# A methodological framework to support sustainable value creation in collaborative innovation contexts

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# A methodological framework to support sustainable value creation in collaborative innovation contexts

**Cadre méthodologique pour l'accompagnement de la création de valeur durable dans un contexte d'innovation collaborative**

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## Introduction

La création de valeur durable traduit l'interêt des entreprises envers les objectifs du développement durable à travers des modèles économiques innovants. Au-delà des interêts l'économiques, les entreprises dites durables, sont de plus en plus soucieuses de la protection de l'environnement et de la garantie du bien-être social. En accord avec la recherche academique, la creation de valeur durable peut être analysée à trois niveaux différents : l'entreprise, la chaîne logistique, et la société au sens large (Boons and Lüdeke-Freund, 2013; Bocken et al., 2014). Tout d'abord, au niveau de l'entreprise, l'adoption d'une stratégie axée sur le développement durable représente une opportunité de s'aligner sur les tendances actuelles du marché, ainsi qu'une source precieuse d'avantage competitive (Hart et al., 2003; Matinheikki et al., 2017; Brown et al., 2019). Deuxièmement, au niveau de la chaîne logistique, la création de valeur durable nécessite de l'alignement stratégique des acteurs dans une dynamique de collaboration étroite, ayant pour but le partage des ressources et des responsabilités vis-à-vis des besoins de durabilité (Maestrini et al., 2017; Arnold, 2017). Enfin, la société comprend les acteurs non-économiques qui sont impactés par l'activité économique. Cela représente les pressions externes qui poussent les entreprises à adopter des pratiques plus vertueuses, favorisant la préservation de l'environnement et le bien-être commun (Bocken et al., 2014; Boons and Lüdeke-Freund, 2013; Baldassarre et al., 2017).

Bien que l'adoption de pratiques durables semble fondamentale dans le milieu industriel actuel, elle nécessite des transformations radicales aux niveaux interne et externe des entreprises. Par exemple, les entreprises sont amenées à innover dans leurs produits, leurs processus, et leurs modèles d'aff pour atteindre le triple objectif de la durabilité (i.e., croissance economique, protection de l'environnement et bien-être social) (Ballantyne et al., 2011; Baldassarre et al., 2017). Par conséquence, le rôle de l'entreprise dans la création d'une société plus durable est un défi complexe mais puissant, qui peut transformer les modes de production et de consommation de la societé.

Des nombreuses recherches academiques ont traité la question de la création de valeur, analysée du point de vue de plusieurs domaines de la conaissance, en dégageant des pistes prometteuses (Ueda et al., 2009; Bocken et al., 2014; Joyce and Paquin, 2016; Aquilani et al., 2018). En soulignant les travaux de Bocken et al. (2014), ces auteurs mettent en lumière le potentiel durable des modèles économiques innovants tels que les systèmes produits-services (PSS), l'économie de la fonctionnalité, et l'économie circulaire. Dans la même direction, Pieroni et al. (2019) démontre le lien existant entre les modèles économiques en boucle fermée et la réalisation de la valeur durable. Cependant, en dépit de l'importance de transformer les modèles d'entreprise envers le développement durable, il n'existent toujours pas de mécanismes concrets pour y parvenir. La recherche académique a mis en évidence deux grands défis pour la suite : premièrement, il est nécessaire de trouver un consensus sur le concept de valeur durable a travers la construction d'un cadre conceptuel général (Kaihara et al., 2018). Deuxièmement, des recherches supplémentaires sont nécessaires pour développer des méthodologies opérationnelles, permettant d'orienter les entreprises vers la durabilité (Bocken et al., 2015).

Cette thèse, a donc pour objectif de répondre à ces besoins relevés dans la littérature. D'abord un cadre méthodologique pour soutenir la création de valeur durable a été proposé. Concrètement, ce travail propose en prémier lieu une conceptualisation de la valeur durable basée sur une vaste revue de la littérature. Ensuite, un cadre méthodologique pour aider à la prise de décisions dans la conception d'offres innovantes, tenant compte de la durabilité, est proposé. L'ensemble des contributions s'inscrit dans une perspective stratégique de relations de collaboration entre plusieurs acteurs industriels. Enfin, la méthodologie proposée a été en partie construite et appliquée suivant une démarche de recherche-intervention dans le cas d'une entreprise Française (Groupe EDF - Electricité de France).

## Organisation du manuscrit et contenu des chapitres

Le manuscrit est structuré en quatre parties (y compris la partie introductoire I) et composé par un total de sept chapitres. La deuxième partie présente l'état de l'art en appui de cette recherche, et se divise en trois chapitres. La troisième partie présente le cadre méthodologique proposé et illustre son application à travers un cas industriel, comprenant les chapitres 5 et 6. Enfin, la quatrième partie présente les conclusions, en distinguant les contributions scientifiques de celles managériales, ainsi que les perspectives de recherche.

Dans la Partie II, le chapitre 2 concerne la caractérisation de la création de valeur durable. Une vaste revue de la littérature sur le concept de création de valeur dans différentes disciplines et au fi du temps est developpée. Cette revue de littérature a pour objectif de parvenir à une conceptualisation structurée de la création de valeur dans le contexte actuel autour de la durabilité et de l'innovation des entreprises. À la fi du chapitre, un cadre conceptuel pour caractériser la valeur durable est fourni, contribuant ainsi au prémier axe de recherche de ce travail de thèse. Ensuite, le chapitre 3 a pour objectif de montrer le lien entre l'innovation collaborative et la création de valeur durable dans les relations inter-organisationnelles. À la fi de ce chapitre, les éléments permettant d'analyser et de modéliser les relations collaboratives entre plusieurs acteurs industriels sont mises en lumière. Enfin, le chapitre 4 explore à la fois les approches de modélisation des systèmes et des méthodes d'analyse multicritères. D'un côté, les méthodes de modélisation de systèmes sont explorées pour comprendre les relations menées entre les acteurs à travers leurs échanges de valeur. De l'autre côté, les approches d'analyse multicritères sont étudiées pour aboutir à des pistes pour l'évaluation de la valeur dans le contexte de la conception collaborative d'off innovantes.

Concernant la Partie III de cette thèse, le chapitre 5 développe le cadre méthodologique proposé. Suivant une approche progressive, les éléments retenus dans la littérature, et adaptés au contexte de création de valeur durable, sont couplés dans un cadre méthodologique global composé de quatre phases : i) analyse de la création de valeur, ii) modèle d'alignement de la valeur, iii ) la modélisation des préférences, et iv) le processus de consensus. En fi de ce chapitre, la reproductibilité de la méthodologie proposée est discutée. En complément, le chapitre 6 detaille l'application du cadre méthodologique à un cas industriel. Dans ce chapitre, l'évolution méthodologique de la proposition est illustrée à travers le cas d'étude. Les résultats obtenus lors de la mise en ouvre de la proposition sont analysés et débouchent sur un ensemble d'implications en matière de gestion et de perspectives pour l'entreprise, en soulignant les effets sur la stratégie des achats, pour favoriser les politiques RSE (Responsabilité Societale des Entreprises) de l'entreprise.

La dernière Partie IV est consacrée au chapitre 7, contenant les conclusions et les perspectives de recherche degagées de ce travail de thèse. Cette partie présente donc, les principales contributions vis-à-vis de l'état de l'art. Ensuite, les limites de la recherche concernant l'approche méthodologique et les théories et méthodes mobilisées sont spécifiées. À partir de l'étude de cas, les implications managériales sont discutées. Enfin, les sujets non couverts sont pésentés en tant que perspectives de recherche.

## Conclusions

Ce travail de thèse contribue à la littérature sur la durabilité, l'innovation et la création de valeur. Plus précisément, le cadre proposé contribue à la conceptualisation, à la modélisation et à l'évaluation de la création de valeur durable dans les contextes d'innovation collaborative entre plusieurs acteurs industriels. Le cadre a été construit à partir d'une solide base conceptuelle obtenue d'une revue de la littérature dans les domaines de la création de valeur, la gestion de l'innovation, la modélisation des systèmes et l'aide a la décision. Notre proposition est donc le résultat de la convergence de plusieurs disciplines, démontrant ainsi la complexité autour du sujet de la création de valeur durable.

Le cadre méthodologique proposé a necessité la mobilisation de plusieurs méthodes dans chaque phase. Ainsi, le cadre a été testé dans un cas réel lié au développement de l'innovation pour la durabilité. La démarche adoptée a permis de structurer les attentes des acteurs clés en termes de création de valeur, et d'analyser leur compatibilité. Enfin, l'ensemble de la démarche aboutit à une aide á la decision du point de vue stratégique par rapport à la conception d'off innovantes.

Du point de vue managérial, la méthodologie proposée suit une logique participative, permetant la communication et le travail collaboratif entre plusieurs parties prenantes au sens d'un projet d'innovation commun. Dans le cas concret de EDF, la méthodologie a permis d'identifier les conditions pour le développement d'une innovation radicale autour des vêtements de travail, en faisant parti tous les acteurs de la chaîne loqistique. Ainsi, ce travail a permis d'améliorer la performance de la fonction achats en ce qui concerne la stratégie RSE de l'entreprise. Enfin, étant le but principal d'une démarche d'innovation collaborative, la méthodologie proposée a abouti á la mise en relation collaborative, avec un horizon étendue, entre EDF est ses anciens et nouveaux prestataires dans la chaîne loqistique des vêtements de travail.

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# Part I

# General introduction

# Chapter 1

# Introduction

## Contents



## 1.1 Research context

Value creation is undergoing profound transformations in current industry, going beyond economics and increasingly concerned with environmental and social aspects. In academic research, such a transformation is known as sustainable value creation (Boons and Lüdeke-Freund, 2013; Bocken et al., 2014), and can be analysed from three diff t levels: the fi the supply chain and the society. Firstly, from the firm level, adopting a sustainability-oriented strategy could represent an opportunity to fi the current market trends and to get competitive advantage (Hart et al., 2003; Matinheikki et al., 2017; Brown et al., 2019). Secondly, at the supply chain level, creating sustainable value requires the entailment of collaborative relationships between the actors, seeking for sharing resources and responsibilities (Maestrini et al., 2017; Arnold, 2017). Finally, the society comprehends non-economic actors, and represents the external pressures that push companies towards sustainability-oriented practices, seeking for environment preservation and people well-being (Bocken et al., 2014; Boons and Lüdeke-Freund, 2013; Baldassarre et al., 2017).

Although the adoption of sustainable practices appears to be fundamental in today's businesses, it requires drastic transformations of the internal and external organisations of a any company. For instance, companies should be able to innovate in their products, processes, and business models to achieve the triple bottom line of sustainability.

Furthermore, sustainable value creation necessitates a collaborative integration of several and heterogeneous actors, which increase the business complexity in terms of relationships management (Ballantyne et al., 2011; Baldassarre et al., 2017). Hence, the role of the company to achieve a more sustainable society is complex and powerful, since it can transform the current patterns of production and consumption.

A plethora of academic researches have treated the question of sustainable value creation drawing out some promising directions (Ueda et al., 2009; Bocken et al., 2014; Joyce and Paquin, 2016; Aquilani et al., 2018). For instance, Bocken et al. (2014) highlight the potential of product-service systems (PSS), functional economy, and circular economy as sustainable business archetypes. In the same perspective, Pieroni et al. (2019) demonstrate the existing link between circular oriented business models and the achievement of sustainable value. Other authors propose generic frameworks for the evolution of business models towards sustainability (Boons and Lüdeke-Freund, 2013; Joyce and Paquin, 2016).

Although several contributions demonstrate the importance of transforming business models towards sustainability, concrete mechanisms to achieve it are still missing. Two main challenges have been highlighted in academic research, fi , it is necessary to build a consensus about the concept of sustainable value (Kaihara et al., 2018). Secondly, further research is needed to build holistic and operational methodologies for guiding companies in the pursuit of sustainability (Bocken et al., 2015). Concretely, while the economic aspect is well mastered, environmental, social, and other intangible aspects are still hardly integrated into the business mindset. Throughout this thesis, a methodological framework to support sustainable value creation has been proposed. Concretely, this work proposes fi a conceptualization of sustainable value based on literature review. Then, a methodological framework to support decision-making at early development phases of innovative offers. The entire contribution is framed into a strategic perspective of collaborative relationships between industrial actors.

