a bike for 25 units a day amount to pay 5 euros a day) Afterwards, you only had to go on-site and bring a photocopy of your driving license if required. You would then immediately get the use of the product ordered. The process does not seem burdensome at all and should not have constituted a significant barrier to its implementation and acceptance by customers. Those new mobility services were at that time only proposed among Peugeot dealerships located in France, some of them providing customers with specific offers of their own (e.g. "winter holiday package" proposed in Rennes-Cesson). Given the early success it experienced though, the company nurtured big ambitions and intended to extend its offer across Europe within a year (CNET France, 2010). This was achieved later that year with a consolidated presence across Belgium, Germany and the UK (Economie-de-fonctionalité.fr, 2010).

Mu by Peugeot offered highly flexible services adapted to various customer needs and started from a simple observation: owning an individual car is no more a one-size-fits-all solution to ensure sustainable mobility. In that sense, this alternative mobility solution wanted to initiate a change in customer mindset regarding car use in cities, while social status seemed from that time less and less driven by ownership. It was then mainly focused on urban users with regular needs but who were not willing to buy a car or to use everywhere all the time. Though, the targeting went beyond that since the offer could also be applied when leaving for short holidays (e.g. weekend) or moving out on its own by renting utility vehicles. This could

also have been coupled with other means of transportation such as train or plane through partnership with external travel organizations, still in line with the inter-modality principle. Moreover, the company also aspired to attract and retain young customers in search of new driving experiences and who could not afford those kinds of products otherwise.

Thus, in principle Mu by Peugeot had many advantages: Firstly, it allowed to optimize the usage of vehicles which is beneficial to the company efficiency and, in turn, profits. The implied decrease in the number of vehicles manufactured/used can also result in a positive induced environmental impact. On the other side, the fees proposed by Peugeot to its customers were most of the time equal or even lower than the price of its competitors (e.g. car leasing companies) which made it very appealing for price-sensitive customers. For example, the renting price for its scooters turned out to be 20% less than elsewhere. However, the situation was more complex regarding its bicycle renting offer since they had to face an uneven competition on price with Vélib' for instance which constituted a more attractive solution for potential customers. Moreover, scooters and bikes rentals put together only accounted for 5% of total operations which means they were considered as exceptional rentals (Asso-scooter, 2010). Those two elements might help explain why the rent of those product ranges are not part of Peugeot offering anymore.

As a matter of fact, Mu by Peugeot did not satisfy customers enough and was rapidly updated with a simplified version called Peugeot Rent. Although Peugeot claimed they just changed its name because it was unclear in their customers mind, it is a fact that the offer is not the same anymore. Indeed, this new proposal is now restricted to the rental of specific Peugeot vehicle models instead of being able to choose among a variety of vehicles. Moreover, scooters, bikes and accessories have all been removed from the offer. Tough, it still shares similarities with the previous offer since it consists of short-term contracts and the booking is done via their website.

To conclude, several reasons tend to explain the shift from the broad Mu by Peugeot to the more limited Peugeot Rent offer. Indeed, the unmet satisfaction of customer needs, the fierce price competition with Velib' and the rather low share of bikes and scooters in its total operations, among other things, might have forced Peugeot to weigh in favor of a revised offer. In the same vein, a report published in January 2016 by the Direction Générale des Entreprises (DGE, ministère de l'Economie, 2016) highlighted the strong conviction among

car manufacturers that there is more to lose than to win when transitioning towards this kind of model (i.e. renting-based model). Indeed, it has been drawn from consultations with PSA and Renault that the high transition costs without any guarantee of results would constitute a significant barrier to its adoption by producers (L'argus.fr, 2016). Moreover, another explanation may lie in a shift of their interest towards future opportunities related to connected and autonomous vehicles.

2.5.7. Xerox asset management program: printer leasing

Xerox, a large US company considered as the inventor of the xerographic photocopier and of the first printer, is also a pioneer in proposing solutions related to FE (Xerox, 2020). The company offers to its clients (B2B) long-term and exclusive leasing contracts in line with its asset management program. This implies that the company keeps responsibility for its equipment and provides classic maintenance operations on it such as paper and consumables supply. On top of that, Xerox proposes an extended set of services from customer employee training for establishing eco-responsible practices to optimization and management of the whole park (including non-xerox machines) via its own employees deployed on-site.

This second option, component standardization across all Xerox products (scan, fax, printer, photocopier, etc.) enabled by appropriate and updated product conception is essential for the viability of the Xerox model. Its revenues from customers are based on a fixed payment by photocopy in addition to a fixed monthly fee for maintenance services and consumables. From that point of view, it would be interesting to understand why Xerox decided not to extend its pay-per-photocopy model to all consumables and even maintenance services.

Over the course of its history, technological progress has always played an essential part in Xerox development and ability to stay a leader on its market. For instance, in the 1980s the company realized a major switch from electromechanical to digital print, with all the resulting advantages. More recently, the evolution of information networks incited Xerox to adjust its offering again and to propose the Management Print Service solution to meet the new needs of customers in terms of documentation (e.g. archives digitization). Today, the company also relies on monitoring tools to oversee user's behavior and advise them through easy print settings, … Xerox also set up its own R&D operations to foster new services developments in line with information technologies. This evolution takes place in the context of

increasingly stricter regulations regarding environmental compliance which will be discussed in the following section. For example, the EU Directive on waste electrical and electronic equipment (WEEE) was introduced in 2012.

The company must be considered as an early ecological actor since it started recycling materials as early as 1967 and has pursued this strategy until now. Today, the company can be proud of its 90% rate of reuse/recycling/retrieval on its machines. Of course, all those environmentally-friendly innovations as well as the following ones have always been grounded on an economic basis, especially when environmental awareness was not as critical as it is today. Then, still for the sake of competitiveness, the company launched in the course of the 1990s its objective zero waste program for its equipment and consumables. Still today, some contracts include energy & material consumption thresholds and even CO2 emission targets, among others. This has already allowed the company to reduce by a third annual greenhouse gas emission (Xerox, 2020). More specifically, reduced amount of paper printed allows for lower CO2 emission through reduced energy consumption. This latest environmental improvement has been and still is supported by the transition towards digitalization which brings Xerox plenty of new business opportunities out of paper services. Though, the most fundamental condition for Xerox to exert a positive impact on the environment lies in the optimization of sizable printing parks. Indeed, the park should contain between 50 and 100 machines of different types and each with different and limited functionalities to ensure an effective environmental influence, which is quite a demanding requirement.

The underlying reason behind Xerox's economic model lies in the fact that the company faced at that time a lack of confidence from users towards its new technologies and most were not able to align with the high price requested. This is still a valid argument and leasing operations constitute the major part of Xerox revenues today. This implies that the company must rely on elaborate recycling techniques among other things to ensure its profitability, rather than on increased sales volume of its machinery as is the case in the traditional model. This is notably eased due to a high level of component standardization (i.e. commonality principle) which allows in turn a reduction in needs for raw materials and components as well as in the costs related to the storage and treatment of its products. Between 1992 and 1995, it was thus up to 64 million euros in supply costs that have been saved due to materials and components end-of-life (retrieve-reuse-recycle) operations. In

terms of efficiency, machines utilization rate and printing cost objectives are fixed in advance to minimize costs related to waste. Those savings allow Xerox to offset the cost stemming from additional workforce dedicated to maintenance.

From a social perspective, the regionalization of Xerox maintenance activities allows enhanced proximity with customers and better quality of services provided on-site. This leads to several implications on employees who get opportunities to be given enlarged responsibilities at local levels and be provided with advanced trainings in order to acquire the newly requested competences and skills in line with technological progress.

To conclude, even though Xerox early adoption and preservation of the FE model have always been driven by the potential economic benefits resulting from it, it can be said that the company has succeeded in reconciling its economic and environmental objectives in a bright way. Indeed, since the outset of its recycling activities in 1967 both dimensions have always been inherently related and served each other by acting consistently altogether. It is even worth mentioning that the company attempted at some point to embrace the traditional selling model but then retracted and came back to the lease-based one as it was more profitable. Finally, we have seen that this model applied by Xerox also has some positive social implications on people (e.g. employees) besides reducing negative externalities such as CO2 emissions, implying a better living environment.

2.6. Results and interpretations

In this section, the following tables highlight the scores obtained by the (sub-)cases for the FSE main criteria and evaluation criteria. They also classify the cases according to the specific objective pursued. This allows me to test the assumptions I previously made about each classification criteria (see section 2.3.1.c) based on the results obtained.

First of all, I introduce some general results that are shown in table 2.5 below. Indeed, the global average score obtained by the cases altogether is 31.1, the maximum score among the cases is 36.7 and the minimum score is 22.6 (the range of the scores goes from 0 to 40 with 20 corresponding to the median score). The relatively high mean score suggests that the cases considered are quite in line with/leaned towards the FSE model. Moreover, the high variability in the scores obtained (ranging from 22.6 to 36.7) suggests that substantial gaps exist between the cases in terms of fit with the FSE.

I then group the cases successively according to their business type (table 2.6 below), industry type (table 2.7 in appendix) and geography (table 2.8 in appendix).

The first classification criteria I have used to categorize the cases is the business type (B2B, B2C or hybrid as previously defined in section 2.3.1.c). The main results relating to this specific criterion are presented in table 2.6. below.

Table 2.5. Score assigned to each case (sorted alphabetically) for each specific FSE main criterion

	Case studies	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
1	Bergamo's Bike-sharing PSS	34,2	9,2	25,0	9,0	7,7	8,3
2.1	Bicycle-sharing based on PSS-EPR in China: Mobike	28,4	8,3	20,0	9,0	7,7	3,3
2.2	Bicycle-sharing based on PSS-EPR in China: Ofo	25,8	8,3	17,5	8,0	6,2	3,3
2.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	22,8	8,3	14,4	6,5	4,6	3,3
3	Brazilian Olive Oil Case	33,8	7,5	26,3	7,5	8,8	10,0
4	Brazilian Road transport	25,4	5,8	19,6	7,5	5,4	6,7
5.1	Brazilian vs Italian companies: Brazil	28,5	6,7	21,9	7,0	6,5	8,3
5.2	Brazilian vs Italian companies: Italia	22,7	4,2	18,5	4,0	6,2	8,3
6	Caterpillar remanufacturing strategy	36,7	7,5	29,2	10,0	9,2	10,0
7	Colombian cake shop (SME)	22,6	6,7	16,0	7	7,3	1,7
8	Decathlon renting service	28,2	5,0	23,2	9,5	5,4	8,3
9	Distributed Renewable Energy (DRE)	34,9	6,7	28,2	9	9,2	10,0
10	E-mobility case	34,2	8,3	25,8	7,0	8,8	10,0
11	Function-based transportation system	35,8	10	25,8	10,0	5,8	10,0
12.1	Heavy machinery manufacturer	34,4	10,0	24,4	9,5	6,5	8,3
12.2	Telecommunication infrastructure provider	34,4	10,0	24,4	9,5	6,5	8,3
13	Household appliances	34,4	8,3	26,0	9,5	6,5	10,0
14	Michelin Fleet Solutions: Truck tires	34,7	6,7	28,1	10	8,1	10,0
15	The failure of Mu by Peugeot	30,1	5,8	24,3	8,5	5,8	10,0
16	New logistics and freight transportation model	33,3	8,3	24,9	8	6,9	10,0
17	Plastic extrusion pipes	31,6	8,3	23,3	8	6,9	8,3
18	PSS applied to healthcare industry	30,6	10,0	20,6	5,5	8,5	6,7
19	Reshaping washing machine	35,1	9,2	25,9	9,0	6,9	10,0
20.1	Service-oriented electricity system: community-based	32,9	5,8	27,1	9,5	9,2	8,3
20.2	Service-oriented electricity system: third-party service	28,9	6,7	22,2	8,5	5,4	8,3
21	Small Household Equipment Manufacturer (SHEM)	32,1	7,5	24,6	9,0	7,3	8,3
22	Smartphone Case	32,8	7,5	25,3	8,5	8,5	8,3
23	The future of WM as a service	24,6	5,8	18,7	10,0	5,4	3,3
24	The washing machine case	30,4	7,5	22,9	8,5	7,7	6,7
25	WhiteGoods manufacturer	32,5	7,5	25,0	9,5	8,8	6,7
26	Xerox asset management program: printer leasing	36,0	7,5	28,5	10	8,5	10,0
	Average	31,1	7,6	23,5	8,5	7,2	7,8
	Maximum	36,7	10,0	29,2	10,0	9,2	10,0
	Minimum	22,6	4,2	14,4	4,0	4,6	1,7

Table 2.6. Classification of the cases according to the business type and scores for the FSE main criteria

Case number	B2B	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
1	Distributed Renewable Energy (DRE)	34,9	6,7	28,2	9	9,2	10,0
2	Service-oriented electricity system: community-based	32,9	5,8	27,1	9,5	9,2	8,3
2.2	Service-oriented electricity system: third-party service	28,9	6,7	22,2	8,5	5,4	8,3
3	Brazilian Road transport	25,4	5,8	19,6	7,5	5,4	6,7
4	Plastic extrusion pipes	31,6	8,3	23,3	8	6,9	8,3
5	Brazilian Olive Oil Case	33,8	7,5	26,3	7,5	8,8	10,0
6.1	Heavy machinery manufacturer	34,4	10,0	24,4	9,5	6,5	8,3
6.2	Telecommunication infrastructure provider	34,4	10,0	24,4	9,5	6,5	8,3
7	Colombian cake shop (SME)	22,6	6,7	16,0	7	7,3	1,7
8	New logistics and freight transportation model	33,3	8,3	24,9	8	6,9	10,0
9	Michelin Fleet Solutions: Truck tires	34,7	6,7	28,1	10	8,1	10,0
10	Xerox asset management program: printer leasing	36,0	7,5	28,5	10	8,5	10,0
11	Caterpillar remanufacturing strategy	36,7	7,5	29,2	10,0	9,2	10,0
	Average	32,3	7,5	24,8	8,8	7,5	8,5
	Maximum	36,7	10,0	29,2	10,0	9,2	10,0
	Minimum	22,6	5,8	16,0	7,0	5,4	1,7
Case number	B2C	Total score /40	FSE fund. Prcpls. /10	Three pillars fulfilment /30	Environment /10	Economic /10	Social /10
12.1	Bicycle-sharing based on PSS-EPR in China: Mobike	28,4	8,3	20,0	9,0	7,7	3,3
12.2	Bicycle-sharing based on PSS-EPR in China: Ofo	25,8	8,3	17,5	8,0	6,2	3,3
12.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	22,8	8,3	14,4	6,5	4,6	3,3
13	PSS applied to healthcare industry	30,6	10,0	20,6	5,5	8,5	6,7
14	Reshaping washing machine	35,1	9,2	25,9	9,0	6,9	10,0
15	E-mobility case	34,2	8,3	25,8	7,0	8,8	10,0
16	Household appliances	34,4	8,3	26,0	9,5	6,5	10,0
17	Smartphone Case	32,8	7,5	25,3	8,5	8,5	8,3
18	Small Household Equipment Manufacturer (SHEM)	32,1	7,5	24,6	9,0	7,3	8,3
19	The future of WM as a service	24,6	5,8	18,7	10,0	5,4	3,3
20	Decathlon renting service	28,2	5,0	23,2	9,5	5,4	8,3
21	The failure of Mu by Peugeot	30,1	5,8	24,3	8,5	5,8	10,0
22	Bergamo's Bike-sharing PSS	34,2	9,2	25,0	9,0	7,7	8,3
23	Function-based transportation system	35,8	10	25,8	10,0	5,8	10,0
	Average	30,6	8,0	22,7	8,5	6,8	7,4
	Maximum	35,8	10,0	26,0	10,0	8,8	10,0
	Minimum	22,8	5,0	14,4	5,5	4,6	3,3
Case number	Hybrids	Total score /40	FSE fund. Prcpls. /10	Three pillars fulfilment /30	Environment /10	Economic /10	Social /10
24	The washing machine case	30,4	7,5	22,9	8,5	7,7	6,7
25	WhiteGoods manufacturer	32,5	7,5	25,0	9,5	8,8	6,7
26.1	Brazilian vs Italian companies: Brazil	28,5	6,7	21,9	7,0	6,5	8,3
26.2	Brazilian vs Italian companies: Italia	22,7	4,2	18,5	4,0	6,2	8,3
	Average	28,5	6,5	22,1	7,3	7,3	7,5
	Maximum	32,5	7,5	25,0	9,5	8,8	8,3
	Minimum	22,7	4,2	18,5	4,0	6,2	6,7

We observe that the highest total mean score is reached by B2B (32.3), followed by B2C (30.6) and lastly, hybrids (28.5). Those results align somewhat with my assumption (H0a) previously made since B2B cases effectively outperform B2C (and hybrids) on average. This could be partially explained by less serious emotional barriers for B2B cases when implementing the model. Indeed, as referred to in chapter one, some consumers are still highly reluctant to give up on products ownership and move to their temporary use. Of course, this is only one possible interpretation among many others. Furthermore, it is worth

noting that, according to this analysis, B2C prevail over hybrids (B2B and B2C) from a FSE standpoint. By giving a closer look to the results, we observe that B2B dominates in terms of three pillars fulfillment overall, as well as each of the three aspects separately. This statement tend to somewhat dispel the idea that pressure for environmental and social changes comes mainly from end consumers who, in turn, push B2C companies to adapt their behavior and act differently. Finally, the only criterion where B2B does not prevail is associated with the FSE fundamental principles where B2C outperform the others, meaning that they would tend to integrate more elements linked to FSE in their business model.

Regarding the second independent classification criterion referring to industry type, it turns out from table 2.7 in appendix that the highest total mean score is reached by product-&-service-oriented industries (32.5), followed by product-oriented industries (31.1) and finally service-oriented industries (29.5). Those results partly align with my previous assumption (H0b) since they suggest that product-&-service-oriented industries favor indeed the implementation of a FSE model over the others. Though, they also suggest that products-oriented industries override services-oriented industries which hence partly contradict this same assumption (see section 2.3.1.c). Moreover, this pattern is supported by the results obtained for the three pillars fulfillment along with each of its constituting dimensions. The only deviation to underline is about the results obtained for the FSE fundamental principles criterion where the score attributed to service-oriented industries (8.2) prevail over the score of product-oriented industries (7.6) which in turn outpace the score of product-&-service-oriented industries (7.5). Most of the time though, it must be noted that the score differentials are quite marginal.

With regards to the last independent classification criterion I use for this analysis, that is the geography, we notice from table 2.8. in appendix that the highest total mean score is reached by the cases from the developed & developing/emerging countries category (32.8), then the developed countries category (32.0) and lastly, the developing/emerging countries category (28.3). Those results do not fully align with my previous assumption (H0c) since, although they suggest that developed countries effectively outpace developing/emerging countries in terms of alleged fit with FSE, it turns out on the same basis that the most suitable environment for implementing such a model would actually be provided by a combination of both. To go further through this analysis, it would mean that being part of the developing/emerging world besides the developed one would inure to the benefit of the case rather than being detrimental to it. Moreover, this pattern is reinforced by the results relative to the FSE fundamental

principles criterion which stresses the same order in terms of scores magnitude. In that respect, it is worthwhile to stress the relatively high mean score (9.2) achieved by the cases from the developed & developing category altogether regarding the FSE fundamental principles criterion. This could suggest that on average, the cases of this category are somehow able to ensure a better integration of the main FSE components into their business model, compared to the others. Another telling indicator concerns the relatively low score (5.9) achieved by the cases from the developing/emerging category altogether regarding the social dimension. This could notably suggest a relative lack of job opportunities, trainings and protection against negative social externalities provided by developing/emerging countries in line with the FSE on average. Finally, it stands out from the results that the economic dimension is not significantly impacted by the country of residence.

More generally, it appears from the evaluation criteria in table 2.2. in appendix that most of the cases considered consist of relatively recent (i.e. after the year 2000) applications of functional economy principles. Among those cases, the current level of implementation of the model is quite variable. Moreover, the models proposed are generally expected to evolve favorably in the future and are seen as being relatively extendable to other industries. As for the feedback received by the cases from the market and stakeholders, it is mixed with (subjective) scores ranging from 2 to 10. It is the same for the personal scores I assigned to each case which ranges from 2 to 10 as well.

2.7. Conclusions

In the course of this chapter, I have attempted to confront the FSE theoretical framework presented above with some practical applications (i.e. case studies) by means of a grid analysis built on chapter 1. The objective of this approach is to assess from an empirical perspective firstly the extent to which the model has already been put in place up to now, and then the most suitable characteristics for a business or organization to enable its successful implementation.

Based on the various case studies considered and the results from the grid analysis, it appears that the functional economy model has not been widely implemented in the global economy (yet) but rather tend to be limited to a small scale and/or very specific business segments benefiting (mostly economically) from it, sometimes without being even themselves fully aware they belong to it. This suggests that the economic dimension remains the main driver when switching to this new model. Moreover, among the cases where a functional economy

model has effectively been implemented, the outcome appears to be mixed and varies from great success to total failure (table 2.2. in appendix). Lastly, it turns out that the transition is on average more successful for businesses and organizations already offering a combination of products and services and involved in both developed and developing areas and in B2B markets. Although the conclusions above should be considered with caution given the limitations resulting from the methodology adopted, I still do think this exploratory analysis provides a good illustration of the practical implications linked to the implementation of a functional economy model.

In the next chapter, I pay a closer attention to the consumer perspective. Indeed, B2B appears to be more suitable for the implementation of a FSE model compared to B2C which seems to encounter more challenges, both from a customer acceptance and an economic point of view. To get a deeper understanding of the reasons possibly explaining this gap, it is essential to learn more about the actual attitudes and opinions of consumers towards the FSE. In chapter 3 I intend to investigate further this question by analyzing the results from a survey I conducted on the subject in June 2020.

Chapter 3: Survey on the attitude of consumers towards the functional economy

3.1. Introduction and objective pursued by the survey and the model analysis

After a presentation of the prerequisites for the implementation of a functional economy[25] from a broad perspective (chapter 2), I now focus on the model from a consumer point of view. For that purpose, I have carried out an online quantitative survey with Google Forms in June 2020. I have then performed an analysis of the results obtained with STATA.

I begin with a precise description of the different steps I went through for the completion of the survey: from the development of the questionnaire to the sampling method I used, the distribution and follow-up of the survey and finally, the check, collection and processing of the data. Following that, I explain the statistical models I developed to analyze the results of the survey and I present my various conclusions.

The survey is includes 34 questions assigned to five distinct successive categories which assess four main dimensions: (i) the socio-demographic characteristics of respondents, (ii) their attitudes/opinions towards the environment in general, (iii) their familiarity with and perception of the concepts of functional economy, (iv) their interest for some practical solutions (i.e. case studies) illustrating the functional economy model and the probability they effectively use those proposed solutions. Socio-demographic characteristics of respondents are considered as control variables all along the analysis.

Moreover, the model aims to identify and test statistical relationships among those five dimensions. In other words, I seek to measure first the effect of the attitude towards the environment on the perception of the functional economy, then the effect of this perception on the interest shown in practical solutions and ultimately, the effect of this latter aspect on the probability of effectively adopting those solutions. The effect of socio-demographic variables is also systematically tested in each specific case. If these relationships are as expected, this means that the attitude towards the functional economy would act as a mediator[26] between the attitude towards the environment in general and the interest in the proposed solutions on the

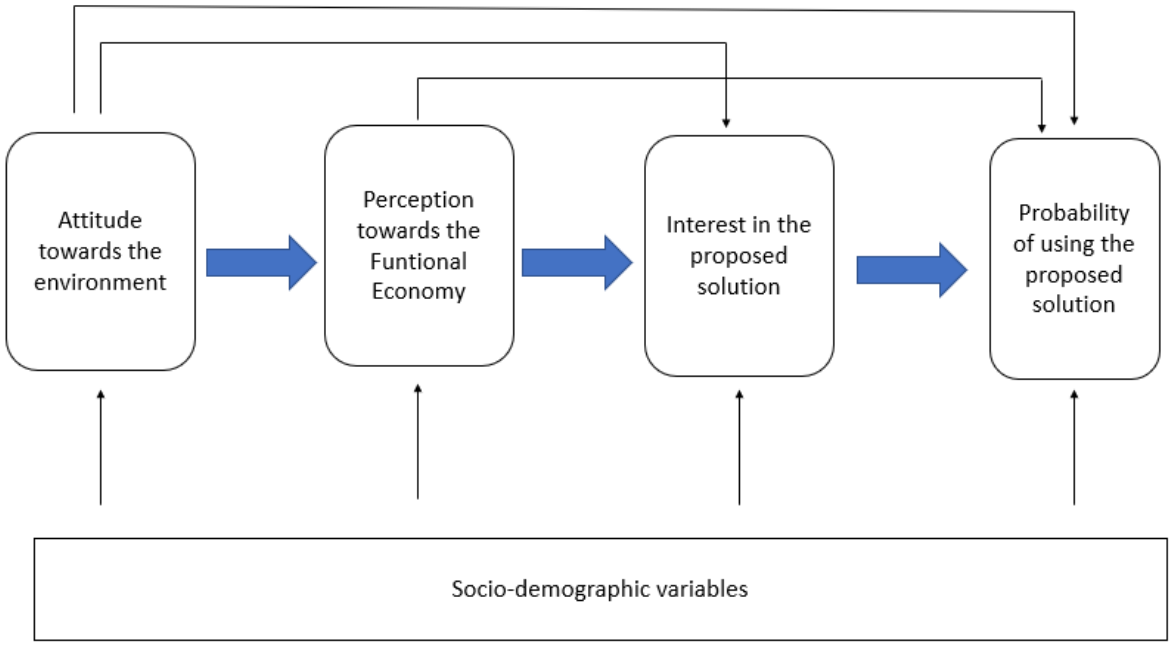
[25] As a quick reminder, the terms of “performance” and “functional” economy are both synonyms (as explained in chapter 1).

[26] A mediator variable is a variable that causes mediation in the dependent and the independent variables. In other words, it explains the relationship between the dependent variable and the independent variable.

one hand, and that the interest in the proposed solutions would act as a mediator between the perception of the functional economy and the probability of effectively using the proposed solutions. The alternative is that there are also more complex effects to take into account.

Figure 3.1 below summarizes the model I will test statistically. The main expected relationships are represented by the blue arrows. Moreover, I also test the existence of direct relationships among the key variables.

Figure 3.1. The model analyzed by this study (with socio-demographic variables used as control variables)



I collected 189 usable answers from respondents with a large variety of distinct socio-demographic characteristics and profiles. All their answers were then taken into account to perform the statistical analysis. All these analyses and the resulting conclusions are presented in section 3.5 later in this chapter.

3.2. Methodology followed to conduct the survey: five steps

3.2.1. Questionnaire structure

I have structured the questionnaire by splitting it into four sequential logical categories: (i) the socio-demographic data of respondents, (ii) the questions related to the environment, (iii) the questions related to the functional economy and finally, (iv) the questions associated with the practical case studies tested. In that sense, it is worth to note that this structure follows a

funnel approach: it starts by asking quite general questions on the topic and then moves progressively towards more specific ones, notably regarding preferences or intentions.

3.2.2. Questions development

The questionnaire[27] is composed of 34 questions in total. The socio-demographic questions are based on a reference pattern drawn from Monkey survey[28] and were then adapted to suit the specificities of this survey. The questions related to the environment are based on current environmental trends and issues. The questions related to the functional economy and its practical applications are based on my previous analyses in chapter 1 and 2. Except for the socio-demographic section which is made up of multichotomic questions with single choice, all the other sections are based on attitude (Likert and, to some extent, intention) scales relying on seven positions[29]. On a last note, the questions of section 2, 3 and 4 have been purposefully related to each other in order to confirm or overturn some attitudes/opinions claimed by respondents.

3.2.3. Choice of the respondents/sampling

I now discuss the sampling method I have used to select the respondents for my survey. First, the population I targeted is the French-speaking adult (over 18 years old) Belgian inhabitants having access to the internet, regardless of socio-demographic characteristics.

Moreover, the "sampling frame", that is the list of persons within the target population who are likely to answer the survey, is exclusively comprised of my personal and family contacts networks/acquaintances, with the limit it entails and that I address in a dedicated subsequent section.

Lastly, I used a non-probabilistic sampling method based on judgment/à priori to proceed with the selection of the respondents and hence, obtain the resulting sample. Regarding the sample size, the objective which had been set prior to the launch of the survey was to reach a minimum threshold of 120 exploitable answers. The survey was administered from the 6th of June until 26th June 2020.

[27] The full Google Forms questionnaire is presented in the appendix to chapter 3.
[28] Monkey survey is a web-based survey platform which provides users with solutions and templates on a large variety of topics.
[29] According to LLSMS2024 Marketing Studies, providing five positions or more on an attitude scale allows respondents to give a satisfactory answer in terms of precision.

3.2.4. Sending of the questionnaire and follow-up

The survey was administered in two subsequent waves. This way, I could collect a large amount of answers in first instance, and then adjust and target more or less intensively specific groups to balance and enhance the representativity of the sample. In either instance, I have mainly reached, informed and invited people to fill the survey by sending them a corresponding URL link, either via a social platform private chat or via a personal e-mail. Thereupon, I neither gave public access to the survey nor asked participants to share it in turn, because I wanted to keep control of its spread and check the identity of respondents all the way along. I also settled timely deadline for each wave in order to control the survey period.

3.2.5. Data check, collection and processing

The consecutive collection, check and processing of data is to a large extent performed by Google Forms itself since the tool automatically identifies and collects the exploitable survey responses before coming up with some insightful preliminary results/data analytics, in the form of graphs, associated with each question. However, I wanted to perform deeper analyses offering more insightful conclusions derived from the survey results for which I used STATA. I refer to it later when reporting my results. More meaningfully now, it is worth to note there are no missing values derived from the survey since an answer was mandatorily required for each question before moving to the next one. This last functionality is once again proposed by Google Forms. To be perfectly clear, the only survey responses that could not be recorded through the process were those registered under a flawed e-mail address, which accounts for a very marginal number of the total answers. I have indeed been requesting to indicate an e-mail address at the beginning of the survey, only for purposes of keeping track of progress in answers accounting and reopening with pending respondents in case of need. It goes without saying that I fully committed to respect and safeguard the anonymity of all the respondents in that regard.

3.3. Limits of the survey methodology

Considering the context in which this survey takes place (master thesis) and the relatively limited capacities available compared to a survey conducted by professionals, a number of limits arise. As a result, this has implications on the methodology used to set up this survey, especially regarding its sampling. Indeed, although I endeavored to build my sample in a way as representative of the target population as possible, some of its shortcomings are highlighted in this section:

Firstly, I applied some exclusion criteria to define my target population. I excluded people under the age of 18 to focus on adults only. I also had to exclude people with no internet connection for the sake of feasibility. This could in turn lead to a bias against some categories of the population. I specifically refer to the elderly, low-income and/or low-skilled people who are more likely to be found in this group and hence, could somewhat be underrepresented.

Furthermore, the exclusive reliance on personal/familial acquaintances (sampling frame) among whom I selected potential respondents is another element that can potentially impact the representativity of the sample. As a matter of fact, the socio-demographic profiles of people surrounding myself and my close family do certainly not constitute a perfect mirror of the current Belgian population distribution but probably refer to a larger extent to specific social categories.

Moreover, the fact that I used a non-probabilistic sampling method based on judgment/à priori to set the proportion of each population category in the sample can call the sample representativeness into question as well. Indeed, by definition I did not stick to the exact proportion existing within the target population.

Lastly, the determination of the sample size was not subject to a specific rule or based on a formal computation except that I wanted to have a sufficiently large number of respondents.

All those elements among others might have impinged upon the effective representativity of the sample and the generalizability of the results. This is why the conclusions of the survey have to be considered with caution and rather as illustrative and exploratory.

3.4. Short presentation of the questionnaire

As previously mentioned, the survey is composed of four distinct sections associated with different types of questions. I will now briefly present each of them in order of appearance. Incidentally, the list of all the questions and their associated variable name used for the analysis are available in table 3.21. in appendix.

The first section invites respondents to answer 6 socio-demographic questions. Those questions respectively cover the age category, the gender, the professional situation, the level of education, the field of study/training and the area of residence. As a last note, I could have indifferently placed this section at the end of the questionnaire since both practices are common.

The second section deals with the attitude and opinion of respondents about the changing environment. It raises 7 questions about current environmentally-related trends and aims to assess the level of awareness, sensitivity and involvement of respondents towards such matters. Some of the big trends broached have to do with growth, the use of resources, the (de)globalization and the current consumption pattern in the developed world.

Following this, the third section gets to the heart of the matter by introducing and defining the functional economy. Indeed, I first judge the familiarity of respondents with the concept of functional economy before assessing their attitudes and opinions towards its most essential aspects, all of it by means of 12 questions. A number of them pertain to questions already raised in the previous section (consumption pattern, resources management, deglobalization, etc.) while introducing meanwhile some notions specific to a functional economy (use over ownership, product sharing, extended product life, etc.). Furthermore, some additional questions refer to notions that relate (in this framework) exclusively to the concept of functional economy (technology, competitive advantage, etc.).

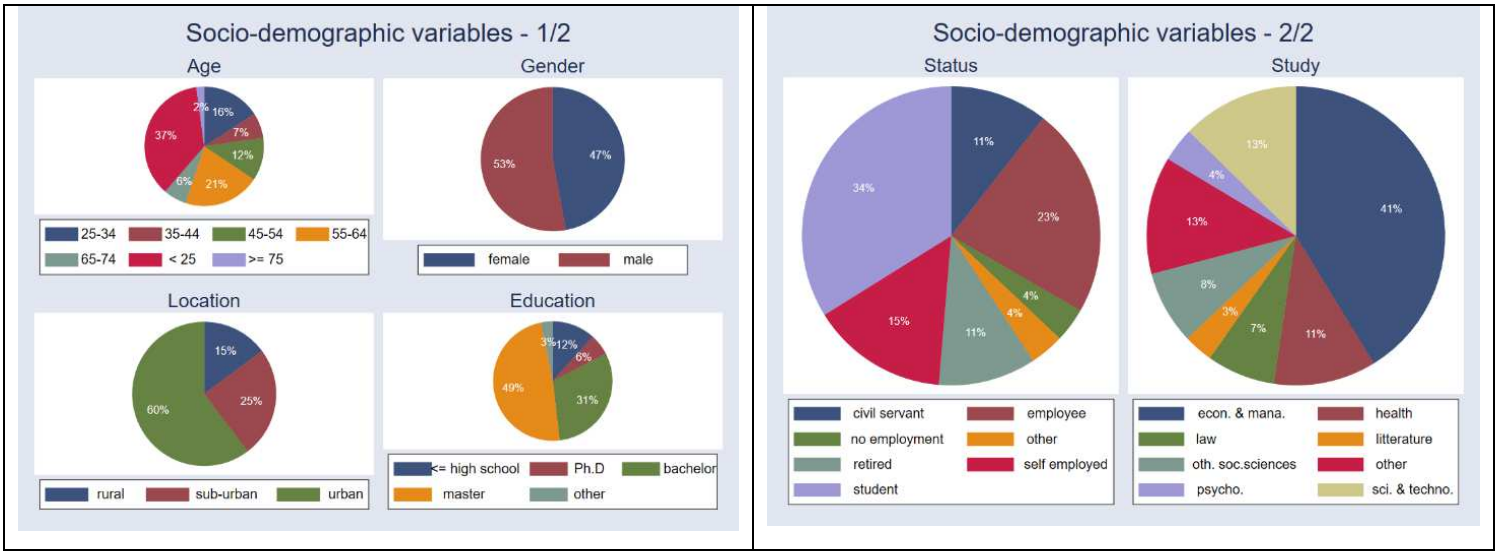
Finally, the fourth section analyses the view of respondents on a more practical perspective, by bringing out four existing or potential applications/cases studies in line with the functional economy. More specifically, the questions evaluate respondents attitude on two separate aspects for each case. The first question tests the degree of interest of the respondent for the proposed case. The second question intends to foresee the probability that the respondent effectively uses the solution when the opportunity is offered to him. The specific features of each case will be described later in this chapter.

3.5. Results of the survey, analysis and conclusions

3.5.1. The socio-demographic variables

Figure 3.2. below shows a set of graphs associated with the socio-demographic characteristics of respondents. From it, I infer that the survey was mostly submitted to students or young workers from the private sector, with a bachelor and/or a master degree predominantly in economics and management and living mainly in a city or nearby. Also, there are slightly more men than women who responded to the survey, although the difference is rather marginal. As a result, one can note that the people interviewed are overall young and highly educated (with even some doctoral students included). What is more, people aged between 35 and 55 on one side, and beyond 65 on the other, are somewhat underrepresented in the sample.