## 1.2 Research questions and objectives

The main objective of this thesis work is to guide companies in their transition towards sustainable value creation. Certainly, such a transformation impacts the organisation at internal and external levels, needing the development of new activities and skills, and entailing collaborative relationships with the external actors. As a potential answer to the challenges that a company faces, this thesis provides a methodological framework to support sustainable value creation in collaborative business innovation. The proposed framework enables the visualization of the value creation process in a collaborative context. A focus on sustainability is adopted, considering the life cycle of innovative offers development.

In this thesis, a strategic positioning is adopted with respect to value creation, rather than studying the productive processes of a company. Thus, from a strategic point of view, we analyse and model the relationships between several actors, considering their interdependence in terms of value expectations and propositions. Furthermore, we approach the collaborative innovation process as a multi-stakeholder decisional problem, with the aim of supporting early phases of innovative offer design.

Our proposal comprehends three main axes of research, further detailed into specific questions.

**Research axe 1 – Conceptualization of sustainable value creation.**

- What is the nature of sustainable value in collaborative contexts?
- What are the effects of sustainability on a company, regarding value proposition, value structure and value creation?

**Research axe 2 – Modelling of the collaborative innovation process.**

- Who are the relevant stakeholders to integrate into collaborative innovation processes?
- What are the factors involved in collaborative relationships between several actors?
- How to align actors' value expectations?

**Research axe 3– Value assessment in early phases of collaborative innovation.**

- How to assess the value created within collaborative businesses considering a multidimensional and multi-actor perspective?
- How to reach a consensus between diverse actors' perspectives regarding value creation?

## 1.3 Research methodology design

From a methodological point of view, this research has adopted a research-intervention approach, aiming at the complementarity between theory and practice (David, 2000).

From the theoretical point of view, to answer the previous research questions, this research is based on the following frameworks:

- Based on the framework of Sustainable Business Models (SBM) (Boons and Lüdeke-Freund, 2013), we explore the triggers of sustainable innovation, and the effects on value proposition, value structure, and value creation (Orellano et al., 2018a,b).
- We propose a called value alignment framework, implemented throughout the Goal Modelling technique (GM). The aim of this proposal is to visualize the value co-creation process between several actors at early phases of offer design, considering the alignment between actors' expectations (Orellano et al., 2019a).

- We apply a multi-criteria decision approach in early phases of innovative offers design, by integrating sustainability criteria. Concretely, we propose the implementation of Analytic Hierarchy Process (AHP) to prioritize the diff t dimensions of value creation, considering multiple actors points of view (Orellano et al., 2019b). Then, we couple AHP with clustering techniques and stakeholder-based methodologies to facilitate the consensus process between actors.

From a practical point of view, this research is built within the frame of a French project called ICOVET (*Innovation Collaborative dans les Vêtements de Travail*, in French). The project represents an initiative of collaborative innovation applied to the supply system of safety clothing in EDF (*Electricité de France*, in French), the fi producer and distributor of energy in France. The project consists in the transformation of a product-purchasing model into a service-based offer of safety clothes. The aim of the project is to manage the entire life cycle of the safety clothes, to reduce the economic expenses, and to mitigate environmental and social impacts. The three theoretical approaches, explained above, were applied to the case study, providing valuable evidence about the support of sustainable value creation in B2B contexts. From a scientific perspective, the case study contributes to enrich theory about sustainable value creation in a context of collaborative innovation.

## 1.4 Structure of the manuscript

The manuscript is structured in four parts (including the preliminary part I) and a total of seven chapters. Part II introduces the state of the art supporting this research, divided into three chapters. Part III presents the methodological framework proposed through this research and its application to an industrial case, comprehending chapters 5 and 6. Part IV reports the conclusions, diff tiating between scientific and managerial contributions, and research perspectives.

### 1.4.1 Part II: Theoretical Background

**Chapter 2: Characterization of sustainable value creation.** This chapter presents a literature review about the concept of value creation from diff t disciplines along the time. The aim of the literature review is to reach a structured conceptualization of value creation regarding the current context of sustainability and business innovation. At the end of the chapter, a conceptual framework to characterise sustainable value is provided, contributing to the fi research axe of this thesis work.

**Chapter 3: Collaborative innovation enabling sustainable value creation in B2B relationships.** The main intend of this chapter is to establish the link between collaborative innovation and the creation of sustainable value. To this end, the starting questions are why?, how? and to do what? companies collaborate in innovation

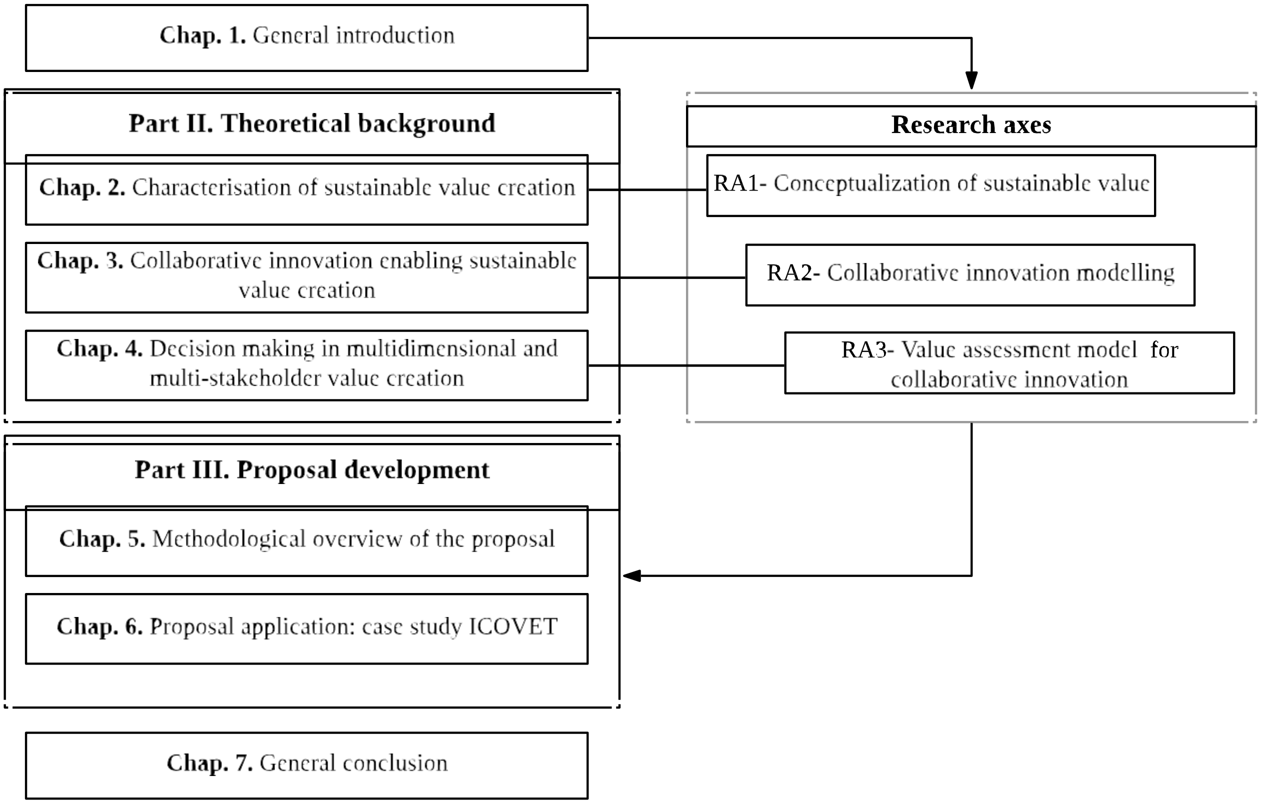


Figure 1.1: Structure of the manuscript.

development. The aim of this chapter is to identify a typology of collaborative relationships enabling sustainable value creation in innovative businesses. At the end of this chapter, the elements to analyse collaborative relationships are identified.

**Chapter 4: Decision making in multidimensional and multi-stakeholder value creation.** This chapter explores both system modelling and multi-criteria analysis approaches to support the process of collaborative value creation. On the one side, system modelling methods are explored to understand actors' relationships with respect to their value exchanges. On the other side, multi-criteria analysis approaches are investigated for value assessment in early stages of innovation development, considering multiple actors perspectives.

### 1.4.2 Part III: Proposal Development

**Chapter 5: Framework to support sustainable value creation in collaborative innovation.** This chapter presents the methodological proposal for the analysis and decision-making around the creation of sustainable value in collaborative businesses.

Following a step-by-step approach, the elements retained from the literature and adapted to the context of sustainable value creation are integrated into a holistic methodological framework composed by four main phases: i) value creation analysis, ii) value alignment model, iii) preference modelling, and iv) consensus process. At the end of the chapter, the robustness and reproducibility of the proposed methodology is discussed.

**Chapter 6: Case study application - ICOVET project.** In this chapter the methodological development of the proposal is illustrated through a real case study at EDF (*Electricité de France*, in French), a big-sized company in France. The results obtained from the proposal implementation are analysed, leading into a set of managerial implications, and perspectives for the company, pointing out its purchasing strategy.

### 1.4.3 Part IV: General conclusion

**Chapter 7: Conclusions and research perspectives.** This part outlines the main contributions of the thesis regarding the state of the art and the research question. Then, it presents the limits of the research regarding the methodological approach and the mobilised theories and methods. From the case study, the managerial implications are discussed. Finally, the uncovered topics are mentioned as research perspectives.

# Part II

# Theoretical background

# Chapter 2

# Characterisation of sustainable value creation

## Contents



## 2.1 Introduction

The increase of environmental and social needs demands the adoption of more sustainable practices in the industry, which should focus on the creation of value other than economic (Brown et al., 2019). For international institutions, as the United Nations, the European Union, and the World Business Council for Sustainable Development (WBCSD), the sustainability approach seeks for a trade-off between the environmental, social and economic pillars. Some companies adopt this approach in their CSR strategy (Corporate Social Responsibility), as an opportunity to fi with the market trends and to diff tiate themselves from competitors (Hart et al., 2003).

From an academic perspective, value creation is considered as the principal objective of any business activity, and it is generally addressed as both an economic and marketing issue. In economics, the defi of value is narrowly linked to the market price of products and services (Bowman and Ambrosini, 2000). Historically, the notion of value has been studied in marketing literature (Payne and Holt, 1999), which explains the strong customer orientation observed until the last decade (Eggert et al., 2006; Xing et al., 2013; Patala et al., 2016; Eggert et al., 2018). Here, value is defi as the trade-off between benefits and sacrifices perceived by the customer with respect to an offer (Eggert et al., 2006, 2018). During the 2000s', the concept of "value in use" appeared with the growing importance of the service in the global market as a source of competitiveness, focusing on the customer experience (Vargo and Lusch, 2008). Currently, businesses are evolving in accordance with the global need for sustainability, integrating economic, environmental and social objectives to their strategies (Bocken et al., 2015; Patala et al., 2016; Baldassarre et al., 2017; Hankammer and Kleer, 2018). Moreover, sustainability businesses require the integration of several stakeholders into the value creation process (Bocken et al., 2015; Lacoste, 2016; Reypens et al., 2016). The literature makes it evident that the concept of value is in constant evolution, according to the market context. Therefore, in the current industrial context, increasingly concerned with environmental and social needs, a re-conceptualization of value creation is required.

The aim of this literature review is fi to analyse the evolution of the concept of value in business-to-business (B2B) relationships throughout the time; then, to characterise the value from a sustainability approach. The following research questions guide this review:

- *RQ1. How has the notion of value been approached in different research fields since 2000?*
- *RQ2. What does the notion of sustainable value mean in B2B relationships?*
- *RQ3. What are the research challenges about sustainable value creation?*

Following a systematic literature review methodology, 50 papers published after 2000 in peer-reviewed journals in the fi of industrial engineering, management, marketing and environmental sciences have been analysed. Two principal features were taken into account to conduct this literature review. First, we included papers providing a conceptualization of value and a description of the value creation process. Second, we included studies addressing sustainable business models in B2B contexts. The literature analysis revealed four main categories of the conceptualization of value: economic, customer, sustainable, and multi-stakeholder value. The results were discussed and synthesize into a structured framework for sustainable value characterisation in B2B contexts. The conclusions elucidate the main directions for this research fi

## 2.2 Literature review methodology

To address the research questions, a systematic literature review has been conducted. Systematic literature review methodology is a replicable, scientific, and transparent process that makes it possible to retain a reliable sample of scientific publications (Maestrini et al., 2017). The research methodology has been structured in three main steps: i) identification of sources, ii) selection fi by inclusion criteria, and iii) descriptive and content analysis of articles. Figure 2.1 summarizes the entire process of the systematic literature review, showing the results at each stage.