Figure 3.2. The socio-demographic characteristics of the respondents



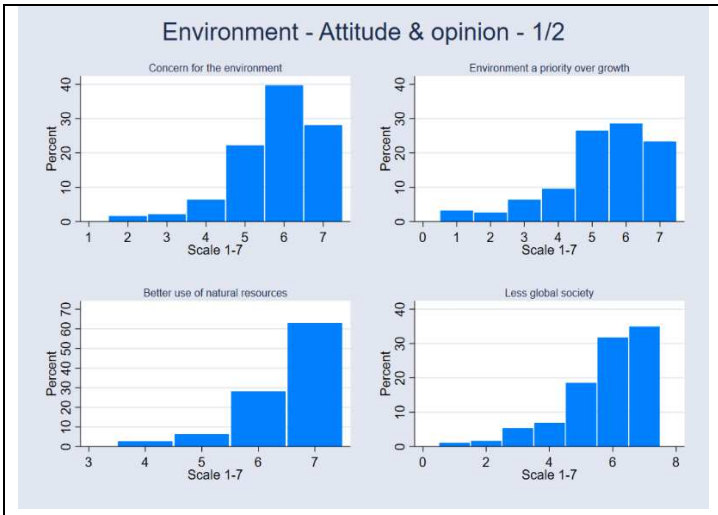
3.5.2. Attitude and opinion about environmental issues

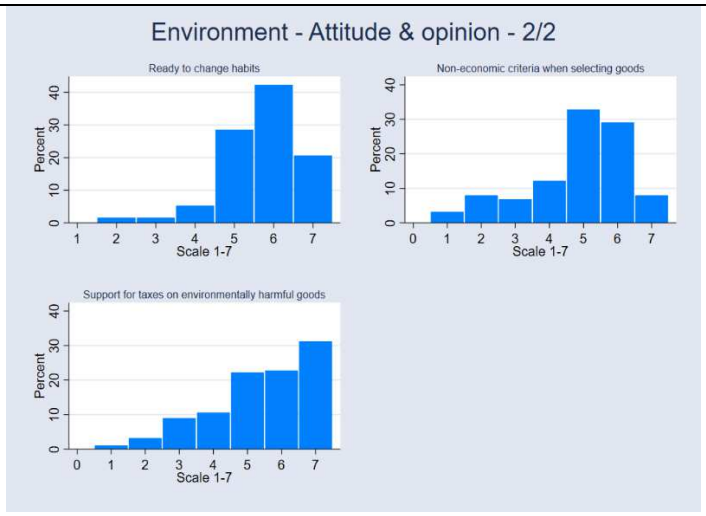
The questionnaire contains seven questions measuring various aspects of the attitude and opinion of respondents about environmental issues. Table 3.1. in appendix[30] presents the questions for this section and the name associated with each question for the following statistical analysis.

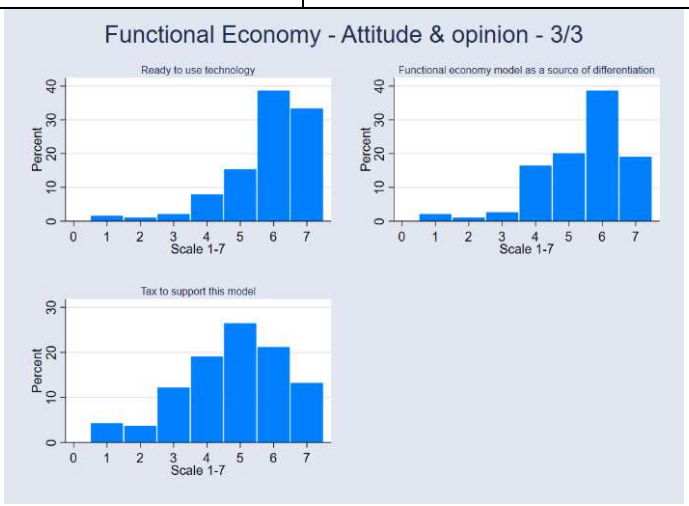
Figure 3.3. below and table 3.2. in appendix present histograms of the scores and some descriptive statistics respectively for the seven environmental questions. Replies tend to be clearly left-skewed. There is a strong consensus about a better use of our natural resources. Next come a general concern about our environment, a less globalized world and an acceptance that our habits must change. There is less agreement about giving the priority to the protection of our environment over and above economic growth or taxes environmentally driven. Finally, when asked whether non-economic criteria play a role when making a purchase decision, I get the lowest score. The seven indicators provide a general profile of the respondent vis-à-vis environmental topics. I want to see if and how this influences or not the attitude towards the functional economy model and some potential market offers later in the survey.

[30] All the tables and some of the figures discussed in this chapter are available in an appendix to chapter 3.

Figure 3.3. Distribution of the scores for the environmental themes (low=1, high=7)







Does the answer to the seven questions depend on the socio-demographic characteristics of the respondent? Table 3.3. in appendix provides the results of multiple regressions of the score of each question on some socio-demographic indicators. The seven variables are defined as follows in table 3.4. presented below.

The impact of the socio-demographic dimensions appears to be limited (table 3.3. in appendix). Women tend to be somewhat more sensitive to environmental matters and more willing to accept some changes while respondents with a current lower level of education are somewhat less concerned. It also appears that respondents with a background in economics and management are less inclined to support a tradeoff between the protection of our environment and economic growth.

Table 3.4. Description of the demographic variables

Variable	Description
Age	variable going from 0 (age less than 25) to 6 (75 or more)
Female	binary variable equal to 1 if the respondent is a woman
Student	binary variable equal to 1 if the respondent is a student
Non active	binary variable equal to 1 if the respondent is not (or no longer) working
Low education	binary variable equal to 1 if the respondent has a high school degree or less
Economics & management	binary variable equal to 1 if the respondent' background is economics and management
Suburb	binary variable equal to 1 if the respondent lives in the suburbs
Rural	binary variable equal to 1 if the respondent lives in a rural environment

Can we summarize the results of the seven questions with a limited number of variables? A first possibility is to construct a simple variable that measures for each respondent the average score across the seven variables (I call this variable environment-attitude in what follows). Another possibility is to use factor analysis to extract a limited number of factors that capture a significant fraction of the overall variance contained in the data. Table 3.5. in appendix summarizes the results of the analysis[31] with a technical note added. Practically, a single factor (called f1 environment) is selected to describe the seven variables. This factor explains 51% of the total variance.

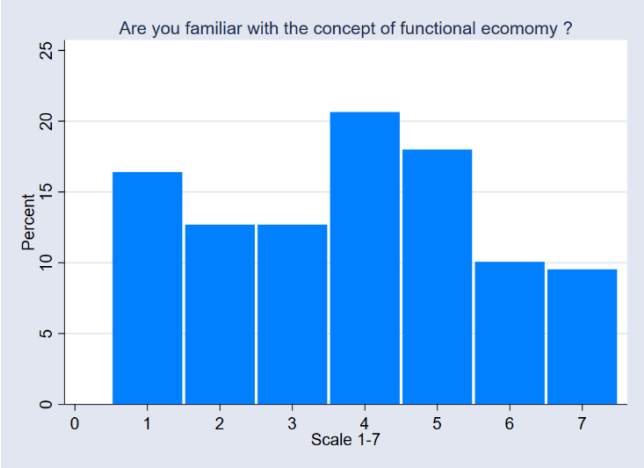
3.5.3. Attitude and opinion about the functional economy

In the third section of the questionnaire I begin testing several aspects of the functional economy model (table 3.6. in appendix). I start by asking respondent whether they are familiar with the functional economy model (économie de la fonctionnalité). I provide them with an official definition of the concept[32]. Figure 3.4. below shows that a very large proportion are not much familiar with the concept which tends to confirm that this remains a relatively new model that still has to be better known and understood.

[31] The analysis follows closely the various steps (and Stata commands) described in Mooi et al. (2018), chapter 8 Principal Components and Factor analysis. The analysis is applied to standardized variables (zero mean and variance equal to one).

[32] https://www.belgium.be/fr/economie/developpement_durable/economie_durable/modeles_economiques_innovants/economie_de_la last consulted 30 June 2020.

Figure 3.4. Familiarity with the performance or functional economy model (low=1, high=7)



The following eleven questions focus on various dimensions and characteristics of a functional economy model as described in chapter 1. The scores are presented in figure 3.5 below and some descriptive statistics in table 3.7 in appendix. Increasing the life of products and using goods longer get the highest scores. There seems to be a broad consensus about these two themes as can also be checked by looking at the distribution of the scores which is very skewed. If technology is an enabler of some functional economy solutions this clearly does not constitute a major concern given the high level of technology readiness of most respondents. If some additional costs are associated with a different more sustainable management of the whole life cycle, respondents are relatively inclined in general to bear it.

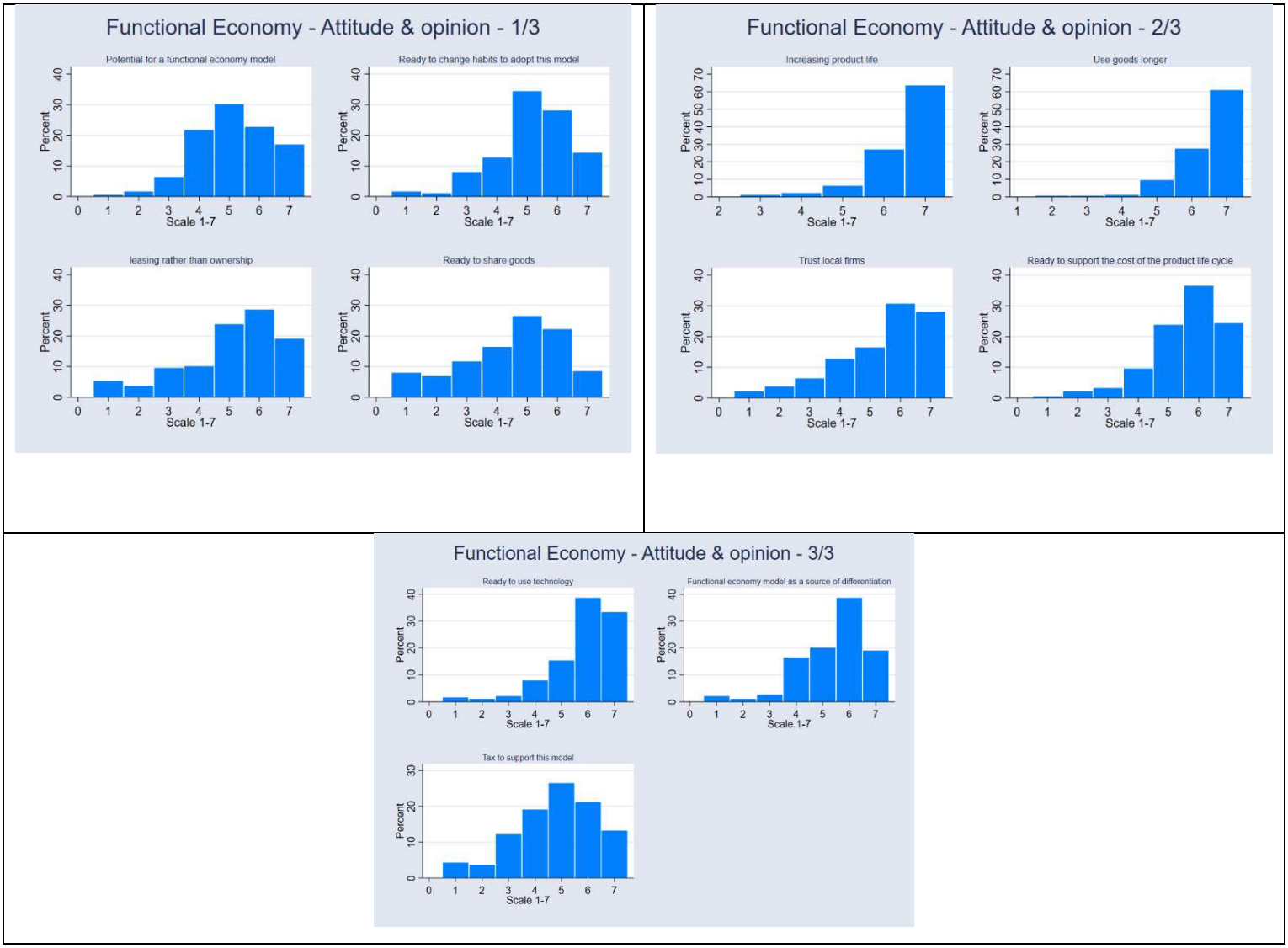
There is some acceptance that a functional economy approach can be a source of differentiation for a firm and that the local dimension can be a plus. When asked about the potential they see in this new model the score of 5.2 is below the average score for the general attitude towards the environment (average score of 5.6). There is a positive attitude about the idea of leasing rather than buying a product and changing some consumptions habits accordingly, but clearly the concept of sharing goods is still not widely accepted. Finally, there is not much support in the survey for the idea of using tax mechanisms to support the development of this new concept.

The regressions presented in appendix (table 3.8.) allow us the assess the impact of the global score[33] a respondent gave to the various dimensions about the environment on all the

[33] The same model was also run with the factor extracted from the seven questions about the environment. The results are not reported here but the conclusions are quite similar.

questions related to the functional economy model while controlling for the impact of socio-demographic variables. The attitude towards the various aspects of this model are clearly influenced by his attitude towards environmental issues in general. It is worth noticing however that in all cases a difference of 1 on the scale of environment attitude (measured from 1 to 7) always translate into an impact of less than one on the functional economy model. A few socio-demographic variables have an additional impact such as the impact of age, of the level of education or the educational background for instance.

Figure 3.5. Distribution of the scores for the performance economy model



I also construct an aggregate score of the attitude towards the functional economy model considering all the variables except the one on the familiarity with the concept (the variable name is functional economy attitude). If we consider that aggregate relation, we notice that

an increase of 1 of the score on the aggregate environment scale has a significant positive impact (of 0.5) on the aggregate score of the functional economy model.

For a given level of attitude towards the environment, we notice that age has a negative impact on the functional economy score, non-active respondents tend to give higher scores and people with lower education a lower score. However, even if some impacts are statistically significant, the quantitative impact is relatively modest.

I also looked at the eleven questions in a different way. Can we again summarize the information contained in the data with a more limited number of variables? The results of this factor analysis are presented in appendix (table 3.9.). The analysis is similar to the one presented in table 3.5. in appendix. In this particular case though, I retain 3 factors that explain together 63% of the total variance of the data.

How do we interpret these factors? Looking at the factor loadings, we notice that the first factor correlates strongly with the fundamental ideas of the functional economy model, the move towards services and the concept of sharing. I call therefore this first factor the service factor (the name of the variable is f1 functional: service). The second factor loadings show that this factor is closely associated with the life cycle of the product and its use over a longer period of time. I call this factor durability (the variable name is f2 functional: durability). The interpretation of the third factor is somewhat less obvious, but its loadings are high (in absolute terms) with various aspects of the product offering, the use of technology, the local versus the global dimension and the differentiation aspect. I call this factor the package factor (the variable name is f3 functional: package).

In what follows, I will use both the aggregate score of the functional economy model and these three factors to test their impact on potential consumer preferences. The advantage of the factors is that they capture three separate key dimensions of the model and that they are by construction uncorrelated with each other.

3.5.4. Some possible market offers: four case studies

The two previous sets of questions focus on general opinions and attitudes but do not cover any practical possible market offerings. In chapter two, I explored in details various case studies covering B2B, B2C and hybrid applications across many different countries and industries. Hence, the next natural step in the survey was to move to more specific and

tangible situations by considering some market opportunities. I now turn my discussion to the four case studies.

I consider four short case studies and for each of them raise two different questions. The exact description of each case (in French) is included in the questionnaire presented in appendix (table 3.10.). The first question is whether the respondent believe that the concept is interesting and the second one asks whether he or she would possibly use it which obviously is a quite different question. I will also test whether the scores to the two questions are the same or not (from a statistical perspective).

The first case is based on a variation of a solution that now exists for a few years in many different cities and that many people are familiar with (see also chapter 2). I consider the short-term renting of bicycles in an urban environment with a focus on electric bikes (to hopefully enlarge the potential for a broader fraction of the population) and with some additional services available via a smartphone (to add some technological components).

The second case tests the concept of sharing goods in the context of an eco-friendly laundry service that actually goes beyond most existing solutions by clearly stating the sustainability objective while at the same time offering the possibility to wait in a nice environment with access to a bar and a restaurant. The concept has actually been implemented by a company called WASBAR[34]. Figure 3.6. in appendix presents a few pictures to better understand the concept and the services offered. WASBAR currently operates in Flanders with currently eight locations, three in Antwerp, two in Gent, one in Mechelen, one in Hasselt and one in Leuven. To test the impact of variations of the package offered I consider two different offers. The first offer insists on the efficiency and sustainability of the concept but implies that people have to go to the shop with their laundry. This corresponds to the actual concept of WASBAR. A second package offers the possibility to use the same shop but provides a full service where your laundry is collected at your home and brought back to you. Both offers rely on the same underlying principles and objectives but with two very different service packages. Do respondents rate them in a similar way? Do the two solutions have a different appeal to different groups? These are some of the questions I want to investigate.

The third case is another example of sharing goods. A retailer of sport equipment offers the possibility to rent sport equipment either on a short-term basis, for instance for a holiday

[34] See for instance the website of the company for a more detailed presentation of the concept and the services offered: https://www.wasbar.be/ last consulted 17 December 2020.

period or on a long-term basis. The retailer also stresses that sustainability and a long life for the products will be two major characteristics and that it will cooperate closely with equipment manufacturers. This concept is actually tested right now in Belgium by Decathlon, a French sport equipment retailer operating more than 1 500 shops in 51 countries[35] as discussed in chapter 2. Figure 3.7. in appendix presents the e-mail sent to introduce the concept, offering 1 000 people to test it. A survey was conducted by the company in parallel to better understand the preferences of consumers and allow to fine tune its offer accordingly.

Finally, the fourth case focuses on leasing rather than buying a product, in this example car tires. The customer would in this case have the exclusive use of the tires, but the product is bundled with additional services that make the life of the car owner easier. Sensors are used to monitor the tires and select their optimal replacement. This is to my knowledge a hypothetical example today at least in a B2C environment but the case is derived from what Michelin is currently developing in a B2B environment to help companies manage their truck fleet (see also chapter 2).

Figure 3.8. below presents the distribution of scores for the four concepts and the likelihood of the respondents to use the five packages offered. Thus, a higher score on a scale of 1 to 7 means a higher level of acceptance of the concept by respondents and a higher likelihood that they use it. Table 3.11. in appendix presents some descriptive statistics. Looking at the concepts we see that the electric bicycle case comes first, followed by the sport equipment leasing one, the car tyres and finally the laundry concept. If we now turn our attention to the likelihood of using the various solutions the scores are systematically lower than those associated with the respondent's attitude towards the concept. In other words, respondents may find a concept rather interesting but may not be that likely to use the solution in practice.

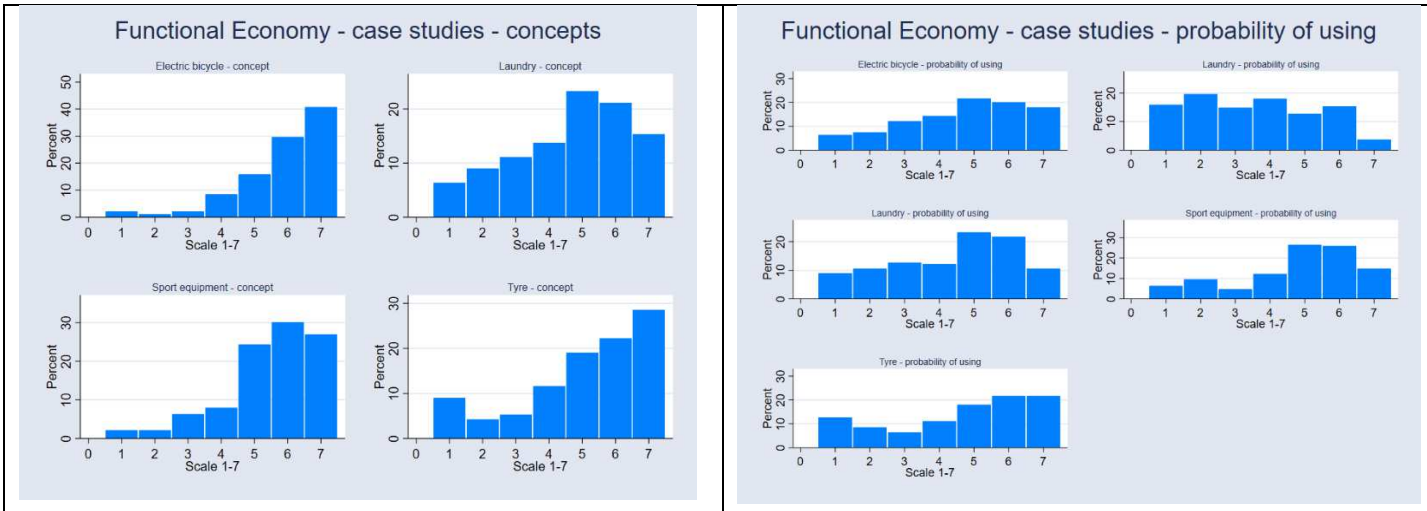
Table 3.12. in appendix presents the results of various statistical tests performed on the case studies[36]. I first test whether the mean scores are equal across the four concepts, an assumption rejected by the data. I next test the assumption that the mean scores for the likelihood of using the five solutions proposed are identical which is again rejected. It can be seen as mentioned above that the average scores of the concepts are systematically higher than the corresponding probability of using it. I test whether the differences are significantly

[35] https://www.decathlon.be/fr/about/who-are-we/_/R-a-who-are-we last consulted 1 July 2020.

[36] I am testing the hypothesis that several different variables (all measured on the same scale from 1 to 7) have the same mean. Stata provides the command mvtest means (multivariate tests of means) to perform such tests. The tests assume multivariate normality.

different for each pair. The conclusion is that they are for bilateral tests at a 5% level of significance. Even the two solutions around the laundry concepts have different mean scores associated with the probability of using them.

Figure 3.8. Distribution of the scores for the various case studies



The conclusion is clearly that there is a lot of diversity across the attractiveness of the different concepts and discrepancy between the attitude towards a concept and the likelihood of actually using it. The next natural question is to see whether the survey data allow us to better understand the drivers of the responses to these case studies. I now turn my attention to this question.

I start by analyzing the attractiveness of the four concepts proposed. Table 3.13. in appendix presents the regressions of the score of each concept on the two aggregate measures of attitude towards environmental issues and the functional economy model as well as several socio-demographic variables. It is clear that the attitude towards the functional economy model is the main driver of the score given by the respondent to each concept. It is interesting that the general attitude towards the environment has no or little impact on the scores. In other words, the attitude towards the functional economy model can be interpreted as the mediator of the general perception of environmental issues. Indeed, we have seen above that aggregate attitude towards the environment has a strong positive impact on the attitude towards the functional economy model. Finally, we notice that socio-demographic variables generally have no additional influence on the scores except in a few cases. We can actually develop the

model a little bit further by using the three factors identified above that summarize the main dimensions included in the various variables describing the functional economy model. I also use the factor summarizing the different variables associated with the general view of the respondent vis-à-vis environmental topics. The three factors associated with the functional economy model are uncorrelated by construction but table 3.14. in appendix shows also only moderate correlation between each of them and the factor associated with the general attitude towards the environment. Table 3.15. in appendix presents the regressions of the score achieved by the various concepts when factors replace the aggregate variables.

The results clearly show that the three factors contribute very differently to the score of each concept. The main factor is the one associated with the attitude towards the service concept. The third factor which I associated with the overall package offered also appear to play a role but surprisingly, the second one that summarizes the attitude towards a longer use of products and repair and maintenance does not seem to play any role in the score of any of the four concepts. Finally, the residual impact of the general attitude towards the environment remains insignificant except in a few cases. The conclusions about the effect of socio-demographic variables remain unchanged.

I next turn my attention to the likelihood of respondents to use the various solutions offered. Table 3.16 and table 3.17. in appendix summarize the various models I estimated.

In table 3.16. in appendix I estimate how the score of using a certain solution depend on the score given by the respondent to the corresponding concept, the overall aggregate attitude vis-à-vis the environment, the aggregate score the respondent gave to the various dimensions of the functional economy model and socio-demographic variables.

The conclusions are again rather clear. The score given by a respondent to a certain concept is the main driver of the likelihood of using it. The marginal effect of an additional one-unit score on the scale always translate into a less than one-unit impact on the likelihood score. There still remains an additional effect of the overall score given by the respondent to the functional economy model but there is clearly no residual direct effect of the general attitude towards the environment. The score given to the proposed concept captures rather well the overall attitude of the respondent. Finally, there is very little direct residual effect of socio-demographic characteristics.

Table 3.17. in appendix presents essentially the same model but this time the score of the functional economy model is essentially the same as the previous one but where we break down the attitude towards the functional economy into its three main underlying factors. The main driver clearly appears to be the score of the concept with some residual effect of the first factor, that is the attitude towards the service concept, and still some impact of the factor representing the overall package offered. There is no direct impact left of the overall attitude towards environmental themes. The same conclusions apply to the direct impact of the socio-demographic characteristics of the respondent.

3.5.5. A cluster analysis of the data

In the previous sections, I have described the results of the survey and progressively built a model that shows how the attitude towards the environment impacts the attitude towards the functional economy model. I have then shown how the attitude towards this model impacts the score given by a respondent to the various proposed concepts and finally how that score ultimately influences the likelihood of using the solutions. At all stages of this analysis, I have looked at the direct effect of several socio-demographic variables. The general picture that emerges is that these characteristics have some impact on the different measures of attitudes and opinions vis-à-vis the different ideas tested in this survey. In that regard, is there a way to identify the profile of the respondents who are the most or the least likely to be interested in the different functional economy-based solutions proposed? In order to address that question which is of course practically important if the firm developing a concept wants to understand who in the population should be the potential target groups, I decided to implement a cluster analysis[37].

My objective is to use the results from the survey to group the respondents into a limited number of clusters that can be given practical interpretations to better understand who may be interested or not in the solutions proposed. The next question is how the build these clusters. A natural way is to use the questions covering the attitudes towards the environment and those covering the functional economy. This means using the results of 18 questions to build the clusters. However, we also have to take into account the number of respondents which is 189. Mooi et al (2018) explains how to select a reasonable ratio between the number of variables used to create the clusters and the size of the sample. Rules of thumbs suggests sample size between 10 to 30 times the number of variables used to create the clusters, and possibly more

[37] As for factor analysis, the approach follows closely the various steps (and Stata commands) described in Mooi et al. (2018), chapter 9 Cluster Analysis.

depending also on other factors such as the correlations between the variables. Given our sample size this clearly limits the number of variables I can use to create the clusters. For this reason, I decided to use the factors extracted from the variables covering the attitude towards the environment (one factor) and the three factors extracted from the questions about the functional economy concepts. Our cluster analysis is thus based on four variables. The details of the analysis are presented in figure 3.9. in appendix.

I now turn my attention to the interpretation of the three clusters selected. They have been constructed based on the responses of individuals to the various questions about their attitude to environmental issues and their views on the functional economy model. These attitudes and opinions can obviously not be observed in general and therefore the question is whether the ways respondents are classified can be linked with specific socio-demographic characteristics. Regression analysis showed that socio-demographic characteristics had some impact on the responses to the various questions.

Table 3.19. in appendix presents the clusters with the average value of the socio-demographic variables in each cluster and the global average across all respondents. To see whether there are real differences in terms of these characteristics across the selected clusters I ran a test of equality of the means for each of them[38].

The tests show that respondents in the three clusters differ mainly on age, gender, whether the individual is a student or not and finally whether is background is economics and management or not.

We can see that the first cluster is characterized by individual typically in the 25-35 age range, with a lower proportion of women. Many individuals in this group are student with a background in economics and management. This group has the lowest score in terms of attitude towards the environment and the functional economy model.

[38] There are two approaches to test for differences across the means. The first one is a one-way ANOVA but since variances are often different across the various groups I ran an ANOVA with a Welch correction. This is not directly available in Stata but an add-on is available (Mooi et al. (2018) p.165). The code can be downloaded by using the following link: https://stats.idre.ucla.edu/stata/ado/analysis/ , last consulted 2 July 2020. An alternative is to use the same command used above mvtest means using the option by group and heterogeneous. I report in the table the results based on this second approach. The p-values are identical for both methods.

The second cluster is characterized by individuals typically in the 35-45 age range, with a relatively high proportion of women. This group achieves the highest score both for the attitude towards the environment and the functional economy concept.

Finally, the third group tend to correspond to even older individuals, many of them with a background outside economics and management. It can also be seen from the table that the relationship between the age category and the attitude about the environment and the functional economy model is non-linear.

Having characterized the clusters, we can say that the second is clearly the one showing the greatest interest for the environment and this new model. I can consider whether this classification also impact the responses to the various concepts presented in the short cases and the likelihood of ultimately using the proposed solution. Table 3.20. in appendix provides the statistics to address this question.

The selected clusters show that they strongly differentiate across the scores as well. The individuals included in the second cluster clearly also assign the highest scores to the proposed solutions and are also the most likely to use them. The equality of the means across the three groups is always rejected by the statistical tests.

3.5.6. Summary of the key results and interpretations

In this last section, I want to wrap up some of the important lessons that can be drawn from the survey.

First of all, a large fraction of the respondents seems to be concerned by the evolution of our environment and are to a certain degree ready to accept changes, a review of our priorities and even additional taxes to support this evolution. The attitude towards the functional economy model is generally high as well but slightly lower though[39]. If we look at the different questions associated with the functional economy model we also note that the correlations are typically positive but not necessarily large. The various questions included in the section on functional economy allow us to extract three main underlying factors. The first one unsurprisingly corresponds to the idea of leasing and sharing goods, the essence of the concept. The second one is clearly associated with another important dimension, the lifecycle of the product, while the third can be interpreted as associated with other characteristics such

[39] The average score of environment-attitude is 5.6 and of functional economy attitude is 5.4 and the difference is significant statistically (F = 9.76, F(1,188) and p-value = .002).

as the use of new technologies. We have shown that the attitude towards the environmental issues has a significant impact on the way respondents judge the functional economy model.

I then turned my attention to more specific solutions to illustrate and test various tangible propositions based on the functional economy concepts, making a clear distinction between the attitude vis-à-vis the concept itself and the likelihood of actually using the proposed solutions.

The statistical analysis provides strong support to the idea that the attitude towards the functional economy model drives the overall judgment of a proposed solution. The attitude towards services and sometimes the overall package have a strong impact although maybe more surprisingly, the lifecycle dimension of the product does not seem to have any impact. It is also clear that the level of concern about our environment acts via the attitude towards the functional economy model which act as a full mediator of environmental concern.

If we look at the various concepts though, we notice that the perceived attractiveness varies significantly across the different solutions proposed. A positive attitude towards the functional economy model might be a powerful enabler but each case is evaluated separately on its own merits.

Finally, if we look at the likelihood of using a proposed solution, we conclude that the score depends on the attractiveness of the concept itself with some direct influence from the attitude towards the functional economy model in general. We again notice that each case is judged by the respondents on its own merits for him. Correlations among the five solutions are always positive but relatively low and the dispersion of the scores rather wide. As we move from general attitude towards the environment to increasingly specific and personal preferences we see more divergence in the scores. We also note that the same underlying case (the laundry shop) translate into different scores for the two solutions based on the same idea. The details of each solution obviously do matter. Figure 3.10. in appendix summarizes the model that I have built with the survey data.

I concluded the analysis by using the survey data to try to identify the profile of the respondents most likely to be responsive to the ideas of the functional economy model and therefore the most likely to have a positive perception of the solutions offered. The cluster analysis suggests that the target individuals are relatively young adults aged between 35 and 45.

3.6. Some general conclusions, remarks and comments

The objective of this chapter was to get a better understanding of the attitude of consumers regarding the functional economy. This has been achieved by conducting a survey on the subject first, and then using the results obtained from the 189 respondents to perform a thorough statistical analysis.

Moreover, a rigorous methodology implying five distinct steps was followed in order to conduct the survey. As mentioned earlier, there are clearly some limitations to this methodology which have implications in terms of representativity of the sample and in turn thus, on the further generalization of the results. I tend to think however that this exploratory survey analysis can still bring insightful conclusions about the functional economy and its underlying principles.

The key takeaways of this chapter lie in the great variety of responses and de facto, attitudes and opinions of consumers about the functional economy. This concept still seems to be at an early stage of development in consumers mind even though they appear to be generally favorable once they have understood what the concept is. Indeed, most of respondents are rather open to the general ideas of the model even if they turn a bit more reluctant when it comes to its more specific and practical implications. What is more, the impact of socio-demographic characteristics turns out to have a quite limited impact on the consumer attitudes compared to other factors, as previously exposed.

In my view, it is essential to adopt a consumer-centric perspective since consumers are a major driver for businesses and organizations willing to shift towards this new economic model, at least in B2C markets.

Time has come now to synthetize and provide some general conclusions about this thesis as a whole.

Conclusion

In this thesis, I wanted to understand why, despite being often praised as a very promising approach, the functional economy model still seems to remain quite marginal in the economy overall, compared to the more traditional linear system.

With this in mind, I decided to perform an extensive review of the existing literature on the subject in order to derive a sound conceptual framework. This first step showed me that, although the functional economy model has been around for a long time now since it was first developed in the 1980s, it still struggles to find its place in the "servitization" landscape which it allegedly belongs to in the same way as other related concepts. Indeed, there is still no clearly shared agreement among scholars about where the concept stands in comparison with the circular economy or the product-service system, for instance, which can at times make the field of study fuzzy. Moreover, there is an arguably lack of clarity regarding some of its basic concepts, in particular when it revolves around its practical implications and key success factors. Against this background, I decided to adopt a more empirical approach in order to better understand the practicalities of the model which I did through two different complementary approaches.

My first objective was to understand the underlying conditions for the model success and, on the contrary, the reasons explaining its failure. For that purpose, I decided to perform a thorough analysis of 26 case studies selected from the literature and my own personal research and potentially in line with the functional economy model. The results show that most of the cases found in the literature or through my own research have implemented the concept only marginally – or even conceptually – and in a limited way, which tends to confirm my previous assumption that the functional economy model is still at an early stage of development today. Moreover, among the successful cases reported, at least some of them seem to have initially embraced the concept naturally (sometimes even prior to its emergence in the 1980s), evidently driven by economic, strategic and other reasons unrelated to the functional economy framework. In my opinion, there are three important conclusions to draw from this: Firstly, this means that the economic, strategic and other reasons still prevail over the sustainability rationale. Secondly, this implies that those successful cases might actually fit with the requirements of the model without ever having intentionally decided to embrace it. Thirdly, it suggests that some businesses are more likely to be successful in implementing the model than others depending on their inherent characteristics such as their industry,

geographical area, etc. As far as this last point is concerned, one interesting insight coming out from the analysis is that cases in B2B markets tend on average to reach higher performance levels (i.e. higher scores) in complying with the model principles. As a consequence, it appeared highly relevant to me to investigate further the reasons why B2C environments seem more challenging to deal with when it comes to implementing such a model.

Therefore, this reflection led me to focus more particularly on consumer attitude towards the environment and functional economy concept by means of a survey I conducted in June 2020 and the analysis of its results. What it shows is that people are rather conscious of the environmental challenges we face today and are to some extent ready to change their behavior although responses vary widely among respondents. Furthermore, the functional economy concept is generally not very well-known but, after providing them with some explanations about it, respondents tend to have a rather positive attitude towards it, although with certain limitations again. Finally, their interest in case studies varies widely as well and truly depends on the specificities of the proposed solution. What is more, there is a notable difference between their interest in the solution and their readiness to effectively make use of it, the latter being generally associated with a lower acceptance level (i.e. score) than the former. As a conclusion, it should be said that the majority of respondents agree with the conceptual ideas of the model but tend to become more reluctant when it comes to its practical aspects. This assertion could help explain the limited actual implementation of the model in the economy up to now, at least in B2C markets. It is also worth noting that the socio-demographic characteristics of respondents can only partially explain the variability observed in responses and that other underlying factors must be considered to understand their perception and attitude. Yet, it turns out from the cluster analysis that the profile of respondents who are the most likely to be interested in the functional economy model and, therefore, its practical solutions is characterized by individuals aged between 35 and 45, especially women.

To sum up, the key takeaways from this thesis are that, although considered as a promising approach by its main proponents, the functional economy still struggles to convince many of its potential adopters to endorse it on a wide basis. According to the results of this study, the reasons behind this fact could notably lie in the lack of clear practical insights and guidelines provided by its theoretical framework and/or the current relative reluctance of consumers to effectively adopt its concrete solutions. Moreover, the model seems obviously more suitable for businesses with some specific characteristics. This, among other things, could explain why

the traditional linear economic model, although questionable for its sustainability, is still globally dominant today.

Although I have tried to remain objective and rigorous in this thesis, I have clearly encountered some limitations throughout its completion. In my view, those limits are mainly associated with some aspects of the methodology used to perform my analyses which are to some extent subject to personal interpretation, perception and judgment and sometimes somewhat simplified. I think this is especially true regarding the selection process of the case studies (chapter 2) and the sampling method used to select the respondents to the survey (chapter 3) which might not be perfectly representative. Hence, this could in some way have an impact on the accuracy of the results and the generalizability of the conclusions.

I would firstly recommend future research to develop further the theoretical framework of the functional economy by means of a practical approach. More specifically, I would encourage to work on the development of a clearer set of guidelines for businesses in line with the model. This implies to get a better understanding of its practical implications and key success factors for each dimension of sustainability, especially the economic one. In that sense, one could endeavor to provide a deeper economic perspective of the functional economy model by means of a thorough economic framework using standard economic principles. In turn, this should also allow to fathom the reasons why some business characteristics seem more favorable than others in this context. In my view, the above-mentioned elements are key from a strategic point of view. What is more, one could also tackle more deeply the consumer perspective by trying to find ways to alter their current attitude towards the practical implications of the concept, notably by relying on the various findings presented throughout this survey analysis. Lastly, I think that it could be insightful to adopt another empirical approach by trying to assess in particular the effect of specific government policies geared towards businesses and consumers on their willingness to adopt the model.

I hope this thesis, although exploratory, can provide a good theoretical and practical framework to understand better the functional economy model and its underlying mechanisms. Indeed, despite its limitations, I think this study offers some relevant insights on the topic and I believe it can at least to some extent contribute to its further development in the coming years. Though, it goes without saying that additional research is necessary both on theoretical and practical grounds to be able to figure out whether the functional economy

approach actually represents a broad viable economic solution for the future or if its fate is to remain restricted to a small and limited scale.