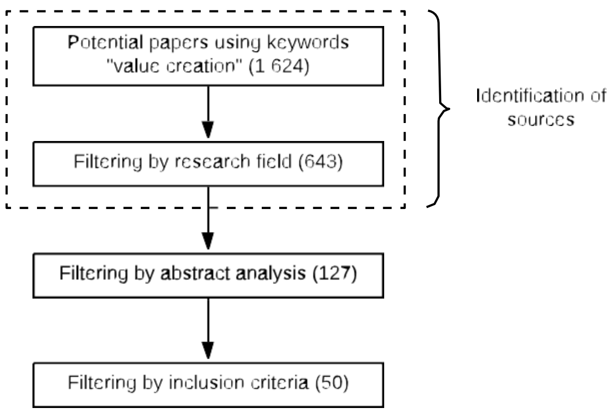


Figure 2.1: Systematic literature review methodology.

### 2.2.1 Identification of sources

The selected databases to perform the research were Web of Science (WOS) and Science Direct (SD). The criteria for selecting the databases were the quality of the sources based on the impact factor of the journal and the scope of research of the databases, including management, engineering and environmental sciences (Harzing and Alakangas, 2016). The research was limited to peer-reviewed papers published from 2000 to 2018, considering that from the year 2000 on, the concept of value creation has gained greatly in importance in research thanks to the emerging fi of business models innovation (Chesbrough and Rosenbloom, 2002). This research was conducted through searching by “topic” in WOS and by “title, abstract and keywords” in SD. The single keyword used to start the research was “value creation” in order to address the notion of value in business and industrial contexts, further developed in the subsequent fi steps. As for the results, 661 papers from WOS and 963 from SD were found, a total of 1 624 potential papers. These papers belong to the general fi of engineering and management, which correspond to our scope of research. Thus, the research domains focusing on natural sciences, agriculture, operations research, tourism, fi nce and civil engineering were discarded by using the fi options of the databases. Hence, 306 papers from WOS and 337 papers from SD were selected, totalling 643 papers for further analysis. Figure 2.2 shows the number of publications over time in both databases, demonstrating that the subject under study has gained in importance in research since the last decade. We obtained 27 journals from WOS and 14 from SD, with six journals overlapping in both databases. The resulting journals come from a variety of disciplines: marketing, management, environmental sciences, and operations management.

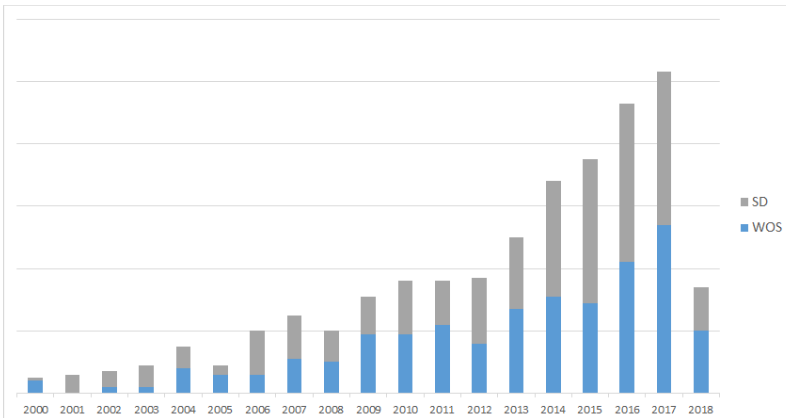


Figure 2.2: Number of publications over time using the keywords “value creation” (2000-2018).

### 2.2.2 Selection filtering

643 peer-reviewed papers constitute the initial sample to start the fi process. First, the analysis of the abstract and the objectives of each article was effectuated, leading to a sample of 127 articles. The papers related exclusively to the fi defi of value (e.g., accounting) and the ones addressing the value from the production point of view (e.g., value stream mapping) were excluded. Then, the articles selection was effectuated according to two criteria of inclusion:

- **Conceptualization of value**: papers discussing the nature of the value concept from diff t historical contexts and disciplines.

- **Value creation process**: papers discussing the organisational configurations and drivers to enable value creation in B2B relationships.

During this step, new keywords were identified: “business models innovation”, “sustainable business models”, “value co-creation” and “sustainable value”. Accordingly, we retained some papers referring to these topics to have a broader scope of literature about value creation in relation to sustainability. Finally, 50 peer-reviewed articles were retained for further analysis.

### 2.2.3 Descriptive analysis

The 50 selected articles belong to 23 diff t international journals, classified into four research domains and according to the WOS suggested categories. Figure 2.3 illustrates the distribution of articles over time according to the research domains. The domain of marketing management focuses on customer value and represents 37% of the sample. The domain of operations, production and technology management comprehends 23% of the selected articles. This domain mainly focuses on supply chain management. The domain of management, business and economics, focusing on the strategic perspective of value creation, represents 21% of the contributions. The fi of environmental sciences covers 18% of the sample, and shows a growth on the integration of sustainability issues within the value creation literature between 2014 and 2018. This domain focuses on the integration of environmental and social impacts to economic activities.

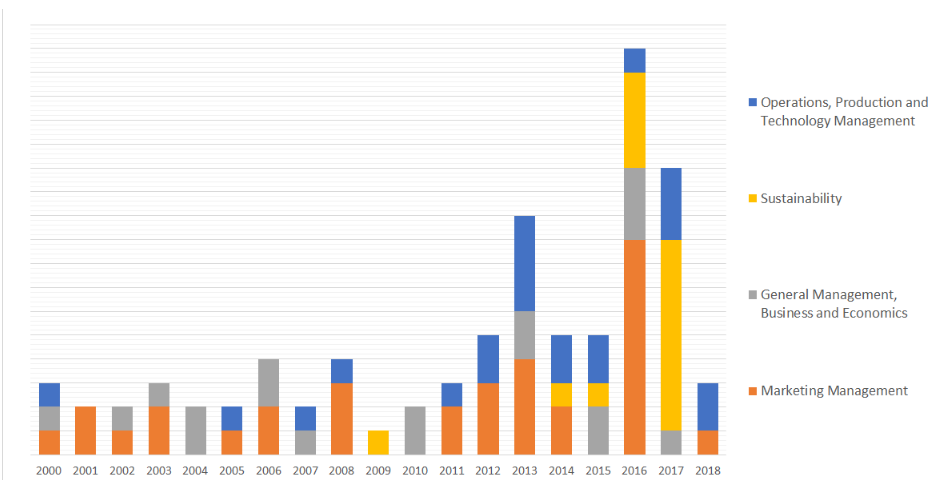


Figure 2.3: Distribution of articles on value creation according to the research domains.

### 2.2.4 Contentanalysis

Regarding the conceptualization of value, four diff t approaches were identified over time: Firstly, value has been studied as an economic concept (Bowman and Ambrosini, 2000). Secondly, being highly infl by the relational marketing perspective, the concept of value has been studied in relation with the customer, known as customer value (Vargo and Lusch, 2008). Thirdly, over the last two decades, the notion of value has been addressed from a sustainability perspective, going beyond economics and integrating environmental and social aspects into its defi known as sustainable value (Hart et al., 2003). Finally, the multi-stakeholder defi of value defends the idea that value is always co-created from the interaction of several actors (Baldassarre et al., 2017). Table 2.1 lists the retained articles from the literature review, classified into the four approaches to value conceptualization.

Table 2.1: Content analysis of the selected articles on value creation.

| N | Author | Journal | Conceptualization of value | | | |
|---|---|---|---|---|---|---|
| | | | Economic | Customer | Sustainable | Multi-stakeholder |
| 1 | Best et al. (2018) | IJOP | | | | X |
| 2 | Kähkönen and Lintukangas (2018) | IJOP | | | | X |
| 3 | Kaihara et al. (2018) | CIRP | | | X | X |
| 4 | Aquilani et al. (2018) | JCP | | | X | X |
| 5 | Hankammer and Kleer (2018) | JCP | | | X | X |
| 6 | Arnold (2017) | JCP | | | X | |
| 7 | Baldassarre et al. (2017) | JCP | | | X | X |
| 8 | Hänninen and Karjaluoto (2017) | JCP | | X | | |
| 9 | Yan and Wagner (2017) | IJPE | | | | X |
| 10 | Matinheikki et al. (2017) | JCP | | | | X |
| 11 | Yan et al. (2017) | JPSM | | | | X |
| 12 | Volschenk et al. (2016) | IMM | | | X | X |
| 13 | Wang et al. (2016) | LRP | | | | X |
| 14 | Lacoste (2016) | IMM | | | X | |
| 15 | Lages (2016) | JBR | X | | | X |
| 16 | Zacharias et al. (2016) | JBR | | X | | |
| 17 | Joyce and Paquin (2016) | JCP | | | X | X |
| 18 | Manda et al. (2016) | JCP | | | X | X |
| 19 | Ekman et al. (2016) | IMM | | | | X |
| 20 | Reypens et al. (2016) | IMM | | | | X |
| 21 | Patala et al. (2016) | IMM | | | X | |
| 22 | Schenkel et al. (2015) | JPSM | | | X | X |
| 23 | Buxel et al. (2015) | BH | | | X | |
| 24 | Bocken et al. (2015) | JIPE | | | X | X |
| 25 | Coutelle-Brillet et al. (2014) | JBIM | | X | | X |
| 26 | Grönroos and Voima (2013) | JAMS | | X | | |
| 27 | Ford and Mouzas (2013) | IMM | | X | | |
| 28 | Jaakkola and Hakanen (2013) | IMM | | | | X |
| 29 | Dominguez-Péry et al. (2013) | IJPE | | | | X |
| 30 | Xing et al. (2013) | IJPR | | X | X | |
| 31 | Haas et al. (2012) | IMM | X | X | | |
| 32 | Corsaro et al. (2012) | IMM | X | X | | X |
| 33 | Hsieh et al. (2012) | Technov. | X | | | |
| 34 | Ballantyne et al. (2011) | IMM | | | | X |
| 35 | Wagner et al. (2010) | JBR | X | | | |
| 36 | Westerlund and Svahn (2008) | IMM | | | | X |
| 37 | Vargo and Lusch (2008) | JAMS | | X | | |
| 38 | Payne et al. (2008) | JAMS | | X | | |
| 39 | Kumar et al. (2007) | IJPR | | X | | |
| 40 | Huemer (2006) | LRP | X | | | |
| 41 | Eggert et al. (2006) | IMM | | X | | |
| 42 | Prahalad and Ramaswamy (2004) | S&L | | X | | |
| 43 | Harmsen and Jensen (2004) | JBR | X | | | |
| 44 | Hart et al. (2003) | AME | | X | | |
| 45 | Möller and Tönen (2003) | IMM | X | | | |
| 46 | Kothandaraman and Wilson (2001) | IMM | | X | | |
| 47 | Walter et al. (2001) | IMM | X | | | |
| 48 | Dumond (2000) | IJOPM | | X | | |
| 49 | Lapierre (2000) | JBIM | | X | | |
| 50 | Bowman and Ambrosini (2000) | BJM | X | | | |

## 2.3 The notion of value throughout the time

### 2.3.1 Economic value

The seminal defi of value has its origins in classical economics theory coming into use at the end of 18th century. The value of something was defi by the amount of labour required to produce it (Bowman and Ambrosini, 2000). During the 1990's, resources management became the dominant paradigm in enterprise management. For instance, the resource-based view (RBV) motivated a more sophisticated vision of the economic value (Bowman and Ambrosini, 2000; Möller and Tönen, 2003; Huemer, 2006). In this paradigm, a valuable thing is anything that generates or economizes money, or that improves the company's efficiency. Indeed, the resources of a company are its main source of value if they are managed strategically, in a way that they provide competitive advantages. In line with the classical economic theory of value, Bowman and Ambrosini (2000) highlight that the value should be understood from two perspectives, value in exchange and value in use. The former, created during the sales-purchasing process, and the latter, during the customer consumption process. In both cases, value is defi as the marginal utility.