Appendix

Appendix: chapter 2

Table 2.1. List and structure of the FSE criteria analyzed

FSE main criteria	FSE sub-criteria	FSE third-layer criteria
Functional Service Economy (FSE) criteria		
	Combination of products & services	
	Use/function (ST/LT contracts) > ownership	
	Sharing platform (bikes, cars,…)	
	Technology component (mobile apps, IoT,…)	
	Governement role & impact	Governement stimulus/penalties
		Is there a PPP ?
"Fullfilment of 3 pillars" criteria		
	Environmental sustainability	
		Emissions reduction (CO2, other GHG, pollution,…)
		Increased/improved product lifecycle
		Resources use reduction (manufact.& dev. phases)
		Resource use reduction (usage phase)
		Resource use reduction (after-life phase) = 3R
		Reduction of existing waste
		Internalization of risk & waste by producer (whole LC)
		Decentralized (local) supply chain
		Integrated supply chain (=partnerships)
		Producer model acceptance
	Economic sustainability	
	Level of competitivity (demand side)	(New) customer needs/market opportunities
		Customer model acceptance
		(New) product/service offering
		Added (use) value to offering (vs traditional)
		Customer satisfaction/loyalty (CRM)
	Level of efficiency (supply side)	Integrated value chain (internal)
		Economies of scale
		Economies of scope
		Reduced idle capacity (machine)
		Net cost effect
	Level of profitability & growth	Increase in short-term profits
		Decreased level of volatility (price, revenue,…)
		Profit growth / perspectives (long-term)
	Social sustainability	
		(Local) jobs creation
		[Online] trainings (increased skills&competences)
		Reduced negative externalities for people (health,…)

Table 2.2. Score assigned to each case (sorted alphabetically) for each specific FSE evaluation criterion

Case number	Case studies	Implementation time	Current implementation Level	Expected evolution	Applicability to other industries	Market feedbacks /10	Personal appraisal /10
1	Bergamo's Bike-sharing PSS	2009	Advanced	Favorable	Generalizable	5	4
2.2	Bicycle-sharing based on PSS-EPR in China: Mobike	2015	Advanced	Favorable	Generalizable	9	8
2.3	Bicycle-sharing based on PSS-EPR in China: Ofo	2014	Advanced	Favorable*	Generalizable	7	7
2.4	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	/	Marginal	Unfavorable	Generalizable	3	5
3	Brazilian Olive Oil Case	2012	Marginal	Favorable	No answer	9	10
4	Brazilian Road transport	2003	Marginal	Unfavorable	No answer	4	4
5.1	Brazilian vs Italian companies: Brazil	>2000	Marginal	Favorable	Generalizable	8	3
5.2	Brazilian vs Italian companies: Italia	>2000	Marginal	Favorable	Generalizable	4	3
6	Caterpillar remanufacturing strategy	+/- 2010	Advanced	Favorable	Generalizable	10	9
7	Colombian cake shop (SME)	/	Marginal	Unfavorable	Specific	5	2
8	Decathlon renting service	2020	Marginal	Favorable	Generalizable	6	8
9	Distributed Renewable Energy (DRE)	2016	Marginal	Favorbale	Generalizable	8	8
10	E-mobility case	2016	Marginal	Favorable	Generalizable	5	8
11	Function-based transportation system	>1990	Marginal	Favorable*	Generalizable	3	7
12.1	Heavy machinery manufacturer	>2000	Advanced	Balanced	Generalizable	6	9
12.2	Telecomm. Infrastrucuture provider	>2000	Advanced	Balanced	Generalizable	6	9
13	Household appliances	>2000	Conceptual	Favorable*	Generalizable	7	7
14	Michelin Fleet Solutions: Truck tires	2001	Advanced	Favorable	Generalizable	10	10
15	The failure of Mu by Peugeot	2009	Marginal	Unfavorable	No answer	2	8
16	New logistics and freight transportation model	> 2000	Advanced	Favorable	Generalizable	5	3
17	Plastic extrusion pipes	>2000	Marginal	Favorable	Generalizable	8	3
18	PSS applied to healthcare industry	/	Conceptual	Unfavorable	Specific	5	3
19	Reshaping washing machine	+/- 2008	Marginal	Favorable*	Generalizable	4	7
20.1	Service-oriented electricity systems: community-based	2013	Marginal	Unfavorable*	Specific	5	8
20.2	Service-oriented electricity systems: third-party service	2000-2016	Marginal	Unfavorable	Generalizable	6	4
21	Small Household Equipment Manufacturer (SHEM)	2012	Marginal	Favorable*	Generalizable	4	6
22	Smartphone Case	2007	Marginal	Favorable*	Generalizable	5	6
23	The future of WM as a service	2014	Marginal	Favorable*	Generalizable	4	7
24	The washing machine case	>2000	Marginal	Favorable*	Generalizable	5	4
25	WhiteGoods manufacturer	2003	Marginal	Favorable*	Generalizable	6	4
26	Xerox asset management program: printer leasing	1967	Advanced	Favorable	Generalizable	10	9

Table 2.4. Raw data set for the case studies analyzed

Case number	Case studies	Product-service	Use >own	Sharing	Technology	Government	PPP	Emission reduction	PLC	Resource reduction (manuf. & dev.)	Resource reduction (usage)	3R	Waste reduction	Risk&waste internalisation	Local supply chain	Integrated supply chain	Producer acceptance	Market opportunities	Customer acceptance	New product/ service offering	Added value	CRM	Integrated value chain	Scale economies	Scope economies	Reduced idle capacity	Net cost effect	Increased short term profits	Decreased volatility	Long term profit	Jobs	Trainings	Reduced negative externalities
1	Bergamo's Bike-sharing PSS	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	1	-1	1	0	1	1	-1	1	0	1	1	1	1	0	1
2.1	Bicycle-sharing based on PSS-EPR in China: Mobike	1	1	1	1	0	0	1	1	1	1	1	1	1	-1	1	1	1	1	1	1	1	1	-1	-1	1	0	1	0	1	-1	-1	1
2.2	Bicycle-sharing based on PSS-EPR in China: Ofo	1	1	1	1	0	0	1	1	1	1	1	1	1	-1	-1	1	1	1	1	1	1	-1	-1	-1	1	0	-1	0	1	-1	-1	1
2.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	1	1	1	1	0	0	1	0	0	1	0	0	1	-1	0	1	1	-1	1	-1	1	0	-1	0	1	0	-1	0	-1	-1	-1	1
3	Brazilian Olive Oil Case	1	1	-1	1	0	1	0	1	1	0	0	1	1	1	-1	1	1	1	1	1	1	0	1	-1	1	1	1	1	1	1	1	1
4	Brazilian Road transport	1	1	-1	1	-1	0	1	1	1	1	-1	1	1	0	1	-1	-1	-1	1	1	1	1	0	0	0	-1	0	1	-1	0	0	1
5.1	Brazilian vs Italian companies: Brazil	1	1	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1	1	1	1	-1	-1	1	1	0	-1	-1	1	0	1	1
5.2	Brazilian vs Italian companies: Italia	-1	-1	0	1	0	0	0	1	0	0	0	0	-1	-1	0	-1	-1	1	-1	1	1	0	1	1	1	0	-1	-1	1	1	1	0
6	Caterpillar remanufacturing strategy	1	1	-1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	1	1	1	1	1	1	1	1
7	Colombian cake shop (SME)	1	1	-1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-1	0	0	1	0	0	1	0	-1	-1	0
8	Decathlon renting service	1	1	-1	1	-1	-1	1	1	1	1	1	1	1	0	1	1	1	0	-1	1	0	0	-1	-1	-1	1	1	0	1	0	1	1
9	Distributed Renewable Energy (DRE)	1	1	1	1	-1	-1	1	1	1	1	1	1	1	1	1	-1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
10	E-mobility case	1	0	1	1	1	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1
11	Function-based transportation system	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	0	-1	1	0	1	1	1	1	0	-1	-1	1	1	1	1
12.1	Heavy machinery manufacturer	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	-1	1	1	1	1	-1	1	1	0	-1	-1	1	1	1	0
12.2	Telecommunication infrastructure provider	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	-1	1	1	1	1	-1	1	1	0	-1	-1	1	1	1	0
13	Household appliances	1	1	-1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	-1	1	-1	-1	-1	1	1	1	1	1
14	Michelin Fleet Solutions: Truck tires	1	1	-1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	0	1	1	1	-1	1	1	1	1
15	The failure of Mu by Peugeot	1	1	-1	1	-1	0	1	1	1	1	1	0	1	1	1	-1	1	-1	1	1	-1	1	-1	1	1	0	-1	1	-1	1	1	1
16	New logistics and freight transportation model	1	1	-1	1	1	1	1	1	1	1	1	1	0	0	1	-1	1	1	-1	1	0	1	-1	1	1	0	0	1	0	1	1	1
17	Plastic extrusion pipes	1	1	-1	1	1	1	1	1	1	0	0	1	1	0	1	0	1	0	1	1	1	1	-1	1	-1	1	0	0	0	0	1	1
18	PSS applied to healthcare industry	1	1	1	1	1	1	0	0	0	1	0	0	1	-1	1	-1	1	0	1	1	0	1	1	1	1	1	0	0	1	0	1	0
19	Reshaping washing machine	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	-1	1	1	-1	1	0	1	-1	1	1	1	-1	1	0	1	1	1
20.1	Service-oriented electricity system: community-based	1	-1	1	1	-1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	1	1	1	1	1	0	1
20.2	Service-oriented electricity system: third-party service	1	1	-1	1	0	0	1	1	0	1	1	1	1	1	1	-1	1	-1	1	1	-1	1	0	1	-1	0	-1	1	-1	0	1	1
21	Small Household Equipment Manufacturer (SHEM)	1	1	-1	1	1	0	1	1	1	1	1	1	1	1	1	-1	1	0	1	1	1	1	0	1	0	-1	-1	1	1	1	1	0
22	Smartphone Case	1	1	-1	1	1	0	1	1	1	1	-1	1	1	1	1	0	1	1	1	1	1	0	1	1	-1	0	1	1	1	1	0	1
23	The future of WM as a service	-1	1	-1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	-1	1	1	-1	1	-1	1	-1	-1	-1	1	1	-1	-1	1
24	The washing machine case	1	1	-1	1	1	0	1	1	1	1	1	1	1	0	1	-1	1	0	1	1	1	1	-1	1	1	0	0	1	0	0	0	1
25	WhiteGoods manufacturer	1	1	-1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1
26	Xerox asset management program: printer leasing	1	1	-1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-1	1	-1	1	1	1	1	1	1	1

Table 2.7. Classification of the cases according to the industry type and scores for the FSE main criteria

Case number	Product	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
1	Brazilian Olive Oil Case	33,8	7,5	26,3	7,5	8,8	10,0
2	Heavy machinery manufacturer	34,4	10,0	24,4	9,5	6,5	8,3
3	Michelin Fleet Solutions: Truck tires	34,7	6,7	28,1	10,0	8,1	10,0
4	Xerox asset management program: printer leasing	36,0	7,5	28,5	10,0	8,5	10,0
5.1	Bicycle-sharing based on PSS-EPR in China: Mobike	28,4	8,3	20,0	9,0	7,7	3,3
5.2	Bicycle-sharing based on PSS-EPR in China: Ofo	25,8	8,3	17,5	8,0	6,2	3,3
5.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	22,8	8,3	14,4	6,5	4,6	3,3
6	Reshaping washing machine	35,1	9,2	25,9	9,0	6,9	10,0
7	E-mobility case	34,2	8,3	25,8	7,0	8,8	10,0
8	Household appliances	34,4	8,3	26,0	9,5	6,5	10,0
9	Smartphone Case	32,8	7,5	25,3	8,5	8,5	8,3
10	Small Household Equipment Manufacturer (SHEM)	32,1	7,5	24,6	9,0	7,3	8,3
11	The future of WM as a service	24,6	5,8	18,7	10,0	5,4	3,3
12	Decathlon renting service	28,2	5,0	23,2	9,5	5,4	8,3
13	The failure of Mu by Peugeot	30,1	5,8	24,3	8,5	5,8	10,0
14	Bergamo's Bike-sharing PSS	34,2	9,2	25,0	9,0	7,7	8,3
15	The washing machine case	30,4	7,5	22,9	8,5	7,7	6,7
16	WhiteGoods manufacturer	32,5	7,5	25,0	9,5	8,8	6,7
17.1	Brazilian vs Italian companies: Brazil	28,5	6,7	21,9	7,0	6,5	8,3
17.2	Brazilian vs Italian companies: Italia	22,7	4,2	18,5	4,0	6,2	8,3
18	Caterpillar remanufacturing strategy	36,7	7,5	29,2	10,0	9,2	10,0
	Average	31,1	7,5	23,6	8,5	7,2	7,8
	Maximum	36,7	10,0	29,2	10,0	9,2	10,0
	Minimum	22,7	4,2	14,4	4,0	4,6	3,3
Case number	Service	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
19	Brazilian Road transport	25,4	5,8	19,6	7,5	5,4	6,7
20	Colombian cake shop (SME)	22,6	6,7	16,0	7,0	7,3	1,7
21	New logistics and freight transportation model	33,3	8,3	24,9	8,0	6,9	10,0
22	PSS applied to healthcare industry	30,6	10,0	20,6	5,5	8,5	6,7
23	Function-based transportation system	35,8	10,0	25,8	10,0	5,8	10,0
	Average	29,5	8,2	21,4	7,6	6,8	7,0
	Maximum	35,8	10,0	25,8	10,0	8,5	10,0
	Minimum	22,6	5,8	16,0	5,5	5,4	1,7
Case number	Product-service	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
24	Distributed Renewable Energy (DRE)	34,9	6,7	28,2	9,0	9,2	10,0
25.1	Service-oriented electricity system: community-based	32,9	5,8	27,1	9,5	9,2	8,3
25.2	Service-oriented electricity system: third-party service	28,9	6,7	22,2	8,5	5,4	8,3
26	Plastic extrusion pipes	31,6	8,3	23,3	8,0	6,9	8,3
2.2	Telecommunication infrastructure provider	34,4	10,0	24,4	9,5	6,5	8,3
	Average	32,5	7,5	25,0	8,9	7,4	8,6
	Maximum	34,9	10,0	28,2	9,5	9,2	10,0
	Minimum	28,9	5,8	22,2	8,0	5,4	8,3

Table 2.8. Classification of the cases according to the geography and scores for the FSE main criteria

Case number	Developed	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
1.1	Service-oriented electricity systems: community-based	32,9	5,8	27,1	9,5	9,2	8,3
1.2	Service-oriented electricity system: third-party service	28,9	6,7	22,2	8,5	5,4	8,3
2	Plastic extrusion pipes	31,6	8,3	23,3	8,0	6,9	8,3
3	New logistics and freight transportation model	33,3	8,3	24,9	8,0	6,9	10,0
4	Michelin Fleet Solutions: Truck tires	34,7	6,7	28,1	10,0	8,1	10,0
5	Xerox asset management program: printer leasing	36,0	7,5	28,5	10,0	8,5	10,0
6	Reshaping washing machine	35,1	9,2	25,9	9,0	6,9	10,0
7	E-mobility case	34,2	8,3	25,8	7,0	8,8	10,0
8	Smartphone Case	32,8	7,5	25,3	8,5	8,5	8,3
9	Small Household Equipment Manufacturer (SHEM)	32,1	7,5	24,6	9	7,3	8,3
10	The future of WM as a service	24,6	5,8	18,7	10	5,4	3,3
11	Decathlon renting service	28,2	5	23,2	9,5	5,4	8,3
12	The failure of Mu by Peugeot	30,1	5,8	24,3	8,5	5,8	10
13	Bergamo's Bike-sharing PSS	34,2	9,2	25	9	7,7	8,3
14	Function-based transportation system	35,8	10,0	25,8	10,0	5,8	10,0
15.1	Brazilian vs Italian companies: Italia	22,7	4,2	18,5	4,0	6,2	8,3
16	Caterpillar remanufacturing strategy	36,7	7,5	29,2	10,0	9,2	10,0
	Average	32,0	7,3	24,7	8,7	7,2	8,8
	Maximum	36,7	10,0	29,2	10,0	9,2	10,0
	Minimum	22,7	4,2	18,5	4,0	5,4	3,3
Case number	Developing/ emerging	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
17	Distributed Renewable Energy (DRE)	34,9	6,7	28,2	9,0	9,2	10,0
18	Brazilian Road transport	25,4	5,8	19,6	7,5	5,4	6,7
19	Brazilian Olive Oil Case	33,8	7,5	26,3	7,5	8,8	10,0
20	Colombian cake shop (SME)	22,6	6,7	16,0	7,0	7,3	1,7
21.1	Bicycle-sharing based on PSS-EPR in China: Mobike	28,4	8,3	20,0	9,0	7,7	3,3
21.2	Bicycle-sharing based on PSS-EPR in China: Ofo	25,8	8,3	17,5	8,0	6,2	3,3
21.3	Bicycle-sharing based on PSS-EPR in China: Yong Jiu	22,8	8,3	14,4	6,5	4,6	3,3
22	WhiteGoods manufacturer	32,5	7,5	25,0	9,5	8,8	6,7
15.2	Brazilian vs Italian companies: Brazil	28,5	6,7	21,9	7,0	6,5	8,3
	Average	28,3	7,3	21,0	7,9	7,2	5,9
	Maximum	34,9	8,3	28,2	9,5	9,2	10,0
	Minimum	22,6	5,8	14,4	6,5	4,6	1,7
Case number	Developed & developing/ emerging	Total score /40	FSE fundamental principles /10	Three pillars fulfillment /30	Environment /10	Economic /10	Social /10
23.1	Heavy machinery manufacturer	34,4	10,0	24,4	9,5	6,5	8,3
23.2	Telecommunication infrastructure provider	34,4	10,0	24,4	9,5	6,5	8,3
24	PSS applied to healthcare industry	30,6	10,0	20,6	5,5	8,5	6,7
25	Household appliances	34,4	8,3	26,0	9,5	6,5	10,0
26	The washing machine case	30,4	7,5	22,9	8,5	7,7	6,7
	Average	32,8	9,2	23,7	8,5	7,1	8,0
	Maximum	34,4	10,0	26,0	9,5	8,5	10,0
	Minimum	30,4	7,5	20,6	5,5	6,5	6,7

Appendix: chapter 3

Table 3.1. The themes and questions about environmental issues

Question	Variable name
Dans quelle mesure vous sentez-vous concerné par le débat sur l'impact négatif de l'activité humaine sur notre environnement (réchauffement climatique, pollution, épuisement des ressources, etc.) ?	Environmental concern
J'accepte l'idée que la protection de l'environnement doit être une priorité, même si c'est au détriment de la croissance du niveau de vie de la population mondiale ?	Environment vs economics
Je suis d'accord avec l'idée que nous devons mieux utiliser nos ressources naturelles au travers d'un changement de nos habitudes de consommation et de production. Exemple : Recyclage systématique, utilisation de matériaux plus respectueux de l'environnement, etc.	Better use of natural resources
Êtes-vous d'accord avec l'idée que nous devrions revenir à une société moins globalisée, impliquant une part plus importante de production locale ?	Less global
Dans quelle mesure êtes-vous disposé à adapter vos habitudes de consommation afin de réduire l'impact sur l'environnement ?	Change habits for environmental reasons
Lorsque vous achetez un bien, prenez-vous en compte des critères autres que la qualité et le prix, tels que l'impact environnemental ou social ?	Non-economic choice criteria
Etes-vous d'accord avec l'idée de taxer davantage des biens/services qui ont un impact négatif sur l'environnement ? Exemple : taxe environnementale sur les voyages en avion	Taxes for the environment