Besides, considering customer-supplier relationships, Walter et al. (2001) integrate non-monetary attributes to the defi of economic value, as market positioning and competitiveness. In this logic, the authors defi economic value from the supplier perspective as a function of customer-supplier relationships. Here, the economic value for a supplier depends on how much a customer is profitable in terms of purchasing volume, cash-flow, and loyalty (Walter et al., 2001). Several authors agree that supplier's value depends on having good relationships with the customers (Möller and Tönen, 2003; Wagner et al., 2010; Hsieh et al., 2012; Corsaro et al., 2012; Haas et al., 2012; Lages, 2016). Nevertheless, the supplier potential of value creation also depends on internal drivers, for instance, price level, efficient processes, diversity of the customer portfolio, innovation capabilities, access to resources, and market positioning. For instance, Harmsen and Jensen (2004), demonstrate throughout an empirical study, that economic value creation depends on the company's fl y to fi market changes, and to rapidly develop new products and skills. Besides, Lages (2016) considers that economic value results from the ability of a company to capture new customers throughout business model innovation. Finally, for Corsaro et al. (2012) and Haas et al. (2012) economic value not only depends on the provider understanding of the customer behaviour, but it is created only by integrating resources, activities and knowledge with the customer. These authors observe value as the result of a mirror process, in which the value is created for the provider as for the customer simultaneously.

In conclusion, from the economic perspective, value can be characterised as market value and fi value, and it depends on the level of knowledge a supplier company has about its customers. Market value corresponds to the profi generated from innovation and ability to fit market trends; while fi value concerns the utility margins generated from the routine company's sales. Economic value is created by the provider through a transactional relationship between the provider and the customer. Afterwards, with the evolution of services in the early 2000s', a strong customer orientation was adopted by the companies, introducing the idea that value is a subjective construction depending on the customer perception (Eggert et al., 2006, 2018). This research stream focused on the customer, represents a counterpart of the supplier orientation, which is predominant in the conceptualization of economic value.

### 2.3.2 Customer value

With the increase of market competitiveness, the concept of value evolved, integrating the perception of the customer in its defi In marketing, value has been strongly studied from the customer perspective, known as customer value, which constitutes a research priority in this fi (Kothandaraman and Wilson, 2001; Eggert et al., 2006; Westerlund and Svahn, 2008; Corsaro et al., 2012; Haas et al., 2012; Coutelle-Brillet et al., 2014; Eggert et al., 2018). Two streams of customer value were identified through the literature review, one from the marketing perspective, and the other one infl ed by service development theories.

Firstly, the marketing literature defi customer value as the trade-off between customer's perceived benefits and sacrifices associated to an offer purchasing (Dumond, 2000; Kothandaraman and Wilson, 2001; Eggert et al., 2006; Hänninen and Karjaluoto, 2017; Eggert et al., 2018). According to this defi the value created by any business is subjectively perceived by the customer rather than objectively defined by the seller. In this logic, value creation depends narrowly on the attributes of the offer that provides customer satisfaction, for instance, the product quality, the level of customization and the responsiveness of the provider company (Lapierre, 2000; Prahalad and Ramaswamy, 2004). Nevertheless, some researchers in marketing consider that this vision does not capture the full meaning of customer value, and need to be further developed. For instance, Coutelle-Brillet et al. (2014) evoke the idea that value is characterised by several intangible dimensions, as efficiency, emotions, and altruism. In the same perspective, Ford and Mouzas (2013) sustain that customer value results from the aggregation of psychological, functional, and economics benefits perceived by the customer. Hänninen and Karjaluoto (2017) propose a characterisation of customer value by a set of technical, economic, social, and image benefits. Considering the idea of the multidimensionality of value, Hänninen and Karjaluoto (2017) highlight the importance of defi customer criteria to measure the level of value obtained from a business transaction.

Secondly, with the emergence of Service-Dominant Logic (SDL) proposed by Vargo and Lusch (2008), the defi of customer value was infl by the relational nature of services. In this context, the main source of value is the knowledge generated from the interaction between the customer and the provider instead of the transactional exchange (Payne et al., 2008; Grönroos and Voima, 2013; Ballantyne et al., 2011; Ekman et al., 2016). SDL reinforced the idea of "value in use", claiming that any form of value is exclusively created by the customer during the consumption process (Vargo and

Lusch, 2008; Grönroos and Voima, 2013; Ekman et al., 2016). From this perspective, the main challenge for companies is meeting several customers' value expectations through customized value propositions (Ballantyne et al., 2011; Zacharias et al., 2016).

To summarize, customer value is based on marketing and service development literature. From these perspectives, the value created by any offer is an individual and cognitive construction of the customer, and takes place during the consumption process. The value depends on the set of attributes of an offer, observed by customers with respect to their own needs, and comparing with similar offers in the market. From this vision, three fundamental characteristics defi the notion of value: subjectivity, multidimensionality and competition (Eggert et al., 2006, 2018).

### 2.3.3 Sustainable value

With the infl of marketing research, the idea of value multidimensionality opened new debates about the conceptualization and assessment of value. Besides, the global challenges, including climate change, resource depletion and extreme poverty, have pushed the industrial transformation towards the consideration of environmental and social benefits in their business strategies (Bocken et al., 2015; Buxel et al., 2015; Schenkel et al., 2015; Patala et al., 2016; Ekman et al., 2016; Manda et al., 2016; Aquilani et al., 2018). This panorama triggered a re-definition of the concept of value regarding the sustainability issues.

In general, sustainable value is defi as the simultaneous creation of economic, environmental and social benefits from a business activity (Bocken et al., 2015). Nevertheless, a plethora of authors still consider that the major challenge regarding sustainable value is achieving a clear conceptualization. For instance, Bocken et al. (2015) propose a mapping tool that describes economic, environmental and social dimensions of value in terms of value destroyed and value opportunities for diff nt actors. Besides, Schenkel et al. (2015) determine some strategic factors of success to achieve sustainable value. Finally, Volschenk et al. (2016) consider that sustainable value supposes the integration of several actors, therefore, a knowledge dimension should be considered for its characterisation. In spite of the conceptual effort verified in the literature, there is not a clear consensus between the authors about the concept of sustainable value. Furthermore, the authors point out the need for formal methods to assess the sustainable value created by a company (Schenkel et al., 2015; Kaihara et al., 2018). In the literature, two main streams to assess sustainable value has been identified.

Firstly, from a compensatory vision, the three dimensions of sustainable value are considered interchangeable (known as Triple Bottom Line or weak sustainability) (Pope et al., 2004; Patala et al., 2016). In this case, the degradation of one dimension is considered acceptable since it is compensated by the improvement on another one. From this approach, sustainable value creation is often translated into monetary benefits. For instance, Hart et al. (2003) propose a strategic framework to improve sustainable value in companies by implementing technology innovation, waste reduction strategies, and stakeholders integration. Besides, Patala et al. (2016) propose a monetisation-based method that translates economic, environmental and social benefits and impacts, into economic gains, expenses and fi risks. Although monetisation-based methods are attractive for business decisions, some metrics can be selected arbitrary (e.g., price per Kg. of $CO_2$), which could provide unrealistic results. Moreover, these kind of approaches has been largely criticised since they focus on avoiding non-sustainability and extra-costs, rather than on researching real sustainable solutions (Pope et al., 2004).

Secondly, non-compensatory approaches defend a clear multidimensional concept of sustainable value, rejecting any monetisation approach (for instance eco-efficiency and societal approaches) (Pope et al., 2004; Vezzoli et al., 2014). In this line, Xing et al. (2013) propose a coupling of diff t methods to evaluate efficiency, costs and environmental impacts derived from an offer development in an independent way. Besides, Buxel et al. (2015) and Manda et al. (2016) propose the implementation of Life Cycle Assessment (LCA) to determine the sustainable value procured by a given offer expressed in terms of environmental quality. In general, non-compensatory approaches aim at confronting the economic mind-set of the industry with the urgency of the environmental and social needs, encouraging a reliable adoption of sustainable practices (Lacoste, 2016). Nevertheless, these authors point out the complexity of conducting a proper assessment of sustainable value, given the heterogeneity of the metrics, the involvement of non-tangible attributes (e.g., social well-being), the diffi y to collect reliable data (e.g., biodiversity degradation), the context dependency of the results (e.g., resource depletion, employment, society growth, among others). Particularly, LCA-based methods are very time-consuming and data-intensive, not always suitable to be implemented for guiding business decisions (Manda et al., 2016).

An important aspect highlighted in recent literature on sustainable value creation is the need for collaboration between a broader set of stakeholders (Reypens et al., 2016). Therefore, sustainable value is not only a multidimensional concern, but also implies multiple stakeholders (Ekman et al., 2016). For companies, creating sustainable value represents a source of competitiveness, being an opportunity to improve the company's reputation. From the academic point of view, a clear definition of sustainable value creation, and the development of value assessment methods constitute important research streams in management and engineering fi s (Xing et al., 2013; Ueda et al., 2009; Kaihara et al., 2018).

### 2.3.4 Multi-stakeholder value

Recent literature evidences that sustainable value creation requires including relevant stakeholders, who are diff t from the customer and the provider (Ballantyne et al., 2011; Bocken et al., 2015; Reypens et al., 2016; Lacoste, 2016; Joyce and Paquin, 2016; Baldassarre et al., 2017; Hankammer and Kleer, 2018; Aquilani et al., 2018; Best et al., 2018). As cited by Aquilani et al. (2018), sustainable value is always co-created with actors inside and outside a company's boundaries, and should be equitably appropriated by all the stakeholders. Moreover, Ballantyne et al. (2011) and Eggert et al. (2018) suggest that a company co-develops value propositions with its external partners envisioning a reciprocal and fair exchange of the value created. Here, each actor determines what value is in its own terms. The term “reciprocal” evokes the collaborative character of value creation, and the term “fair” is associated with the symmetry in the distribution of value between the diff t actors concerned. Two main knowledge streams have study the notion of multi-stakeholder value, the resource-based view (RBV) and the relational marketing.

On the one side, from RBV perspective, value in relationships is determined by the access to new resources, which include knowledge, experience, and skills (Westerlund and Svahn, 2008; Jaakkola and Hakanen, 2013; Kähkönen and Lintukangas, 2018). Moreover, value creation takes place during creative interaction processes, which allows developing new products, services or more sophisticated knowledge. Dominguez-Péry et al. (2013) evoke the necessity of inter-organisational relationships to achieve tangible and intangible forms of value, for instance, the access to new physical and fi assets, human capital, knowledge, brand image, and market position. Besides, Schenkel et al. (2015) name the value created from stakeholders interaction as informational value, which is defi as the ability to learns and to collect and share information thought the supply chain. For the authors, informational value can enable the acquisition of other types of value (e.g., economic, environmental, social) (Schenkel et al., 2015).

On the other side, from the relational marketing perspective, each stakeholder represents a social actor, whose relationships are infl by power interdependencies (Reypens et al., 2016). In this literature stream, relationships are a means to achieve some sort of value and not a by value itself (Coutelle-Brillet et al., 2014; Reypens et al., 2016; Arnold, 2017). Coutelle-Brillet et al. (2014) distinguish four value dimensions created from multiple actors interactions, named as efficiency, social, emotional and ethical. Similarly, Reypens et al. (2016) consider relationships as a means to achieve innovation, knowledge and relational outcomes. The fi can be translated into process improvement, the second one into technological and managerial improvements, and the last one into powerful positioning. In contrast, Ekman et al. (2016) conducted an empirical study, fi that relationships are considered as a form of value by itself, known in industry as brand value.

In general, both RBV and relational marketing perspectives consider multi-stakeholder value mostly as a means than as an objective itself. One of the biggest challenges on multi-stakeholder value creation in B2B markets is to guarantee the reciprocity and fairness in the value distribution among the actors (Reypens et al., 2016; Aquilani et al., 2018). Although there exist several frameworks in the literature addressing this research question, there is not proper measurements mechanisms to operationalize them. Under this panorama, current research should be oriented to propose collaborative mechanisms to create, assess and distribute value in multi-actor relationships.

Table 2.2 summarizes the results obtained from the literature review, highlighting the evolution of the value concept in relation to the context, the value drivers, the mobilised theories, and the kinds of relationships between the involved actors.

Table 2.2: Evolution of the research on value creation.

| | **Economic value** | **Customer value** | **Sustainable value** | **Multi-stakeholder value** |
|---|---|---|---|---|
| **Representative research** | Bowman and Ambrosini (2000) | Vargo and Lusch (2008) | Hart et al. (2003) | Reypens et al. (2016) |
| **Industrial context** | Mass production | Service development | Circular economy | Open innovation |
| **Value driver** | Utility margin | Customer satisfaction | Resource efficiency | Knowledge |
| **Actors' Relationships** | Transactional | Dyadic co-creation | Networked co-creation | Networked co-creation |
| **Mobilised Theories** | Economic theory of value<br>Resource-based view (RBV) | Service-Dominant Logic (SDL) | Strong and weak sustainability | Stakeholder theory |

## 2.4 Sustainable value creation in B2B markets

**Value creation process.** Past research, in economic and marketing fi considered the value creation as a delivery activity from the provider to the customer (Bowman and Ambrosini, 2000; Eggert et al., 2006). Currently, two main approaches to value creation are observed in the industry from the process perspective: the dyadic co-creation between the provider and the customer, and the networked collaboration. In dyadic value co-creation processes, value is classified into value in exchange and value in use (Vargo and Lusch, 2008). From the perspective of the value in exchange, the provider creates value in monetary terms. Value in use, in contrast, is associated to the customer perception according to the fulfilment of its needs during the use phase, translated into customer satisfaction. According to the Service-Dominant Logic, fi 2.4 illustrates the process of value co-creation from a dyadic relationship between provider and customer.

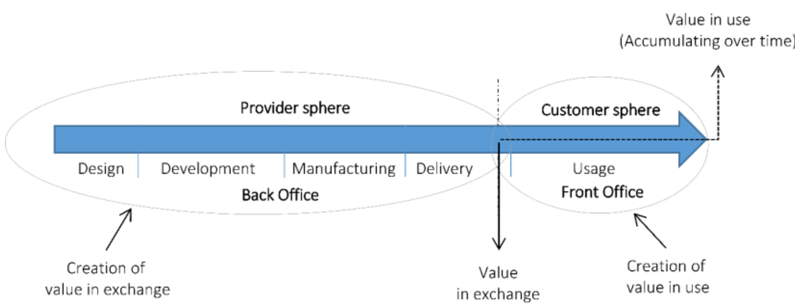


Figure 2.4: Value co-creation process according to Service-Dominant Logic (SDL) (Vargo and Lusch, 2008)

In current business configurations, value is created and perceived by a networked set of actors, and not only by dyadic provider-customer relationships (Corsaro et al., 2012; Reypens et al., 2016; Aquilani et al., 2018). Actually, Integrating sustainability within a company's value creation process, needs the participation of economic and non-economic actors (i.e., suppliers, public actors, research entities, local communities, customers, among others), triggering the organizational transformation of the company (Schenkel et al., 2015; Joyce and Paquin, 2016; Lacoste, 2016; Geissdoerfer et al., 2017; Baldassarre et al., 2017). The level of sustainability achieved is conditioned by the engagement of each individual stakeholder, who evaluates diff tly the importance of environmental and social issues within the process of value creation (Ballantyne et al., 2011; Schenkel et al., 2015; Baldassarre et al., 2017; Aquilani et al., 2018). Moreover, multiple stakeholder integration takes place at different levels, enabling diff t confi of the value creation process (Schenkel et al., 2015; Jaakkola and Hakanen, 2013; Lacoste, 2016). For instance, demand and supply networks (Yan et al., 2017) (figure 2.5); and business ecosystems (Bocken et al., 2015) (figure 2.6).

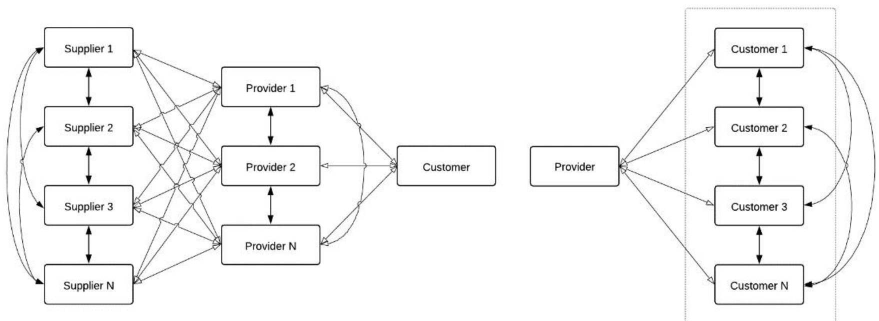


Figure 2.5: Value creation configuration: supplier network (left) and demand network (right).

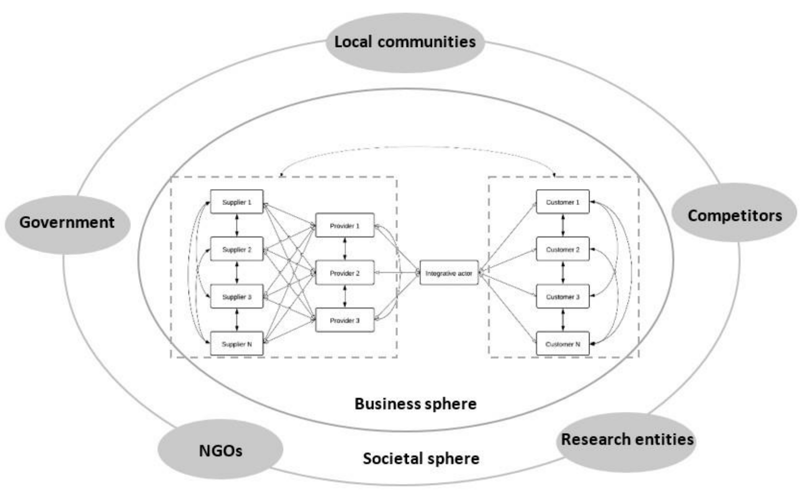


Figure 2.6: Value creation configuration: business ecosystem.

**Sustainable value propositions development.** Sustainable value propositions refer to offers of products or services, which are designed by for the reduction of resource consumption, emissions to the environment, and human damage (Manda et al., 2016). Although there is not a standard pathway to develop sustainable value propositions, the literature proposes various sustainability-oriented solutions such as product-service systems, functional economy, circular economy, industrial symbiosis, among others (Bocken et al., 2014). Several studies focused on the value proposition as the core element on the business exchange (Wang et al., 2016; Ballantyne et al., 2011; Lacoste, 2016). To develop sustainable value proposition, suppliers should collaborate with their customers, involving them into the diff t stages of the offer development. The offer co-development favours knowledge sharing, and the monitoring of the offer performance during the use phase.

**Relational ambiguities in value creation.** Taking into account the need for collaboration between several actors, the systematic review revealed the risk of relational ambiguities in value co-creation processes. The greater the number of stakeholders, the greater the risk of relational ambiguities and misunderstandings of individual expectations (Ballantyne et al., 2011). Sjödin et al. (2016) propose a set of relational ambiguities that can occur when sharing sensitive information and resources in an intensive relational context. These ambiguities can render the value co-creation process diffi Such ambiguities can involve some subsequent relational risks, namely, opportunistic behaviours and conflicts of interest, which can affect the stability of the relationships. To reduce the risk of confl and ambiguity, Kohtamäki and Rajala (2016) propose establishing the roles and the relational governance between actors before the start of the value co-creation process. In this regard, in a multi-stakeholder context, value creation becomes a question of trust between actors, depending on the ethics each actor (Coutelle-Brillet et al., 2014; Reypens et al., 2016).

## 2.5 Proposed framework for the characterisation of sustainable value creation

Considering the literature background, sustainable value is mainly constituted by the three classical dimensions contained into the triple bottom line approach to sustainability (i.e., economic, environmental, and social dimensions). Nevertheless, the value in sustainable oriented businesses also integrates a relational dimension. This fourth dimension is a fundamental element to access to resources and knowledge from the diff t key stakeholders concerned with sustainability. Additionally, integrating the marketing and engineering perspectives of value, the main intend of a business activity is creating value to their customers. Certainly, customer value is achieved throughout the provision of functionalities that fi the customer expectations. Considering the above, fi e dimensions have been proposed to characterize the creation of sustainable value in current business models.

**(E) Economics:** this dimension of value is determined by the benefits and cost savings achieved by the stakeholders involved in the offer development. Achieving the expected economic benefits involves integration of fi risks, uncertainties and return on investments in long-term horizons.

**(N) Environmental:** this dimension explains the environmental impact of an offer throughout its life cycle. There is the need to perform an input-output analysis of the offer during its life cycle. Input analysis addresses resource consumption, while output analysis addresses emissions of substances to the environment (air, soil, water, biodiversity).

**(S) Social** : explains the impact of an offer on the well-being of the economic and non-economic stakeholders. The social value is defi in terms of respect for the human rights, dignifi employment conditions, and development of local economies.

**(R) Relational:** this dimension explains the value derived from the relationships maintained between the actors, going beyond a simple monetary transaction, and which are based on the level of trust and commitment. The value is derived from the quality of the relationships between the actors, enabling the common construction of knowledge.

**(F) Functional:** this dimension focuses on the functional purpose of the offering, that is, the provision of product and service functionalities that meet the customer needs.

## 2.6 Conclusion

This chapter presented a review of the value concept in business-to-business (B2B) relationships as a multidisciplinary subject, which has evolved over time. We conduct a content analysis of 50 papers published between 2000 and 2018. Three principal features about the concept of the value. Firstly, value is a multidimensional concept, involving economic, environmental, social and other forms of value as knowledge and customer satisfaction. Secondly, achieving sustainable value needs a close collaboration between a broaden set of actors in the value chain. Thirdly, one of the main underpinnings of the multi-stakeholder context is the subjective character of value. Regarding the research questions proposed at the beginning of the chapter, the fi can be detailed as follows:

- *RQ1. Howhas the notion of value been approached in different fields since 2000?* The subject of value creation has been studied mostly in marketing and operations management literature, in which value is an important topic of research, since the 1990s. Moreover, over the last fi e years, the literature on value creation has integrated issues concerning sustainability and actors' collaboration as research priorities.
- *RQ2. What does the notion of sustainable value mean in B2B relationships?* Value creation in B2B relationships continues to be an area of relevance and interest to academics and practitioners. Recent studies recognize the multi-dimensional character of the value and the need for multi-stakeholder participation in the value creation process. Recently, researches in industrial marketing adopted the triple bottom line approach, integrating economic, environmental, and social dimensions to assess sustainable value. Through the thematic analysis, we concluded that the notion of value is multidimensional, subjective and contextual. Then, we proposed an extended characterization of the value concept according to fi e dimensions: economic, environmental, social, relational and functional (section 2.5).
- *RQ3. What are the research challenges about sustainable value creation?* Current literature demonstrates that the main challenge on value research is to defi formal frameworks that make it possible to perceive, evaluate and communicate value among a broader set of stakeholders. In this sense, this thesis work aims at contributing to this challenge, integrating multidimensional and multi-stakeholder perspective of value creation. In this chapter, the conceptualization of value has been treated, providing a fi scheme to characterise value creation.

# Chapter 3

# Collaborative innovation for sustainable value creation

## Contents

## 3.1 Introduction

According to the literature, any company has the sufficient skills to fulfil by its own the current market requirements related to sustainability issues (Rohrbeck et al., 2013; Hellström et al., 2015; Baldassarre et al., 2017; Aquilani et al., 2018; Hankammer and Kleer, 2018; Brehmer et al., 2018; Brown et al., 2019). In this sense, companies are pushed to collaborate with other actors in the business ecosystem (i.e., customers, suppliers, competitors, research institutions, among others) to develop competent and sustainable value offers (Chesbrough, 2007; Geum et al., 2013; Baldassarre et al., 2017; Jugend et al., 2018). However, the collaboration between multiple actors is a complex process that implies the understanding of actors' expectations, the efficient management of the relationships, and setting up collaborative decision-making processes (Ueda et al., 2009). Indeed, collaboration between several actors goes beyond of simply putting resources together, instead, it refers to the co-creation of value thought strategic alignment (Chester Goduscheit and Faullant, 2018; Grimm et al., 2014; Nudurupati et al., 2015; Kohtamäki and Rajala, 2016; Baldassarre et al., 2017; Brown et al., 2019). One of the main objectives of multiple actors collaboration is the development of unique innovations, achieved through the strategic combination of resources and knowledge (Neutzling et al., 2017). Such innovations are key drivers in the creation of sustainable value (Neutzling et al., 2017; Calabrese et al., 2018; Brown et al., 2019).