Table 3.2. Descriptive statistics for the seven environmental themes

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
environmental concern	189	5.8	1.1	2	7
environment vs economics	189	5.3	1.5	1	7
better use of natural resources	189	6.5	0.7	4	7
less global	189	5.8	1.3	1	7
change habits for environmental reasons	189	5.7	1.0	2	7
non economic choice criteria	189	4.8	1.5	1	7
Taxes for the environment	189	5.4	1.5	1	7

Correlation matrix	environmental concern	environment vs economics	better use of natural resources	less global	change habits for environmental reasons	non economic choice criteria	Taxes for the environment
environmental concern	1.00						
environment vs economics	0.50	1.00					
better use of natural resources	0.56	0.34	1.00				
less global	0.28	0.32	0.32	1.00			
change habits for environmental reasons	0.45	0.40	0.49	0.36	1.00		
non economic choice criteria	0.42	0.40	0.36	0.34	0.56	1.00	
Taxes for the environment	0.52	0.44	0.47	0.33	0.49	0.51	1.00

Table 3.3. The impact of some socio-demographic characteristics on environmental concern

VARIABLES	(1) environmental concern	(2) environment vs economics	(3) better use of natural resources	(4) less global	(5) change habits for environmental reasons	(6) non economic choice criteria	(7) Taxes for the environment
age	-0.03	-0.14	-0.05	0.03	0.01	0.23**	0.13
	(0.07)	(0.10)	(0.05)	(0.08)	(0.06)	(0.09)	(0.09)
female	0.56***	0.29	0.20*	0.45**	0.33**	0.74***	0.48**
	(0.16)	(0.23)	(0.11)	(0.20)	(0.15)	(0.21)	(0.22)
student	-0.05	-0.17	-0.10	0.17	-0.13	0.04	0.25
	(0.24)	(0.33)	(0.17)	(0.29)	(0.22)	(0.31)	(0.33)
non active	0.27	0.59	0.19	0.26	0.20	-0.33	0.11
	(0.27)	(0.38)	(0.19)	(0.33)	(0.26)	(0.36)	(0.38)
low education	-0.51**	-0.30	-0.29*	0.17	-0.61***	-0.37	-0.75**
	(0.24)	(0.34)	(0.17)	(0.30)	(0.23)	(0.32)	(0.34)
economics & management	-0.12	-0.65***	-0.03	-0.39*	-0.03	-0.26	-0.18
	(0.17)	(0.24)	(0.12)	(0.21)	(0.16)	(0.23)	(0.24)
suburb	0.07	0.12	-0.06	0.02	-0.03	0.28	0.24
	(0.19)	(0.26)	(0.13)	(0.23)	(0.17)	(0.24)	(0.26)
rural	-0.12	-0.11	-0.03	0.74***	-0.03	-0.11	0.30
	(0.22)	(0.31)	(0.16)	(0.27)	(0.21)	(0.29)	(0.31)
Constant	5.68***	5.72***	6.58***	5.42***	5.63***	4.17***	4.91***
	(0.23)	(0.32)	(0.16)	(0.28)	(0.22)	(0.30)	(0.32)
Observations	189	189	189	189	189	189	189
R-squared	0.11	0.08	0.04	0.11	0.10	0.18	0.10

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.5. Factor analysis of environmental questions

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	3.55	2.76	51%	51%
Factor 2	0.79	0.10	11%	62%
Factor 3	0.69	0.02	10%	72%
Factor 4	0.67	0.16	10%	81%
Factor 5	0.51	0.09	7%	89%
Factor 6	0.42	0.05	6%	95%
Factor 7	0.37	.	5%	100%

Variable	kmo *	Rotated factor loadings Factor 1	Uniqueness	Scoring coefficients** Factor 1
environmental concern	0.84	0.76	0.42	0.21
environment vs economics	0.88	0.68	0.54	0.19
better use of natural resources	0.84	0.71	0.49	0.20
less global	0.91	0.56	0.69	0.16
change habits for environmental reasons	0.86	0.76	0.42	0.21
non economic choice criteria	0.85	0.72	0.48	0.20
Taxes for the environment	0.89	0.77	0.41	0.22
Overall	0.86			

* Kaiser–Meyer–Olkin
** method = regression; based on varimax rotated factors

Technical note:

Using the Kaiser criterion, (and looking at the scree plot) I selected a single factor (called f1 environment) to describe the seven variables since only the first factor has an eigen value greater than one. This factor explains 51% of the total variance. The Kaiser-Meyer-Olkin

statistic (KMO) indicates the proportion of variance across variables that might be common variance. All values are above 0.8 which is considered as adequate. The rotated factors loadings result from an orthogonal rotation of the original factors and are used to interpret the underlying meaning of the factors by showing their correlation with the original variables. This is of course particularly useful with more than one factor. In this case we can see that all seven variables correlate strongly with the single selected factor. Uniqueness is another indicator of how well the factors represent a variable and should have a value below 0.5. Two variables out of seven do not satisfy this criterion. I consider however in the following analysis that the overall fit is reasonable and will always compare the results with those of the simple average variable (environment-attitude). The factors are then constructed as linear combination of the underlying variables and the weights of the variables are the scoring coefficients.

Table 3.6. The themes and questions about the functional economy model

Question	Variable name
Etes-vous familier avec le concept d'économie de la fonctionnalité ?	Familiarity with functional economy
Je pense que ce modèle à un potentiel de développement important aujourd'hui.	Potential of functional economy
Seriez-vous prêt à changer certains aspects de votre mode de consommation actuel pour supporter cette évolution ?	Change habits for functional economy
Dans quelle mesure êtes-vous prêt à louer pour votre usage exclusif un bien plutôt que de l'acheter ? Exemple : contrat de leasing d'une voiture plutôt qu'achat.	Lease vs ownership
Dans quelle mesure seriez-vous prêt à partager avec d'autres l'utilisation d'un bien dont vous n'auriez pas un besoin quasi permanent ? Exemple : voiture, vélo, machine à laver, …	Sharing goods
Etes-vous d'accord avec l'idée que l'on devrait augmenter la durée de vie des biens de consommation en les réparant plutôt qu'en les remplaçants ?	Increase life of products
Êtes-vous prêt à utiliser le même bien plus longtemps dans la mesure où celui-ci sera réparé aussi longtemps que possible ?	Use good longer
En admettant que le fabricant soit responsable de l'ensemble du cycle de vie du produit, de sa conception à sa fin de vie, êtes-vous d'accord avec l'idée qu'il reflète les coûts supplémentaires éventuels dans le prix de vente ?	Cost life cycle
J'ai tendance à faire davantage confiance à un producteur local plutôt que géographiquement éloigné.	Trust local
En admettant que certaines solutions nouvelles reposent fortement sur l'utilisation de technologies modernes de communication (applications mobiles, réservation et paiements en ligne, internet des objets, etc..), êtes-vous prêt à les adopter ?	Technology ready
Seriez -vous tenté de choisir les produits/services d'une entreprise qui adopterait ce modèle, contrairement à ses concurrents ?	Functional economy as differentiation
Etes-vous d'accord avec l'idée de taxer des produits/services liés au mode de consommation actuel pour favoriser l'émergence de ce nouveau modèle ?	Taxes to support functional economy

Table 3.7. Descriptive statistics for the 12 functional economy themes

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
familiarity with functional economy	189	3,8	1,9	1	7
potential of functional economy	189	5,2	1,3	1	7
change habits for functional economy	189	5,2	1,3	1	7
lease vs ownership	189	5,1	1,6	1	7
sharing goods	189	4,5	1,7	1	7
increase life of products	189	6,5	0,8	3	7
use good longer	189	6,5	0,8	2	7
cost life cycle	189	5,6	1,2	1	7
trust local	189	5,4	1,5	1	7
technology ready	189	5,8	1,2	1	7
functional economy as differentiation	189	5,4	1,3	1	7
taxes to support functional economy	189	4,8	1,5	1	7

Correlation matrix	familiarity with functional economy	potential of functional economy	change habits for functional economy	lease vs ownership	sharing goods	increase life of products	use good longer	cost life cycle	trust local	technology ready	functional economy as differentiation	taxes to support functional economy
familiarity with functional economy	1,00											
potential of functional economy	0,49	1,00										
change habits for functional economy	0,35	0,69	1,00									
lease vs ownership	0,26	0,42	0,62	1,00								
sharing goods	0,24	0,36	0,53	0,54	1,00							
increase life of products	0,02	0,20	0,24	0,11	0,23	1,00						
use good longer	-0,03	0,13	0,17	0,06	0,13	0,73	1,00					
cost life cycle	0,06	0,05	0,16	0,21	0,19	0,37	0,30	1,00				
trust local	0,10	0,22	0,27	0,12	0,22	0,15	0,18	0,12	1,00			
technology ready	0,18	0,23	0,29	0,29	0,15	0,00	-0,09	0,06	-0,07	1,00		
functional economy as differentiation	0,18	0,30	0,42	0,37	0,31	0,07	0,10	0,11	0,06	0,64	1,00	
taxes to support functional economy	0,17	0,39	0,51	0,48	0,47	0,24	0,16	0,30	0,27	0,23	0,44	1,00

Table 3.8. The impact of the attitude towards environmental issues and socio-demographic characteristics on the functional economy model

VARIABLES	(1) familiarity with functional economy	(2) potential of functional economy	(3) change habits for functional economy	(4) lease vs ownership	(5) sharing goods	(6) increase life of products
age	0.02	-0.08	-0.04	-0.11	-0.21**	-0.04
	(0.12)	(0.08)	(0.07)	(0.10)	(0.10)	(0.05)
female	-0.34	0.16	0.20	-0.00	0.16	-0.19
	(0.29)	(0.18)	(0.17)	(0.24)	(0.25)	(0.12)
student	0.32	0.35	0.45*	-0.33	0.12	-0.13
	(0.42)	(0.26)	(0.25)	(0.35)	(0.36)	(0.17)
non active	0.09	0.43	0.48*	0.24	0.63	0.07
	(0.48)	(0.30)	(0.28)	(0.40)	(0.41)	(0.19)
low education	-0.13	0.15	-0.26	-0.62*	-0.32	-0.45***
	(0.43)	(0.27)	(0.25)	(0.36)	(0.37)	(0.17)
economics & management	0.87***	0.53***	0.50***	0.64**	-0.10	-0.19
	(0.31)	(0.19)	(0.18)	(0.26)	(0.27)	(0.12)
suburb	0.05	0.04	-0.23	-0.01	0.11	-0.23*
	(0.33)	(0.21)	(0.19)	(0.27)	(0.28)	(0.13)
rural	-0.27	-0.10	0.16	-0.02	-0.31	-0.30*
	(0.39)	(0.25)	(0.23)	(0.33)	(0.34)	(0.15)
environment-attitude	0.41**	0.52***	0.73***	0.68***	0.64***	0.32***
	(0.16)	(0.10)	(0.10)	(0.14)	(0.14)	(0.07)
Constant	1.16	1.89***	0.72	1.32	1.14	5.12***
	(0.98)	(0.62)	(0.58)	(0.83)	(0.85)	(0.39)
Observations	189	189	189	189	189	189
R-squared	0.10	0.19	0.32	0.17	0.15	0.21

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(1) use good longer	(2) cost life cycle	(3) trust local	(4) technology ready	(5) functional economy as differentiation	(6) taxes to support functional economy	(7) functional economy attitude	(8) functional economy attitude
age	-0.01	0.10	-0.04	-0.25***	-0.31***	-0.23***		-0.11***
	(0.05)	(0.08)	(0.09)	(0.07)	(0.08)	(0.08)		(0.04)
female	-0.09	-0.23	0.28	-0.19	0.06	-0.04		0.01
	(0.12)	(0.18)	(0.22)	(0.18)	(0.19)	(0.21)		(0.10)
student	-0.09	0.05	-0.20	-0.16	-0.22	-0.01		-0.02
	(0.18)	(0.26)	(0.32)	(0.26)	(0.28)	(0.30)		(0.14)
non active	0.11	0.16	0.25	0.26	0.65**	0.97***		0.39**
	(0.21)	(0.30)	(0.36)	(0.30)	(0.32)	(0.34)		(0.16)
low education	-0.16	-0.58**	0.17	-0.81***	-0.58**	-0.09		-0.32**
	(0.19)	(0.27)	(0.33)	(0.27)	(0.29)	(0.31)		(0.15)
economics & management	-0.18	-0.14	-0.17	0.28	0.03	0.27		0.13
	(0.13)	(0.19)	(0.23)	(0.19)	(0.21)	(0.22)		(0.10)
suburb	-0.13	0.01	0.30	0.39*	0.33	0.05		0.06
	(0.14)	(0.21)	(0.25)	(0.20)	(0.22)	(0.23)		(0.11)
rural	-0.37**	-0.27	0.40	0.36	0.16	-0.01		-0.03
	(0.17)	(0.24)	(0.29)	(0.24)	(0.26)	(0.28)		(0.13)
environment-attitude	0.25***	0.36***	0.67***	0.12	0.27**	0.97***	0.48***	0.50***
	(0.07)	(0.10)	(0.12)	(0.10)	(0.11)	(0.12)	(0.05)	(0.06)
Constant	5.33***	3.64***	1.56**	5.59***	4.41***	-0.46	2.74***	2.75***
	(0.42)	(0.62)	(0.74)	(0.61)	(0.66)	(0.70)	(0.30)	(0.33)
Observations	189	189	189	189	189	189	189	189
R-squared	0.13	0.15	0.22	0.20	0.15	0.32	0.30	0.38

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.9. Factor analysis of functional economy questions

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	3,85	1,98	35%	35%
Factor 2	1,86	0,66	17%	52%
Factor 3	1,20	0,31	11%	63%
Factor 4	0,89	0,06	8%	71%
Factor 5	0,83	0,20	8%	78%
Factor 6	0,63	0,13	6%	84%
Factor 7	0,51	0,08	5%	89%
Factor 8	0,42	0,08	4%	93%
Factor 9	0,35	0,10	3%	96%
Factor 10	0,25	0,03	2%	98%
Factor 11	0,22	.	2%	100%

Variable	kmo *	Rotated factor loadings Factor 1	Rotated factor loadings Factor 2	Rotated factor loadings Factor 3	Uniqueness	Scoring coefficients* * Factor 1	Scoring coefficients* * Factor 2	Scoring coefficients* * Factor 3
potential of functional economy	0,78	0,73	0,04	0,08	0,45	0,27	-0,08	-0,09
change habits for functional economy	0,80	0,84	0,11	0,18	0,25	0,29	-0,05	-0,03
lease vs ownership	0,84	0,72	0,03	0,27	0,41	0,23	-0,07	0,05
sharing goods	0,87	0,72	0,13	0,07	0,46	0,25	-0,03	-0,08
increase life of products	0,61	0,14	0,88	-0,05	0,21	-0,06	0,46	-0,01
use good longer	0,56	0,07	0,87	-0,09	0,23	-0,08	0,46	-0,03
cost life cycle	0,81	0,12	0,62	0,12	0,59	-0,06	0,33	0,10
trust local	0,79	0,51	0,14	-0,40	0,56	0,26	-0,02	-0,37
technology ready	0,61	0,18	-0,03	0,86	0,22	-0,09	0,00	0,55
functional economy as differentiation	0,68	0,36	0,10	0,77	0,26	-0,02	0,05	0,46
taxes to support functional economy	0,87	0,66	0,24	0,23	0,45	0,19	0,04	0,04
Overall	0,75							

* Kaiser–Meyer–Olkin
** method = regression; based on varimax rotated factors

Technical note:

Looking at the KMO statistics we conclude that the model is satisfactory (overall value of 0.75) but with one variable (use good longer) which is barely about 0.5. Considering the uniqueness statistics, two variables out of eleven are somewhat problematic with value greater than 0.5. Despite this comments and limitations, I decided to continue the analysis with these three factors.

Table 3.10. Description of the proposed case studies (in French)

Location de vélos électriques en milieu urbain	Vous avez la possibilité de louer un vélo électrique pour faciliter vos déplacements urbains. De multiples points sont disponibles au sein de la ville pour emprunter et déposer les vélos après usage. Via votre smartphone, vous pouvez identifier l'endroit le plus proche, vérifier la disponibilité d'un vélo et effectuer votre paiement. Le gestionnaire du parc s'occupe de l'entretien et s'assure de la disponibilité des vélos à tous les points d'accès.
Service de blanchisserie	Vous avez la possibilité d'accéder à une blanchisserie à proximité de chez vous. Celle-ci met à votre disposition des machines à laver et des séchoirs professionnels conçus pour avoir une longue durée de vie. Le service offert vise également à minimiser la consommation d'eau et d'électricité, en particulier. Ce service est combiné avec un espace bar-restaurant séparé qui permet d'attendre dans un cadre agréable et confortable. Vous payez sur base du nombre de machines utilisées et bien entendu, de votre éventuelle consommation dans l'espace bar-restaurant.
Service de blanchisserie (suite)	La même entreprise vous offre également un service de nettoyage et repassage du linge avec enlèvement et livraison à domicile, ce service vous étant facturé en plus de l'usage des machines.
Location d'équipements sportifs	Un magasin de sport propose la location d'équipements sportifs à court, moyen ou long-terme à la place d'un achat. Vous pourrez ainsi louer de l'équipement pour le ski, des planches de surfs, des kayaks, du matériel de randonnée ou des équipements de fitness, par exemple. L'offre met à disposition des produits durables qui pourront être loués sur des périodes longues et développés en collaboration avec des fabricants qui eux aussi s'inscrivent dans cette même logique. Le paiement est basé sur un abonnement flexible et avantageux. Une application smartphone permet de sélectionner et de réserver des équipements en ligne.
Location de pneus	Un fabricant de pneus vous propose une solution intégrée pour votre voiture. Ce service inclut l'installation et le remplacement de vos pneus à domicile, y compris pour vos pneus été/hiver. Les pneus sont conçus de manière à permettre au fabricant de contrôler à distance leur usure. Le service est facturé sur base du nombre de kilomètres parcourus. Cette solution permet d'optimiser la durée de vie de vos pneus et de choisir ceux qui sont les plus adaptés à vos besoins, notamment en termes de consommation de carburant.

Figure 3.6. The WASBAR concept

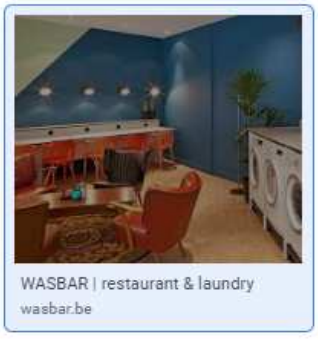
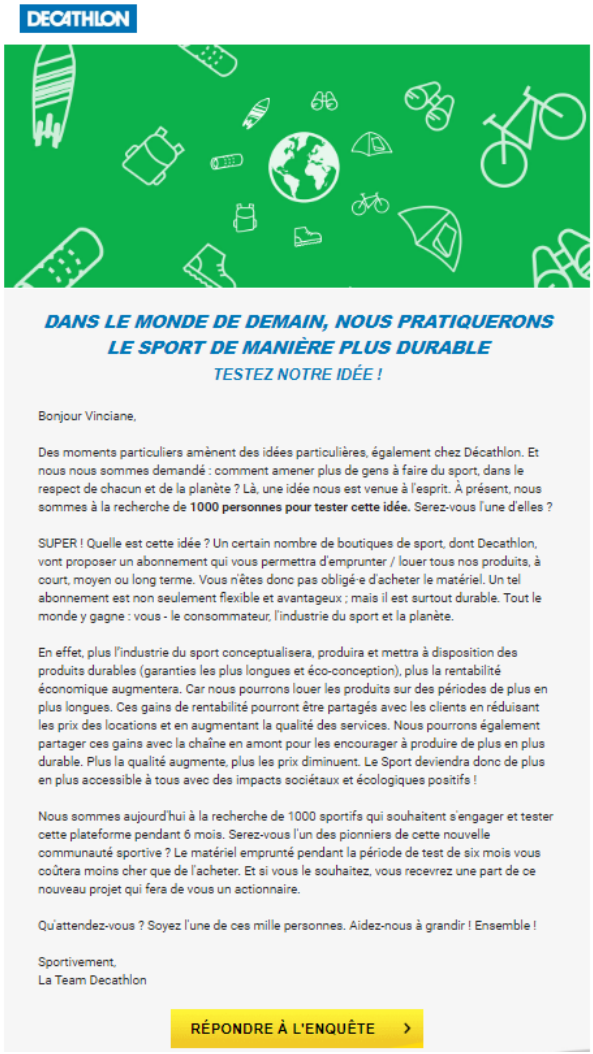


Figure 3.7. Email sent by Decathlon to introduce its leasing of sport equipment concept and invite to answer the survey



DECATHLON

DANS LE MONDE DE DEMAIN, NOUS PRATIQUERONS LE SPORT DE MANIÈRE PLUS DURABLE

TESTEZ NOTRE IDÉE !

Bonjour Vinciane,

Des moments particuliers amènent des idées particulières, également chez Décathlon. Et nous nous sommes demandé : comment amener plus de gens à faire du sport, dans le respect de chacun et de la planète ? Là, une idée nous est venue à l'esprit. À présent, nous sommes à la recherche de **1000 personnes pour tester cette idée.** Serez-vous l'une d'elles ?

SUPER ! Quelle est cette idée ? Un certain nombre de boutiques de sport, dont Decathlon, vont proposer un abonnement qui vous permettra d'emprunter / louer tous nos produits, à court, moyen ou long terme. Vous n'êtes donc pas obligé·e d'acheter le matériel. Un tel abonnement est non seulement flexible et avantageux ; mais il est surtout durable. Tout le monde y gagne : vous - le consommateur, l'industrie du sport et la planète.

En effet, plus l'industrie du sport conceptualisera, produira et mettra à disposition des produits durables (garanties les plus longues et éco-conception), plus la rentabilité économique augmentera. Car nous pourrons louer les produits sur des périodes de plus en plus longues. Ces gains de rentabilité pourront être partagés avec les clients en réduisant les prix des locations et en augmentant la qualité des services. Nous pourrons également partager ces gains avec la chaîne en amont pour les encourager à produire de plus en plus durable. Plus la qualité augmente, plus les prix diminuent. Le Sport deviendra donc de plus en plus accessible à tous avec des impacts sociétaux et écologiques positifs !

Nous sommes aujourd'hui à la recherche de 1000 sportifs qui souhaitent s'engager et tester cette plateforme pendant 6 mois. Serez-vous l'un des pionniers de cette nouvelle communauté sportive ? Le matériel emprunté pendant la période de test de six mois vous coûtera moins cher que de l'acheter. Et si vous le souhaitez, vous recevrez une part de ce nouveau projet qui fera de vous un actionnaire.

Qu'attendez-vous ? Soyez l'une de ces mille personnes. Aidez-nous à grandir ! Ensemble !

Sportivement,
La Team Decathlon

RÉPONDRE À L'ENQUÊTE ›

Table 3.11. Descriptive statistics for the various case studies

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
bike concept	189	5.9	1.3	1	7
bike-use	189	4.7	1.8	1	7
laundry concept	189	4.6	1.8	1	7
laundry-shop-use	189	3.5	1.8	1	7
laundry-service-use	189	4.4	1.8	1	7
sport concept	189	5.5	1.4	1	7
sport-use	189	4.8	1.7	1	7
tyre concept	189	5.1	1.9	1	7
tyre-use	189	4.7	2.0	1	7

Correlation matrix	bike concept	bike-use	laundry concept	laundry-shop-use	laundry-service-use	sport concept	sport-use	tyre concept	tyre-use
bike concept	1.00								
bike-use	0.64	1.00							
laundry concept	0.23	0.16	1.00						
laundry-shop-use	0.08	0.25	0.77	1.00					
laundry-service-use	0.03	0.02	0.51	0.49	1.00				
sport concept	0.43	0.23	0.36	0.25	0.23	1.00			
sport-use	0.28	0.34	0.31	0.38	0.28	0.74	1.00		
tyre concept	0.21	0.18	0.25	0.17	0.27	0.23	0.17	1.00	
tyre-use	0.15	0.18	0.23	0.19	0.29	0.26	0.27	0.89	1.00

Table 3.12. Differential attitudes and opinions for the various cases

Equality of scores for …	F		p-value
the four concepts	F(3,186)	26.4	0.000
the probabilities of using them	F(4,185)	24.4	0.000
the concept and the probalility of using it - bike	F(1,188)	137.0	0.000
the concept and the probalility of using it -laundry - shop	F(1,188)	156.4	0.000
the concept and the probalility of using it - laundry - service	F(1,188)	4.1	0.045
the probabilties of using the two versions of the laundry concepts	F(1,188)	40.9	0.000
the concept and the probalility of using it - sport	F(1,188)	65.0	0.000
the concept and the probalility of using it - tyre	F(1,188)	41.2	0.000

Table 3.13. Impact of attitude towards the environment, the functional economy model and socio-demographic variables on the scores of the various concepts proposed - aggregate variables

VARIABLES	(1) bike concept	(2) laundry concept	(3) sport concept	(4) tyre concept
age	-0.10	-0.31***	-0.15*	0.18
	(0.08)	(0.11)	(0.09)	(0.11)
female	0.07	-0.04	0.23	0.22
	(0.20)	(0.26)	(0.20)	(0.27)
student	0.03	-0.60	-0.22	0.24
	(0.28)	(0.38)	(0.29)	(0.39)
non active	-0.32	0.96**	-0.18	-0.28
	(0.33)	(0.44)	(0.34)	(0.45)
low education	0.16	0.25	-0.13	-0.11
	(0.29)	(0.40)	(0.31)	(0.41)
economics & management	0.15	-0.12	0.22	0.05
	(0.21)	(0.28)	(0.22)	(0.29)
suburb	-0.00	0.45	0.54**	0.04
	(0.22)	(0.30)	(0.23)	(0.31)
rural	0.27	0.49	0.41	-0.33
	(0.26)	(0.35)	(0.27)	(0.36)
environment-attitude	0.10	-0.04	0.08	0.33*
	(0.13)	(0.18)	(0.14)	(0.19)
functional econonomy -attitude	0.60***	0.70***	0.61***	0.79***
	(0.15)	(0.20)	(0.15)	(0.21)
Constant	2.10***	1.54	1.74**	-1.52
	(0.78)	(1.05)	(0.81)	(1.08)
Observations	189	189	189	189
R-squared	0.20	0.16	0.23	0.21

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.14. Correlations between the factor associated with general attitude towards the environment and the factors associated with the functional economy model

Correlation matrix	f1 environment	f1 functional: service	f2 functional: durability	f3 functional: package
f1 environment	1			
f1 functional: service	0,51	1,00		
f2 functional: durability	0,35	0,00	1,00	
f3 functional: package	-0,06	0,00	0,00	1,00

Table 3.15. Impact of attitude towards the environment, the functional economy model and socio-demographic variables on the scores of the various concepts proposed - factors

VARIABLES	(1) bike concept	(2) laundry concept	(3) sport concept	(4) tyre concept
age	-0.07	-0.32***	-0.13	0.20*
	(0.08)	(0.11)	(0.09)	(0.11)
female	0.05	-0.13	0.24	0.15
	(0.20)	(0.27)	(0.21)	(0.27)
student	0.02	-0.69*	-0.23	0.19
	(0.28)	(0.38)	(0.29)	(0.39)
non active	-0.32	0.96**	-0.20	-0.31
	(0.32)	(0.44)	(0.34)	(0.45)
low education	0.19	0.07	-0.09	-0.17
	(0.30)	(0.40)	(0.31)	(0.41)
economics & management	0.06	-0.22	0.15	-0.11
	(0.21)	(0.28)	(0.22)	(0.29)
suburb	-0.05	0.47	0.52**	-0.00
	(0.22)	(0.30)	(0.23)	(0.30)
rural	0.19	0.43	0.37	-0.45
	(0.26)	(0.36)	(0.28)	(0.37)
f1 environment	0.20*	-0.07	0.12	0.37**
	(0.12)	(0.16)	(0.13)	(0.17)
f1 functional: service	0.34***	0.60***	0.37***	0.57***
	(0.11)	(0.15)	(0.12)	(0.15)
f2 functional: durability	-0.02	0.04	0.08	-0.07
	(0.10)	(0.14)	(0.11)	(0.14)
f3 functional: package	0.33***	0.06	0.31***	0.32**
	(0.10)	(0.13)	(0.10)	(0.14)
Constant	5.96***	5.31***	5.49***	4.74***
	(0.27)	(0.37)	(0.29)	(0.38)
Observations	189	189	189	189
R-squared	0.22	0.18	0.24	0.24

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.16. Impact of attitude towards the environment, the functional economy model, the score of the concept and socio-demographic variables on the likelihood of using the corresponding concept – aggregate variables

VARIABLES	(1) bike-use	(2) laundry-shop-use	(3) laundry-service-use	(4) sport-use	(5) tyre-use
age	-0.11	0.01	-0.04	-0.12	0.07
	(0.09)	(0.08)	(0.11)	(0.08)	(0.06)
female	-0.02	0.03	-0.24	-0.32*	-0.26*
	(0.21)	(0.18)	(0.25)	(0.18)	(0.15)
student	-0.21	0.39	-0.44	-0.11	-0.28
	(0.30)	(0.26)	(0.36)	(0.26)	(0.21)
non active	-0.22	0.30	-0.07	-0.06	-0.56**
	(0.35)	(0.30)	(0.42)	(0.30)	(0.24)
low education	-0.20	0.07	-0.13	0.33	0.19
	(0.31)	(0.27)	(0.37)	(0.27)	(0.22)
economics & management	-0.25	-0.10	0.11	0.10	0.16
	(0.22)	(0.19)	(0.26)	(0.19)	(0.15)
suburb	-0.16	-0.28	-0.32	-0.29	0.01
	(0.23)	(0.20)	(0.28)	(0.21)	(0.16)
rural	-0.86***	-0.55**	0.08	-0.04	0.19
	(0.28)	(0.24)	(0.33)	(0.24)	(0.19)
environment-attitude	-0.04	0.08	0.06	0.10	-0.00
	(0.14)	(0.12)	(0.17)	(0.12)	(0.10)
functional economy attitude	0.46***	0.22	0.42**	0.23	0.23**
	(0.16)	(0.14)	(0.19)	(0.14)	(0.11)
bike-concept	0.75***				
	(0.08)				
laundry-concept		0.75***	0.47***		
		(0.05)	(0.07)		
sport-concept				0.84***	
				(0.07)	
tyre-concept					0.94***
					(0.04)
Constant	-1.38	-1.65**	-0.02	-1.23*	-1.35**
	(0.84)	(0.72)	(0.99)	(0.73)	(0.58)
Observations	189	189	189	189	189
R-squared	0.49	0.63	0.31	0.59	0.81

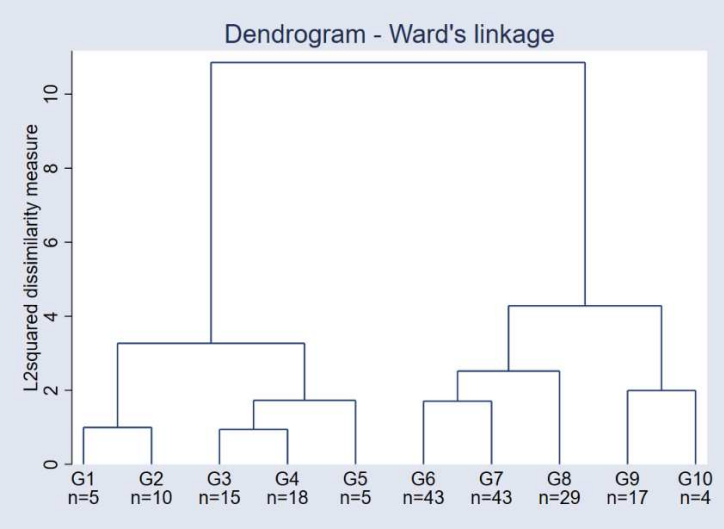
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.17. Impact of attitude towards the environment, the functional economy model, the score of the concept and socio-demographic variables on the likelihood of using the corresponding concept – factors

VARIABLES	(1) bike-use	(2) laundry-shop-use	(3) laundry-service-use	(4) sport-use	(5) tyre-use
age	-0.13	-0.03	-0.03	-0.15*	0.10*
	(0.09)	(0.08)	(0.11)	(0.08)	(0.06)
female	-0.08	-0.04	-0.21	-0.37**	-0.21
	(0.21)	(0.18)	(0.25)	(0.18)	(0.14)
student	-0.26	0.32	-0.42	-0.16	-0.24
	(0.30)	(0.26)	(0.36)	(0.26)	(0.20)
non active	-0.21	0.33	-0.07	-0.05	-0.57**
	(0.35)	(0.30)	(0.42)	(0.30)	(0.24)
low education	-0.34	-0.09	-0.08	0.18	0.31
	(0.32)	(0.27)	(0.38)	(0.28)	(0.22)
economics & management	-0.30	-0.10	0.11	0.07	0.14
	(0.22)	(0.19)	(0.27)	(0.19)	(0.15)
suburb	-0.14	-0.22	-0.33	-0.25	-0.03
	(0.24)	(0.20)	(0.28)	(0.21)	(0.16)
rural	-0.89***	-0.52**	0.07	-0.04	0.17
	(0.28)	(0.24)	(0.34)	(0.25)	(0.19)
f1 environment	-0.05	0.01	0.10	0.00	0.06
	(0.13)	(0.11)	(0.15)	(0.11)	(0.09)
f1 functional: service	0.38***	0.25**	0.20	0.26**	0.06
	(0.12)	(0.11)	(0.15)	(0.11)	(0.08)
f2 functional: durability	0.04	0.08	0.11	0.05	0.05
	(0.11)	(0.09)	(0.13)	(0.09)	(0.07)
f3 functional: package	-0.01	-0.19**	0.19	-0.14	0.27***
	(0.11)	(0.09)	(0.12)	(0.09)	(0.07)
bike-concept	0.76***				
	(0.08)				
laundry-concept		0.74***	0.48***		
		(0.05)	(0.07)		
sport-concept				0.86***	
				(0.07)	
tyre-concept					0.93***
					(0.04)
Constant	0.96*	0.20	2.49***	0.60	-0.15
	(0.57)	(0.37)	(0.52)	(0.45)	(0.28)
Observations	189	189	189	189	189
R-squared	0.50	0.64	0.31	0.60	0.82

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3.9. Dendrogram for the hierarchical clustering method



Technical note:

I first applied a hierarchical clustering method using Ward's linkage and the squared Euclidian distance as measure of dissimilarity. The method is an agglomerative clustering method. Each object (each respondent) initially belongs to an individual cluster. The objects are then progressively grouped into larger clusters based on a selected similarity measure (distance measure). The procedure stops when all the objects have been merged into a single cluster. The dendrogram presented in figure 3.9. above summarizes graphically the distance for ten clusters on the vertical axis, as well as the number of objects each of them contains.

The next step is the selection of an appropriate number of clusters. The Dendrogram presented is a visual method to help decode how many clusters to use for further analysis. Other criteria associating a statistic to each number of cluster also exist and I used three of them to guide me in this process. The first one is the Duda-Hart index. The number of clusters to be selected is the one corresponding to the largest value of the statistics. The second criterion is called the pseudo T squared, which should be minimized and the third one is the variance ratio criterion (VRC) also called the Calinski-Harabasz pseudo-F which should be maximized. The different statistics suggest different solutions, but I decided to use three and four clusters. In what follows I only present the results based on three clusters.

Another approach is to use partitioning clustering methods and particularly k-means clustering. Contrary to hierarchical methods, the number of clusters must be chosen to initialize the algorithm. Given the number of cluster to be created, the k-means then assigns

all objects to one of the clusters and successively re-arranges them to minimize the within-cluster variation. The initial allocation of objects can be done in different ways such as by random assignment.

Why considering another rather different clustering method? The main reason is that different methods can give very different outputs which obviously makes the interpretation of any solution difficult. To verify that the solution of the hierarchical method is reasonably robust, I used a k-means method (with three and four clusters) to compare the results. The initial allocation of objects to the k-means algorithm is the output of the hierarchical clustering method.

Table 3.18. compares the allocation of objects between the two methods. Most objects remain in the same cluster after running the k-means, but the two approaches do not provide exactly the same solution. In fact, 32 respondents or 17% are allocated to different clusters. I consider that this is reasonably robust and will now further present the analysis of the clusters based on the k-means method with three clusters although it should be kept in mind that the solution is not perfect.