The objective of this chapter is to show and analyse the link between collaboration and sustainable value creation throughout the lens of innovation in B2B contexts. To fulfil this aim, the research questions guiding this chapter are the following:

- *RQ1. Why do companies collaborate in B2B?*
- *RQ2. What is the meaning of collaborative innovation in B2B?*
- *RQ3. How do companies collaborate in B2B?*
- *RQ4. How does collaboration enable the creation of sustainable value in B2B?*

## 3.2 Literature review methodology

A bibliometric analysis was conducted to identify the linkage points between diff t disciplines of the literature with respect to a specific research subject (Geissdoerfer et al., 2017). Moreover, this methodology allows representing the conceptual evolution of the subject, facilitating the identification of the current research interests and gaps (Aria and Cuccurullo, 2017). The aim of this research is to identify papers related to collaborative innovation as a driver of sustainable value creation. We performed the research methodology following three main phases: i) sources identification, ii) conceptual structure representation, and iii) thematic analysis. The research framework used to structure the literature review is represented in Figure 3.1. The fi re illustrates the two triggers for adopting a collaborative approach in companies (technology-push and demand-pull). Then, the aim of the collaborative process is to perform a type of innovation, necessary for achieving sustainable value creation.

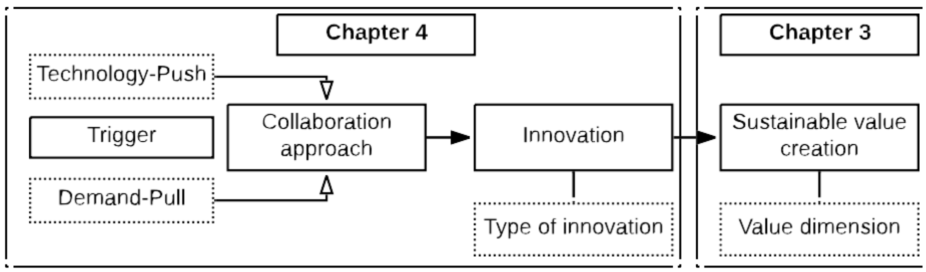


Figure 3.1: Research design framework.

### 3.2.1 Sources identification

Following a classic methodology of literature review, we performed a research by generic keywords in the fi of interest. We crossed the key words “collab*” AND “innovat*” AND “sustainab*” in Web of Sciences (WOS). We obtained a fi sample of 1 813 papers published between 1975 and 2019. We fi ered the contributions, choosing only peer-reviewed journals, then reducing the sample to 944 papers. We excluded all the papers corresponding to the fi of art, ergonomics, archaeology, chemistry, and biology. As a result, we obtained a sample of 291 contributions corresponding to engineering, environmental sciences, and management, which are in line with the scope of this research.

### 3.2.2 Conceptual structure

With the base of the pre-selected 291 articles, a clustering technique based on Multiple Correspondence Analysis (MCA) of the articles’ keywords was performed. The results lead to the representation of the conceptual structure of the research subject (Aria and Cuccurullo, 2017). This analysis was performed using the package *bibliometrix* in *R Studio* developed by Aria and Cuccurullo (2017). Five clusters were identified, corresponding to diff t topic areas in which the subjects of collaboration, innovation and sustainability have been studied together between 1975 and 2019 (Figure 3.2). C1 is related to the strong sustainability approach, characterised by an ecological and normative perspective. C2 corresponds to the topic of sustainable development through organisational innovation and networking. C3 corresponds to product innovation development as a means to improve fi competitive advantage. C4 refers to the role of R&D in the improvement of technological innovation. Finally, C5 corresponds to the collaborative practices implemented in supply chain management. Regarding the conceptual structure of the subject, the clusters C2 and C5 are selected for further analysis in this chapter, since they consider the notion of collaboration from an organisational point of view. The three remaining clusters are considered out of our research scope. This process resulted in 40 articles, in which 35 correspond original researches and fi e are literature reviews in innovation management (Di Stefano et al., 2012; West and Bogers, 2016; Edwards-Schachter, 2018), value creation (Kaihara et al., 2018), and supply chain collaboration (Chen et al., 2017).

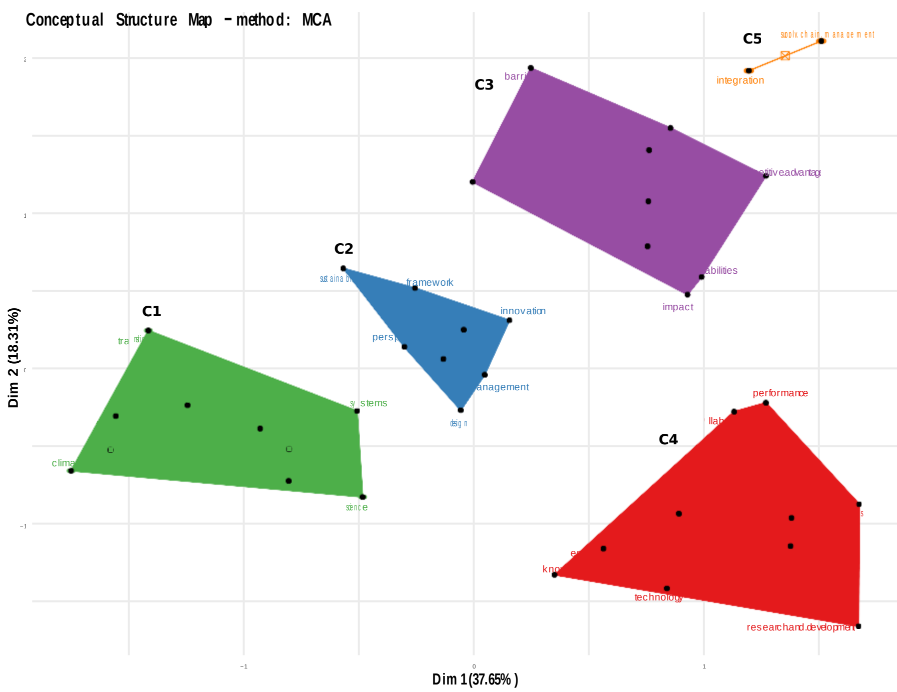


Figure 3.2: Cluster analysis of the scientific research in collaboration, innovation and sustainability (between 1975 and 2019).

### 3.2.3 Thematic analysis

A thematic analysis of the selected sample was performed. A co-word analysis was performed by means of the *bibliometrix* package in *R Studio* (Aria and Cuccurullo, 2017). This technique allows representing a thematic map of the selected papers (Figure 3.3). The thematic map allows classifying the articles according to the two dimensions of centrality and density, resulting in four quadrants of characterisation. The interpretation of each quadrant is as follows: i) upper-right quadrant indicates the motor-themes; ii) lower-right quadrant refers to the basic themes; iii) lower-left quadrant contains the emerging or disappearing themes; and iv) upper-left quadrant covers the very specialized themes (Cobo et al., 2011). Five clusters were obtained, indicating diff t themes or research fi Value creation, collaboration networks, innovation management, supply chain integration and sustainable oriented innovation.

Given the conceptual proximity of the themes of value creation and collaborative networks, we decided to considered them as a single theme. We obtained 37% of the articles addressing value creation and collaborative business models, which are considered basic themes in the research on collaborative innovation for sustainability (Payne et al., 2008; Rohrbeck et al., 2013; Hallikas et al., 2014; Hellström et al., 2015; Kohtamäki and Rajala, 2016; Matinheikki et al., 2017; Hankammer and Kleer, 2018; Brehmer et al., 2018). 26% of the contributions belongs to the fi of innovation management, which is a motor theme (Huizingh, 2011; Shaw and Burgess, 2013; Geum et al., 2013; Maine et al., 2014; Lancker et al., 2016; Chester Goduscheit and Faullant, 2018; Jugend et al., 2018). 26% of the articles addresses the collaborative practices in supply chain management, which is a specialized theme (Schiele, 2006; Walker and Preuss, 2008; Derrouiche et al., 2010; Kang and Kang, 2014; Nudurupati et al., 2015; Wang et al., 2016). Finally, Sustainable-Oriented Innovation (SOI) is an emerging theme constituting the 11% of the total of analysed articles (Hellström, 2007; Neutzling et al., 2017; Calabrese et al., 2018; Brown et al., 2019). A detailed content analysis of the articles was performed to obtain more precise insights about the relationship between collaborative innovation and sustainable value creation. Table 3.1 shows the list of the articles classified by theme, specifying the elements of collaborative innovation (i.e., trigger, collaboration approach, and innovation object), which impact on the dimensions of value creation (c.f., Chapter 2) indicated by "X". The results obtained are developed in the next sections.

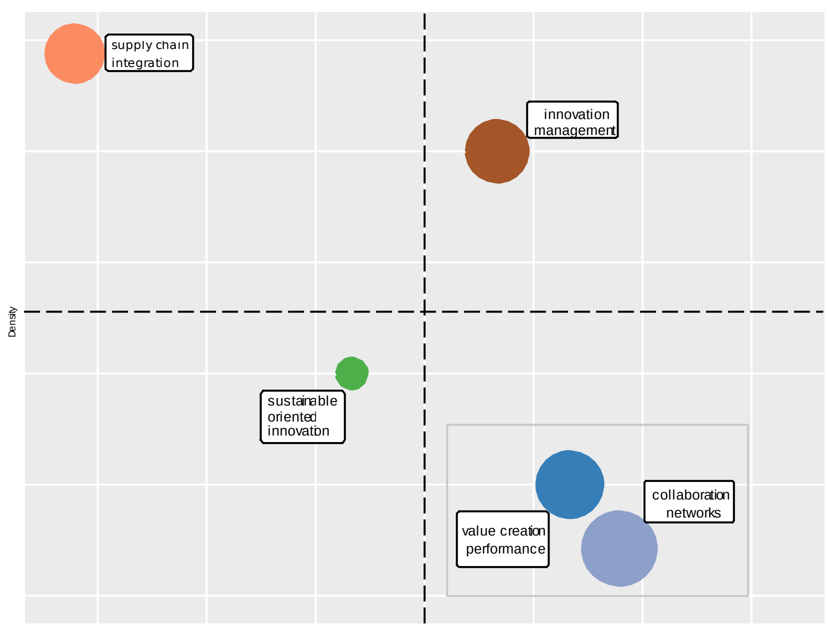


Figure 3.3: Thematic map of the selected articles.