Table 3.18. Comparison of the results of hierarchical and partitioning methods

Number of observations	partitioning method - k-means(3)			
Hierarchical clustering) - Ward's linkage	cluster 1	cluster 2	cluster 3	Total
cluster 1	48	3	2	53
cluster 2	6	89	20	115
cluster 3	0	1	20	21
Total	54	93	42	189

Table 3.19. Clusters and socio-demographic variables

k-means(3)	age	female	student	non active	low education	economics & management	suburb	rural	environment-attitude	functional economy attitude
cluster 1	1,28	0,33	0,50	0,07	0,19	0,61	0,26	0,13	4,7	4,8
cluster 2	1,96	0,57	0,30	0,18	0,06	0,38	0,29	0,18	6,2	6,0
cluster 3	2,64	0,43	0,21	0,14	0,14	0,24	0,14	0,10	5,7	4,9
Total	1,92	0,47	0,34	0,14	0,12	0,41	0,25	0,15	5,6	5,4
Wald chi2(2)*	13,25	8,48	9,73	4,17	5,04	16,08	4,37	2,13	173,11	233,78
Prob > chi2 (chi-squared approximation)	0,001	0,014	0,008	0,125	0,081	0,000	0,112	0,344	0,000	0,000
Prob > chi2 (James' approximation)	0,002	0,018	0,010	0,132	0,088	0,001	0,119	0,350	0,000	0,000

*equality of 3 group means, allowing for heterogeneity

Table 3.20. Clusters and scores of the case studies

k-means(3)	bike concept	bike-use	laundry concept	laundry-shop-use	laundry-service-use	sport concept	sport-use	tyre concept	tyre-use
cluster 1	5.6	4.2	4.5	3.2	4.0	5.1	4.4	4.3	3.8
cluster 2	6.3	5.3	5.0	3.9	4.8	6.0	5.3	5.7	5.4
cluster 3	5.3	4.0	4.0	3.1	3.9	4.8	4.1	4.7	4.0
Total	5.9	4.7	4.6	3.5	4.4	5.5	4.8	5.1	4.7
Wald chi2(2)*	19.7	24.49	9.5	8.21	10.39	27.67	20.18	23.25	32.41
Prob > chi2 (chi-squared approximation)	0.000	0.000	0.009	0.017	0.006	0.000	0.000	0.000	0.000
Prob > chi2 (James' approximation)	0.000	0.000	0.011	0.020	0.007	0.000	0.000	0.000	0.000

*equality of 3 group means, allowing for heterogeneity

Figure 3.10. Summary of the basic model and main relations

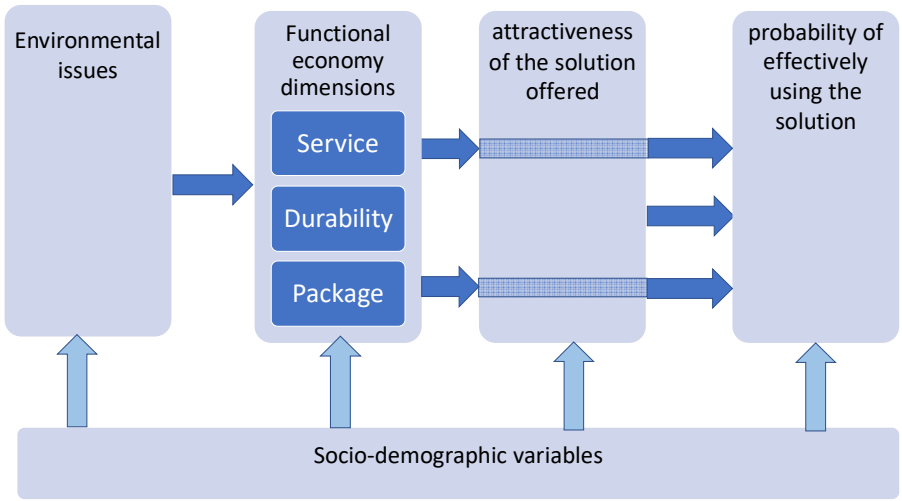


Table 3.21. The list of questions and the associated variable names

Question	Detailed question	Stata variable	Variable name in the text
	Timestamp	time	
	Email address	mail	
Question 1	A quelle catégorie d'âge appartenez-vous ?	age	age
Question 2	Êtes-vous… ?	sex	sex
Question 3	Quelle est votre situation actuelle ?	status	status
Question 4	Quel est votre niveau d'étude le plus élevé ?	education	education
Question 5	Quelle est votre domaine d'études et de formation ?	study	study
Question 6	Dans quel environnement vivez-vous principalement ?	location	location
Question 7	Dans quelle mesure vous sentez vous concerné par le débat sur l'impact négatif de l'activité humaine sur notre environnement (réchauffement climatique, pollution, épuisement des ressources, etc.) ?	env_concern	environmental concern
Question 8	J'accepte l'idée que la protection de l'environnement doit être une priorité, même si c'est au détriment de la croissance du niveau de vie de la population mondiale ?	env_vs_econ	environment vs economics
Question 9	Je suis d'accord avec l'idée que nous devons mieux utiliser nos ressources naturelles au travers d'un changement de nos habitudes de consommation et de production. Exemple : Recyclage systématique, utilisation de matériaux plus respectueux de l'environnement, etc.	better_use_nat_res	better use of natural resources
Question 10	Êtes-vous d'accord avec l'idée que nous devrions revenir à une société moins globalisée, impliquant une part plus importante de production locale ?	less_global	less global
Question 11	Dans quelle mesure êtes-vous disposé à adapter vos habitudes de consommation afin de réduire l'impact sur l'environnement ?	change _habits_env	change habits for environmental reasons
Question 12	Lorsque vous achetez un bien, prenez-vous en compte des critères autres que la qualité et le prix, tels que l'impact environnemental ou social ?	non_econ_choice_criteria	non economic choice criteria
Question 13	Etes-vous d'accord avec l'idée de taxer davantage des biens/services qui ont un impact négatif sur l'environnement ? Exemple : taxe environnementale sur les voyages en avion.	Tax_environment	Taxes for the environment
Question 14	Etes-vous familier avec le concept d'économie de la fonctionnalité ?	know_funct_econ	familiarity with performance economy
Question 15	Je pense que ce modèle à un potentiel de développement important aujourd'hui.	poten_func_econ	potential of performance economy
Question 16	Seriez-vous prêt à changer certains aspects de votre mode de consommation actuel pour supporter cette évolution ?	change_habits_func_econ	change habits for performance economy
Question 17	Dans quelle mesure êtes-vous prêt à louer pour votre usage exclusif un bien plutôt que de l'acheter ? Exemple : contrat de leasing d'une voiture plutôt qu'achat.	lease_vs_ownership	lease vs ownership
Question 18	Dans quelle mesure seriez-vous prêt à partager avec d'autres l'utilisation d'un bien dont vous n'auriez pas un besoin quasi permanent ? Exemple : voiture, vélo, machine à laver, …	sharing_goods	sharing goods
Question 19	Etes-vous d'accord avec l'idée que l'on devrait augmenter la durée de vie des biens de consommation en les réparant plutôt qu'en les remplaçant ?	incr_life_prod	increase life of products
Question 20	Êtes-vous prêt à utiliser le même bien plus longtemps dans la mesure où celui-ci sera réparé aussi longtemps que possible ?	use_good_longer	use good longer
Question 21	En admettant que le fabricant soit responsable de l'ensemble du cycle de vie du produit, de sa conception à sa fin de vie, êtes-vous d'accord avec l'idée qu'il reflète les coûts supplémentaires éventuels dans le prix de vente ?	cost_life_cycle	cost life cycle
Question 22	J'ai tendance à faire davantage confiance à un producteur local plutôt que géographiquement éloigné.	trust_local	trust local
Question 23	En admettant que certaines solutions nouvelles reposent fortement sur l'utilisation de technologies modernes de communication (applications mobiles, réservation et paiements en ligne, internet des objets, etc..), êtes-vous prêt à les adopter ?	techno_ready	technology ready
Question 24	Seriez -vous tenté de choisir les produits/services d'une entreprise qui adopterait ce modèle, contrairement à ses concurrents ?	funct_econ_differentiation	performance economy as differentiation
Question 25	Etes-vous d'accord avec l'idée de taxer des produits/services liés au mode de consommation actuel pour favoriser l'émergence de ce nouveau modèle ?	tax_func_econ	taxes to support performance economy
Question 26	Location de vélos électriques en milieu urbain-Trouvez-vous le concept intéressant ?	bike_concept	bike concept
Question 27	Location de vélos électriques en milieu urbain-Quelle est la probabilité que vous utilisiez ce service ?	bike_proba	bike-use
Question 28	Service de blanchisserie-Trouvez-vous le concept intéressant ?	laundry_concept	laundry concept
Question 29	Service de blanchisserie-Quelle est la probabilité que vous utilisiez ce service ?	laundry_proba_shop	laundry-shop-use
Question 30	Service de blanchisserie (suite)-Quelle est la probabilité que vous utilisiez ce service ?	laundry_proba_serv	laundry-service-use
Question 31	Location d'équipements sportifs-Trouvez-vous le concept intéressant ?	sport_concept	sport concept
Question 32	Location d'équipements sportifs-Quelle est la probabilité que vous utilisiez ce service ?	sport_proba	sport-use
Question 33	Location de pneus-Trouvez-vous le concept intéressant ?	tyre_concept	tyre concept
Question 34	Location de pneus-Quelle est la probabilité que vous utilisiez ce service ?	tyre_proba	tyre-use
		age_c	age
		female	female
		student	student
		non_active	non active
		low_education	low education
		econ_mana	economics & management
		suburb	suburb
		rural	rural
		env_att	environment-attitude
		func_econ_att	performance economy attitude
		f1_env	f1 environment
		f1_func_serv	f1 performance: service
		f2_func_dura	f2 performance: durability
		f3_func_pack	f3 performance: package

Survey questionnaire

L'économie de la fonctionnalité

Dans le cadre de mon travail de fin d'étude à la Louvain School of Management de l'UCL, j'étudie le développement de nouveaux modèles et concepts économiques dans une perspective de développement durable. L' objectif de cette enquête est de mieux comprendre les opportunités et les enjeux de cette nouvelle approche. Je vous remercie d'avance pour le temps et l'attention que vous accorderez à ce questionnaire.

Pour beaucoup de questions, nous allons vous demander de donner votre opinion sur une échelle allant de 1 à 7 afin de vous permettre de répondre de manière précise et nuancée, particulièrement si votre réponse dépend de certaines conditions ou situations particulières. Si vous avez une attitude neutre ou n'avez pas d'opinion claire sur une question, sélectionnez alors le milieu de l'échelle (4).

Merci de bien vouloir me donner votre adresse mail. Elle ne me servira qu'au suivi des réponses. L'exploitation des données sera totalement anonymisée. Une fois l'analyse terminée, le lien entre les réponses et l'adresse mail sera supprimé.
*Required

1. Email address *

_____

Données personnelles

2. A quelle catégorie d'âge appartenez-vous ? *

Mark only one oval.

- ◯ moins de 25
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65-74
- ◯ 75 ou plus

3. Êtes-vous... ? *

Mark only one oval.

- ◯ un homme
- ◯ une femme

4. Quelle est votre situation actuelle ? *

Mark only one oval.

- ◯ étudiant
- ◯ employé du secteur privé
- ◯ employé du secteur public
- ◯ indépendant/profession libérale/entrepreneur
- ◯ sans emploi
- ◯ retraité
- ◯ Other: _____

5. Quel est votre niveau d'étude le plus élevé ? *

Si vous êtes étudiant, merci d'indiquer le dernier diplôme que vous avez acquis.

Mark only one oval.

- ◯ pas de diplôme
- ◯ école primaire
- ◯ école secondaire
- ◯ bachelier
- ◯ master
- ◯ doctorat
- ◯ Other: _____

6. Quelle est votre domaine d'études et de formation ? *

Mark only one oval.

- ◯ économie & gestion
- ◯ sciences sociales, politiques et de communication
- ◯ philosophie, arts & lettres
- ◯ droit
- ◯ psychologie
- ◯ sciences & technologies
- ◯ sciences de la santé
- ◯ Other: _____

7. Dans quel environnement vivez-vous principalement ? *

Mark only one oval.

- ◯ En ville
- ◯ En périphérie
- ◯ En milieu rural

Opinion et attitude face à l'évolution de l'environnement

8. Dans quelle mesure vous sentez vous concerné par le débat sur l'impact négatif de l'activité humaine sur notre environnement (réchauffement climatique, pollution, épuisement des ressources, etc.) ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout concerné	◯	◯	◯	◯	◯	◯	◯	Très concerné

9. J'accepte l'idée que la protection de l'environnement doit être une priorité, même si c'est au détriment de la croissance du niveau de vie de la population mondiale ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

10. Je suis d'accord avec l'idée que nous devons mieux utiliser nos ressources naturelles au travers d'un changement de nos habitudes de consommation et de production. Exemple : Recyclage systématique, utilisation de matériaux plus respectueux de l'environnement, etc. *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

11. Êtes-vous d'accord avec l'idée que nous devrions revenir à une société moins globalisée, impliquant une part plus importante de production locale ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

12. Dans quelle mesure êtes-vous disposé à adapter vos habitudes de consommation afin de réduire l'impact sur l'environnement ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout disposé	◯	◯	◯	◯	◯	◯	◯	Tout à fait disposé

13. Lorsque vous achetez un bien, prenez-vous en compte des critères autres que la qualité et le prix, tels que l'impact environnemental ou social ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Jamais	◯	◯	◯	◯	◯	◯	◯	Toujours

14. Etes-vous d'accord avec l'idée de taxer davantage des biens/services qui ont un impact négatif sur l'environnement ? Exemple : taxe environnementale sur les voyages en avion. *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

L'économie de la fonctionnalité

L'économie de la fonctionnalité substitue à la vente d'un bien la vente d'un service remplissant les mêmes fonctions que le bien. Elle repose sur la valeur d'usage d'un produit et non sur la possession du produit. En effet, le produit reste la propriété du producteur et c'est son usage qui est facturé au client. La relation entre le fournisseur et le client s'étale alors tout au long de l'utilisation du bien et non plus de manière unique lors de la transaction de vente.

Ce nouveau mode de consommation peut renforcer la position d'une entreprise sur son marché, favorise le maintien de l'emploi local et favorise la prolongation de la durée d'utilisation d'un produit. A travers l'optimisation de l'utilisation des ressources matérielles, l'économie de la fonctionnalité contribue à une économie plus durable.

15. Etes-vous familier avec le concept d'économie de la fonctionnalité ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout familier	◯	◯	◯	◯	◯	◯	◯	Tout à fait familier

16. Je pense que ce modèle à un potentiel de développement important aujourd'hui. *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

17. Seriez-vous prêt à changer certains aspects de votre mode de consommation actuel pour supporter cette évolution ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout prêt	◯	◯	◯	◯	◯	◯	◯	Tout à fait prêt

18. Dans quelle mesure êtes-vous prêt à louer pour votre usage exclusif un bien plutôt que de l'acheter ? Exemple : contrat de leasing d'une voiture plutôt qu'achat. *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout prêt	◯	◯	◯	◯	◯	◯	◯	Tout à fait prêt

19. Dans quelle mesure seriez-vous prêt à partager avec d'autres l'utilisation d'un bien dont vous n'auriez pas un besoin quasi permanent ? Exemple : voiture, vélo, machine à laver, ... *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout prêt	◯	◯	◯	◯	◯	◯	◯	Tout à fait prêt

20. Etes-vous d'accord avec l'idée que l'on devrait augmenter la durée de vie des biens de consommation en les réparant plutôt qu'en les remplaçant ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

21. Êtes-vous prêt à utiliser le même bien plus longtemps dans la mesure où celui-ci sera réparé aussi longtemps que possible ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout prêt	◯	◯	◯	◯	◯	◯	◯	Tout à fait prêt

22. En admettant que le fabricant soit responsable de l'ensemble du cycle de vie du produit, de sa conception à sa fin de vie, êtes-vous d'accord avec l'idée qu'il reflète les coûts supplémentaires éventuels dans le prix de vente ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

23. J'ai tendance à faire davantage confiance à un producteur local plutôt que géographiquement éloigné. *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

24. En admettant que certaines solutions nouvelles reposent fortement sur l'utilisation de technologies modernes de communication (applications mobiles, réservation et paiements en ligne, internet des objets, etc..), êtes-vous prêt à les adopter ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout prêt	◯	◯	◯	◯	◯	◯	◯	Tout à fait prêt

25. Seriez -vous tenté de choisir les produits/services d'une entreprise qui adopterait ce modèle, contrairement à ses concurrents ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout tenté	◯	◯	◯	◯	◯	◯	◯	Tout à fait tenté

26. Etes-vous d'accord avec l'idée de taxer des produits/services liés au mode de consommation actuel pour favoriser l'émergence de ce nouveau modèle ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout d'accord	◯	◯	◯	◯	◯	◯	◯	Tout à fait d'accord

Quelques illustrations

Nous aimerions maintenant vous présenter quelques propositions qui s'inscrivent dans le cadre de ce modèle de l'économie de la fonctionnalité et vous demander votre avis.

Location de vélos électriques en milieu urbain

Vous avez la possibilité de louer un vélo électrique pour faciliter vos déplacements urbains. De multiples points sont disponibles au sein de la ville pour emprunter et déposer les vélos après usage. Via votre smartphone, vous pouvez identifier l'endroit le plus proche, vérifier la disponibilité d'un vélo et effectuer votre paiement. Le gestionnaire du parc s'occupe de l'entretien et s'assure de la disponibilité des vélos à tous les points d'accès.

27. Trouvez-vous le concept intéressant ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout intéressant	◯	◯	◯	◯	◯	◯	◯	Très intéressant

28. Quelle est la probabilité que vous utilisiez ce service ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout probable	◯	◯	◯	◯	◯	◯	◯	Extrêmement probable

Service de blanchisserie

Vous avez la possibilité d'accéder à une blanchisserie à proximité de chez vous. Celle-ci met à votre disposition des machines à laver et des séchoirs professionnels conçus pour avoir une longue durée de vie. Le service offert vise également à minimiser la consommation d'eau et d'électricité, en particulier. Ce service est combiné avec un espace bar-restaurant séparé qui permet d'attendre dans un cadre agréable et confortable. Vous payez sur base du nombre de machines utilisées et bien entendu, de votre éventuelle consommation dans l'espace bar-restaurant .

29. Trouvez-vous le concept intéressant ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout intéressant	◯	◯	◯	◯	◯	◯	◯	Très intéressant

30. Quelle est la probabilité que vous utilisiez ce service ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout probable	◯	◯	◯	◯	◯	◯	◯	Extrêmement probable

Service de blanchisserie (suite)

La même entreprise vous offre également un service de nettoyage et repassage du linge avec enlèvement et livraison à domicile, ce service vous étant facturé en plus de l'usage des machines.

31. Quelle est la probabilité que vous utilisiez ce service ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout probable	◯	◯	◯	◯	◯	◯	◯	Extrêmement probable

Location d'équipements sportifs

Un magasin de sport propose la location d'équipements sportifs à court, moyen ou long-terme à la place d'un achat. Vous pourrez ainsi louer de l'équipement pour le ski, des planches de surfs, des kayaks, du matériel de randonnée ou des équipements de fitness, par exemple. L'offre met à disposition des produits durables qui pourront être loués sur des périodes longues et développés en collaboration avec des fabricants qui eux aussi s'inscrivent dans cette même logique. Le paiement est basé sur un abonnement flexible et avantageux. Une application smartphone permet de sélectionner et de réserver des équipements en ligne.

32. Trouvez-vous le concept intéressant ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout intéressant	◯	◯	◯	◯	◯	◯	◯	Très intéressant

33. Quelle est la probabilité que vous utilisiez ce service ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout probable	◯	◯	◯	◯	◯	◯	◯	Extrêmement probable

Location de pneus

Un fabricant de pneus vous propose une solution intégrée pour votre voiture. Ce service inclut l'installation et le remplacement de vos pneus à domicile, y compris pour vos pneus été/hiver. Les pneus sont conçus de manière à permettre au fabricant de contrôler à distance leur usure. Le service est facturé sur base du nombre de kilomètres parcourus. Cette solution permet d'optimiser la durée de vie de vos pneus et de choisir ceux qui sont les plus adaptés à vos besoins, notamment en termes de consommation de carburant.

34. Trouvez-vous le concept intéressant ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout intéressant	◯	◯	◯	◯	◯	◯	◯	Très intéressant

35. Quelle est la probabilité que vous utilisiez ce service ? *

Mark only one oval.

	1	2	3	4	5	6	7	
Pas du tout probable	◯	◯	◯	◯	◯	◯	◯	Extrêmement probable

Merci d'avoir participé à cette enquête !

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