Table 3.1: Content analysis of the selected articles.

| N | Theme / Author | Journal | Approach | Trigger: TP | Trigger: DP | Innov. type | Collaboration approach | Value creation: Econ. | Env. | Soc. | Rel. | Func. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Supply chain management** | | | | | | | | | | | |
| 1 | Schiele (2006) | *IMM* | New product development Resource-based view | X | | Offer | Dyadic collaboration | X | | | X | X |
| 2 | Walker and Preuss (2008) | *JCP* | CSR | | X | Organisation Offer | Public-NGO partnership | X | X | X | | |
| 3 | Derrouiche et al. (2010) | *PPC* | Supply chain integration | X | | Organisation | Dyadic collaboration | X | | | X | X |
| 4 | Seuring and Gold (2013) | *JCP* | Triple bottom line | X | | Organisation | Supply chain partnership | X | X | X | | |
| 5 | Kang and Kang (2014) | *JPIM* | Service innovation | | X | Offer | Joint development | X | | | X | X |
| 6 | Grimm et al. (2014) | *IJPE* | Theory of CSF Stakeholder theory | | X | Organisation Offer | Dyadic collaboration | X | X | X | | |
| 7 | Nudurupati et al. (2015) | *IJPE* | Stakeholder theory | | X | Organisation Offer | Intermediated value network | X | | | X | X |
| 8 | Wang et al. (2016) | *LRP* | Resource-based view | X | | Organisation | Collaborative value network | X | | | X | X |
| 9 | Yan et al. (2017) | *JPSM* | Resource-based view | | X | Organisation Offer | Supplier innovation network | | | | X | X |
| | **Innovation management** | | | | | | | | | | | |
| 10 | Huizingh (2011) | *Technov.* | Open innovation | X | | Organisation | Intermediated value network | X | | | X | X |
| 11 | Hsieh et al. (2012) | *Technov.* | Service dominant logic Resource-based view | X | | Offer | Service cluster | X | | | X | X |
| 12 | Shaw and Burgess (2013) | *PPC* | Performance management | X | | Process Offer | Inter-organisational network | X | X | | | X |
| 13 | Geum et al. (2013) | *JETM* | Open innovation | X | | Process Offer | Inter-organisational R&D collaboration | X | | | X | X |
| 14 | Maine et al. (2014) | *JETM* | Open innovation Resource-based view | X | | Process Offer | Inter-organisational R&D collaboration | X | | | | X |
| 15 | Lancker et al. (2016) | *Technov.* | Stakeholder theory Open innovation | X | | Organisation | Innovation network | X | | | X | X |
| 16 | Chester Goduscheit and Faullant (2018) | *JPIM* | Service dominant logic | X | | Organisation | Value network | X | | | | X |
| 17 | Jugend et al. (2018) | *Technov.* | Open innovation | X | X | Organisation | Public-private partnership | | | | X | |
| 18 | Schweizer and He (2018) | *Drug Disc. Tod.* | Open innovation | X | | Organisation Offer | Innovation networks | | | | X | X |

(*Continuation Table 3.1*)

| N | Theme / Author | Journal | Approach | Trigger TP | Trigger DP | Innov. type | Collaboration approach | Value creation Econ. | Value creation Env. | Value creation Soc. | Value creation Rel. | Value creation Func. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Value creation** | | | | | | | | | | | |
| 19 | Payne et al. (2008) | *JAMS* | Service dominant logic | X | | Organisation | Co-creation with the customer | | | | X | |
| 20 | Ueda et al. (2009) | *CIRP Ann.* | Theory of externalities<br>Complex systems | X | | Organisation<br>Offer | Co-creation with the customer | X | X | X | X | X |
| 21 | Romero and Molina (2011) | *PPC* | CSR<br>Network theory | X | | Organisation<br>Offer | Networked organisations<br>Virtual communities | X | X | | X | X |
| 22 | Rohrbeck et al. (2013) | *IJTM* | BMI | | X | Organisation | Collaborative business model | X | X | X | | |
| 23 | Hallikas et al. (2014) | *IJPE* | Service dominant logic | | X | Organisation<br>Offer | Intermediated value network | X | | | X | X |
| 24 | Hellström et al. (2015) | *JCP* | BMI | X | | Organisation<br>Offer | Industrial and innovation ecosystem | X | X | X | X | |
| 25 | Kohtamäki and Rajala (2016) | *IMM* | Service dominant logic | X | | Offer | Co-creation with the customer | X | | | X | X |
| 26 | Volschenk et al. (2016) | *IMM* | Stakeholder theory<br>Resource-based view | X | | Organisation | Coopetition | X | X | X | X | |
| 27 | Reypens et al. (2016) | *IMM* | Stakeholder theory<br>Service dominant logic | X | | Organisation<br>Offer | Public-private partnership<br>Industrial clusters | | | | X | |
| 28 | Matinheikki et al. (2017) | *JCP* | Shared value<br>CSR | | X | Organisation | Public-private partnership | X | | X | | |
| 29 | Hankammer and Kleer (2018) | *JCP* | BMI | X | | Organisation<br>Process | Crowd-sourcing | X | X | X | X | X |
| 30 | Baldassarre et al. (2017) | *JCP* | BMI<br>Stakeholder theory | X | | Organisation<br>Offer | User-driven innovation | X | X | X | | |
| 31 | Brehmer et al. (2018) | *JCP* | BMI | X | | Organisation<br>Offer | Multi-sided platform | | X | X | | |
| | **Sustainable innovation** | | | | | | | | | | | |
| 32 | Yoon et al. (2017) | *Sustain.* | Resource-based view | X | | Offer | Offshore / Joint venture | X | | | X | X |
| 33 | Neutzling et al. (2017) | *JCP* | Sustainable oriented innovation | X | X | Organisation<br>Offer | Supply chain integration | X | X | X | X | X |
| 34 | Calabrese et al. (2018) | *JCP* | Sustainable oriented innovation | X | X | Market<br>Organisation<br>Process<br>Offer | Public-private partnership | X | X | X | | |
| 35 | Brown et al. (2019) | *Sustain.* | Sustainable oriented innovation | X | X | Organisation<br>Process<br>Offer | Cross-sectoral collaboration | X | X | X | X | X |

## 3.3 Collaborative innovation: key concepts

Innovation has been traditionally defi as the set of technical, industrial and commercial improvements that enables organisations to perform efficiently their economic activities (Rothwell, 1992). In general terms, innovation means the introduction of "something new" in a specific context (Schiele, 2006). Although the defi of innovation has not changed significantly with respect to the object (i.e., product, process, organisation, etc.), the way to develop it has changed drastically along the time (Huizingh, 2011). In this sense, innovation has shifted from a closed process inside a company's boundaries to a complex process of collaboration between multiple actors (Chesbrough, 2007; Huizingh, 2011; Hsieh et al., 2012; Lancker et al., 2016; Jugend et al., 2018). For instance, Lancker et al. (2016) consider innovation as the iterative process of learning, which needs intensive collaboration between a broader set of actors to improve a company value creation.

From the content analysis of the selected articles, (c.f., subsection 3.2.3) four main themes were identified in which the notion of collaborative innovation has been studied. Those are value creation, innovation management, supply chain management, and sustainable oriented innovation. Literature on value creation addresses customer satisfaction and sustainability issues through business models innovation (e.g., Kohtamäki and Rajala (2016)). In innovation management, the collaboration between several actors focuses on the exchange and generation of knowledge (e.g., Huizingh (2011)). In supply chain management there is an increasing interest in the integration of sustainability criteria in supply chain decisions. Here, the purchasing function has a fundamental role in pursuing sustainable practices (e.g., Chen et al. (2017)). Finally, sustainability oriented innovation, is a new stream that establishes the link between innovation and value creation, referring to sustainable policies and corporate social responsibility applied to offers, processes and organisations (e.g., Brown et al. (2019)).

Crossing these four research fi s, we explored the three features that contribute to answer our research questions in this chapter: i) the triggers of collaborative innovation, ii) the type of innovation, and iii) the collaboration approach adopted by a given company.

Firstly, the triggers of collaborative innovation address the fi research question of this chapter, concerning to the motivation of companies to perform collaborative innovation. The literature develops two major triggers of collaborative innovation referred as the technology-push and demand-pull approaches, respectively (Di Stefano et al., 2012). Secondly, diff t types of innovation can be identified according to the object, the strategy and the degree of collaboration. According to the object, it can be the offer, the process, or the organisation (Neutzling et al., 2017; Edwards-Schachter, 2018). According to the adopted strategy, innovation can be incremental or radical, and modular or systemic (Shaw and Burgess, 2013; Edwards-Schachter, 2018). Finally, depending on the openness of the focal company to external actors, there is a continuum between closed and collaborative innovation (Chesbrough, 2007; Huizingh, 2011). In the following, these key concepts are further developed.

# 3.4 Triggers of collaborative innovation (why?)

## 3.4.1 Technology-push approach

The technology-push approach highlights the key role of technology and the existing company's knowledge as major triggers of innovation, which is initiated by a provider company (Di Stefano et al., 2012). This approach defends the idea that technology is the main source of innovation development, aiming at pushing an innovative offer to the market (Di Stefano et al., 2012). In this case, the customer demand is taken into account as a complement to guide the innovation in the right economic direction. From the technology-push perspective, collaboration in B2B consists of exchanges between the supplier network and the customer. In general, the customer participates at last stages the process of innovation as a resource integrator (c.f., Resource-based view (Barney, 1991; Möller and Tönen, 2003)). According to the literature review performed by Di Stefano et al. (2012), the technology-push approach is mostly related to technology development, product innovation, and technological diff in the market. In the technology-push approach, the principal motivations that push to adopt collaborative innovation strategy are: increasing the customer satisfaction with innovative offers (Payne et al., 2008; Chester Goduscheit and Faullant, 2018); achieving competitive advantage (Derrouiche et al., 2010; Kohtamäki and Rajala, 2016; Neutzling et al., 2017; Chester Goduscheit and Faullant, 2018; Jugend et al., 2018); capitalization of knowledge (Huizingh, 2011; Geum et al., 2013; Brown et al., 2019); sharing resources, risks and costs (Shaw and Burgess, 2013; Maine et al., 2014); and, recently, addressing sustainability issues (Hellström et al., 2015; Neutzling et al., 2017; Hankammer and Kleer, 2018; Brehmer et al., 2018; Calabrese et al., 2018; Brown et al., 2019).

## 3.4.2 Demand-pull approach

In the demand-pull approach, innovation is the result of market demand, which directly triggers the development of innovations to respond to unmet customer needs (Di Stefano et al., 2012). The principal actors in demand-pull approach are the ones directly involved in customer-provider relationships (e.g., the purchasing function in B2B markets) (Di Stefano et al., 2012). Given the predominance of the technology-push approach in theory and practice, the literature review reveals a lack of knowledge concerning the collaborative practices when the innovation initiative comes from the customer side (Yan et al., 2017). The demand-pull approach to innovation is seen as a complement to the technology-push one, which help to fi the real market needs. According to Möller and Tönen (2003), the main features of the demand-pull approach are the central role of the customer, the complex relationships with old and new actors in the value chain (Nudurupati et al., 2015), the intensive knowledge exchange between the actors (Kang and Kang, 2014; Reypens et al., 2016), and the radical transformation of internal and external value chains (Möller and Tönen, 2003; Nudurupati et al., 2015). The literature reveals that in a demand-pull approach is often diffi to distinguish the exact role of the customer from that of the supplier in the value co-creation process (Möller and Tönen, 2003). Some of the motivations of the demand-pull approach found in the literature are: increasing customer value in use (Hallikas et al., 2014; Nudurupati et al., 2015); creating societal value (Matinheikki et al., 2017); sharing resources and risks (Kang and Kang, 2014); creating sustainable value (Hellström, 2007; Walker and Preuss, 2008; Rohrbeck et al., 2013; Calabrese et al., 2018; Brown et al., 2019); and knowledge capitalization (Hellström, 2007). It is noticed that sustainability issues is a major preoccupation in the demand-pull approach. Usually, the need to integrate sustainability aspects in a company's strategy comes from governmental policies (Brown et al., 2019), which implies the involvement of actors from the public sector (i.e., policy-oriented partnerships) (Hellström, 2007; Walker and Preuss, 2008; Matinheikki et al., 2017; Calabrese et al., 2018).

## 3.5 Types of innovation (what?)

### 3.5.1 According to the innovation object

In a recent literature review, Edwards-Schachter (2018) explains the multidimensionality of the concept of innovation, and highlights the diffi y to get a clear conceptualization of the term. Nevertheless, innovation has been traditionally associated with "a new way to do something", supposing a technological change in a given context (Edwards-Schachter, 2018). Moreover, there exist three well-established types of innovation corresponding to product, process, and organisation, derived from the seminal Schumpeterian innovation theory (Ueda et al., 2009).

Firstly, product innovation is the oldest approach to innovation, highly studied in the literature of New Product Development (NPD) (Schiele, 2006; Edwards-Schachter, 2018). It corresponds to the improvements on a given product, allowing completely new usages (Shaw and Burgess, 2013; Geum et al., 2013; Maine et al., 2014), or enabling the management of environmental impacts (e.g., eco-innovation) (Hellström, 2007; Garcia et al., 2019).

Secondly, process innovation refers to the new ways to perform organisational and production activities into a company (Shaw and Burgess, 2013; Geum et al., 2013; Maine et al., 2014; Wang et al., 2016; Edwards-Schachter, 2018; Brown et al., 2019). The change can be produced from the introduction of new technologies or from activity optimization. It is closely related to product innovation, since the product is the result of a process.

Finally, organisational innovation corresponds to a complex level of innovation that implies a holistic transformation in a company's internal and external structures (Chesbrough, 2007; Shaw and Burgess, 2013; Chester Goduscheit and Faullant, 2018; Jugend et al., 2018; Brown et al., 2019). Company's internal and external structure refers to the relationships between the actors and the diff t processes taking place at the systemic level. (Huizingh, 2011; Shaw and Burgess, 2013; Lancker et al., 2016; Chester Goduscheit and Faullant, 2018; Jugend et al., 2018). Business model innovation is a form of organisational innovation (Chesbrough, 2007; Rohrbeck et al., 2013;

Hellström et al., 2015; Hankammer and Kleer, 2018; Brehmer et al., 2018), and deals with the transformation in the way a company creates and captures value.

### 3.5.2 According to the innovation strategy

Traditionally, the output of the innovation process has been categorised as incremental or radical (Rothwell, 1992; Shaw and Burgess, 2013; Edwards-Schachter, 2018; Chester Goduscheit and Faullant, 2018), and modular or systemic (Hellström, 2007; Shaw and Burgess, 2013). On the one side, this categorisation is related to the level of disruptiveness a company is aiming to achieve (Maine et al., 2014; Edwards-Schachter, 2018). On the other side, this refers to the scope of the innovation (Shaw and Burgess, 2013).

**From incremental to radical innovation.** Incremental innovation refers to small and cumulative improvements in the object of innovation (i.e., offer, process, organisation) (Chester Goduscheit and Faullant, 2018; Edwards-Schachter, 2018). Incremental innovation is often related with the exploitation of company's internal knowledge and resources (Chester Goduscheit and Faullant, 2018; Edwards-Schachter, 2018). Radical innovation, in contrast, needs the integration of external knowledge, since it refers to the development of completely new offers, processes or organisations with the aim to create new markets (Chester Goduscheit and Faullant, 2018; Edwards-Schachter, 2018). In both cases, the innovation effort relies on the capability of the company to exploit knowledge in order to create higher value than in the current situation.

**From modular to systemic innovation.** Innovation can be also modular or systemic (Hellström, 2007; Shaw and Burgess, 2013). Modular innovation addresses one or some parts of a system to be innovated, without changing the entire system. It could take places when, for example, one or more modules nested within a larger system are replaced to improve the system performance. Besides, systemic innovation implies a complete transformation of the object of innovation, which is translated into a completely diff nt functioning of the system. In general, modular and systemic innovation correspond to incremental and radical innovation, respectively. Nevertheless, in some cases, a modular innovation can derive into the transformation of the whole system functioning (Shaw and Burgess, 2013).

### 3.5.3 According to the degree of collaboration

According to Lancker et al. (2016), innovation involves an evolutionary, non-linear and iterative learning process, which requires intense communication and collaboration between diff t actors in the value system. This assumption has its antecedents from the well-known Stakeholder Theory (Freeman et al., 2010), which defi economic and non-economic actors as part of the business ecosystem. Adopting a collaborative approach has some implications to the internal company's configuration and its relationship with the external environment (Freeman et al., 2010). Indeed, adopting an innovation strategy needs the focal company to entail internal and external collaboration processes (Schiele, 2006; Huizingh, 2011; Yoon et al., 2017). According to the willingness of a company to collaborate with its environment, several configurations can take place going from closed to open innovation strategies. Huizingh (2011) proposes four types of innovation according to the degree of openness of the focal company to the external environment:

**Closed innovation.** As stated on previous work (Rothwell, 1992), closed innovation development is based on the internal R&D capabilities of the focal fi in isolation. It is the oldest innovation model, corresponding to the mass production era, in which the main issues are R&D efficiency, intellectual property and technological development. In this model, value creation depends on the company ability to capitalize and exploit its own knowledge to create diff tiated products compared to the competitors. In this context, company's intellectual property is a critical driver of value creation, while collaboration is absent from the managerial concerns .

**Out-bound open innovation.** Refers to the ability of a company to commercialize internal knowledge in the external environment (Huizingh, 2011). This model requires some degree of collaboration of the focal fi with external actors, which are the customers of the innovation. Here, collaborative practices are key value drivers, which allows the focal company to understand the external needs and processes.

**In-bound open innovation.** Corresponds to the sourcing and acquisition of expertise from outside the focal company, and the ability to exploit it internally (Huizingh, 2011). In this case there is a need for an intensive internal collaboration coupled with a strategic external collaboration. The internal collaboration is crucial to align the fi culture and capabilities to the external knowledge, allowing the integration into the company processes.

**Collaborative innovation.** It is a general notion covering all the relationships based on the collaboration and the long-term engagement between two or more industrial actors. Neutzling et al. (2017) affirm that inter-organisational collaboration is essential to achieve effective innovation development in a given industrial sector. There exist several sub-categories going from dyadic collaboration (i.e., provider-customer value co-creation) (Schiele, 2006; Payne et al., 2008; Derrouiche et al., 2010; Grimm et al., 2014; Kohtamäki and Rajala, 2016) to networked approaches (Romero and Molina, 2011; Shaw and Burgess, 2013; Nudurupati et al., 2015; Hellström et al., 2015; Reypens et al., 2016; Wang et al., 2016; Lancker et al., 2016), in which several actors on the extended value chain are integrated, including economic and non-economic ones (i.e., customer, suppliers, competitors, governmental organisations, communities, etc.). The literature reveals that one of the most updated approaches of collaborative innovation is known as open innovation (Chesbrough, 2007; Geum et al., 2013; Maine et al., 2014; Jugend et al., 2018), referring to inside-out and out-side in flows of knowledge between the actors in a long term engagement strategy.

## 3.6 Collaborative innovation in today's business to business relationships (how?)

### 3.6.1 The requisites for successful collaborative innovation

The basis of collaborative innovation is the management of the relationships between actors (Shaw and Burgess, 2013; Maine et al., 2014; Matinheikki et al., 2017; Hellström, 2007). The major aspect to focus on is to characterise relationships in a collaborative context (Derrouiche et al., 2010; Lancker et al., 2016; Yoon et al., 2017). Relationships between the customer and the providers implies relational elements beyond a simple transactional process (e.g., trusts and commitment). Derrouiche et al. (2010) propose to characterise relationships through some criteria related to relational quality, for instance, the degree of commitment between the actors, the long-term vision on the relationships, and the balance on the inter-dependency. In general, collaboration needs an initial effort of the actors at the strategic level which corresponds to defi mutual objectives, establishing integrated policies and performing collaborative decision-making processes (Ueda et al., 2009; Derrouiche et al., 2010; Reypens et al., 2016). The willingness of the companies to collaborate is essential but not sufficient. In this sense, some operational prerequisites that make collaboration possible are highlighted in t he literature and can be classified as preliminary, internal collaboration and external collaboration requisites.

**Preliminary requisites.** First, it is necessary identify the focal fi which is the company initiating the innovation project. Inside the company, it is necessary to identify a corresponding "leader" or "champion" and a leading group formed by internal key actors (Nudurupati et al., 2015; Reypens et al., 2016). The leading group coordinates and monitor the project development inside and outside the company boundaries. Once the focal fi and the respective champion and leading group are set, it is necessary to prepare the company to collaborate inside (cross-functional collaboration) and outside its boundaries (inter-organisational collaboration).

**Internal collaboration requisites.** It is necessary to establish the conditions for collaboration at the company's internal level. Intra-organisational collaboration involves a cross-functional approach that depends very much on the company culture (Huizingh, 2011; Reypens et al., 2016; Yoon et al., 2017). First, the focal company should be able to recognise and forecast the value opportunity in the collaboration. Second, it is required to be aware to invest on internal competences and resources (Neutzling et al., 2017). Finally, the focal company should provoke an inter-functional collaboration with the aim of achieving internal goal-alignment (Grimm et al., 2014; Yoon et al., 2017). In line with Schiele (2006), a robust and organised internal collaboration is the base of a successful external collaboration.

**External collaboration requisites.** Inter-organisational collaboration is much more complex than internal collaboration, since it involves heterogeneous actors with their own organisational culture and interests (Romero and Molina, 2011; Reypens et al., 2016; Baldassarre et al., 2017). The main motivation for the actors to collaborate in a value network is the expected value to be captured, which is superior to the invested efforts (Romero and Molina, 2011; Hellström et al., 2015). Inter-organisational collaboration has its antecedents in the Resource-based view (Barney, 1991), referring to the strategic management of external resources. For Hallikas et al. (2014) and Neutzling et al. (2017), collaboration is much more than putting resources together, instead, it is creating unique capabilities from resources and knowledge integration. Thus, the actors in the value network should be conscious about being part of a network, and not isolated actors looking exclusively for its own benefit.

Indeed, some of the requisites for successful external collaboration are, fi , having the capability to integrate external knowledge into the internal know-how, which is known as "absorption capacity" (Huizingh, 2011; Yoon et al., 2017). Secondly, good quality of actors relationships, determined by the level of trust, adaptation, communication, participation, problem-solving orientation, among others (Schiele, 2006; Yoon et al., 2017). Thridly, a clear understanding of the value expected for each actor, as well as the interdependence relationships between the actors (i.e., goals, resources, capabilities, activities, etc.) (Hellström et al., 2015). Finally, it is necessary to identify the potential sources of conflicts (e.g., information asymmetry, opportunistic behaviour) (Spekman, 1988; Yoon et al., 2017).

The most critical point for a successful collaborative innovation is to ensure the alignment of the actors' objectives at internal and external levels (Derrouiche et al., 2010; Reypens et al., 2016; Baldassarre et al., 2017; Matinheikki et al., 2017). This condition supposes a cognitive alignment between actors that are highly heterogeneous. To this end, it is necessary to recognise the opportunity to create superior value from joint innovation development instead of isolated value creation (Matinheikki et al., 2017). The way in which the collaboration process is hold by the actors depends on the individual need for engaging the collaboration (i.e., related to the company progress), the constraints linked to the confi tiality information (i.e., risk of information asymmetries), and the stage of the development life cycle of the innovation (i.e., idea generation, conceptualization, development, etc.)(Lancker et al., 2016). The analysis of the evolution of the relationships in B2B with a extended vision is indispensable to understand value creation within complex collaborative business ecosystems.

### 3.6.2 The process of collaborative innovation

Any process of collaborative innovation starts with the recognition of an opportunity to create high value in a networked organisation (Kang and Kang, 2014). Then, the opportunity recognition is translated into an innovation project. However, there exist diff t configurations in the collaborative innovation process, depending on the industrial context, the origin of the innovation project, the investment capabilities of the actors, among others factors (Schiele, 2006). It should be noted that the healthcare industry is a rich source of collaborative innovation practices, since it involves a high level of actor’s heterogeneity in terms of knowledge, financial structure and governance (Walker and Preuss, 2008; Nudurupati et al., 2015; Reypens et al., 2016). For instance, Schweizer and He (2018) performed an empirical study in the pharmaceutical industry, which leads to the identification of three main phases that characterise any process of collaborative innovation, described below.

**Inception.** The focal company (i.e., initiator of innovative project of value creation) identifies an innovative opportunity for value creation. Similarly, the need to collaborate into a mutual interest project with external actors is identified. Then, it is necessary to draw out the synergistic values between the potential collaborators, which determines the motivations to adhering the project (Reypens et al., 2016). At this stage, the focal company entails a strong internal communication with the aim of unlocking the cultural barriers to collaborate with external actors. The output of this stage is the general goal of the collaborative innovation project, the identification of the potential external actors to collaborate with, the anticipation of the value to be created, and an initial set of actions to deal with the intra-organisational barriers to the project development (Reypens et al., 2016; Schweizer and He, 2018).

**Ignition.** The aim of this step is to perform a goal alignment between the diff t actors regarding the main goal of the project (Reypens et al., 2016; Baldassarre et al., 2017). The expected benefits of the actors and the individual investments should be discussed, achieving a fair agreement between the parties. The outputs of this phase are the list of actors to participate in the collaborative process, and a synthesis of the actor’s value expectations. Parties should be ready for full collaboration in intellectual and contractual terms (Reypens et al., 2016).

**Implementation.** In line with the model proposed by Rohrbeck et al. (2013), this phase corresponds to the launch of the innovation in operational and commercial terms. The collaboration takes place on the operational planning alignment in terms of resources and activities needed for joint production. This phase is concerned with the offer commercialization and the value capture. At the end it is possible to conduct an assessment of the value created for each actor.

### 3.6.3 Collaborative innovation and sustainable value creation in the supply chain

An important body of literature recognises the importance of collaborative approach in the supply chain as a key driver to create sustainable value (Chen et al., 2017). Here, the role of the purchaser is fundamental to enable innovation development (Spekman, 1988; Schiele, 2006). In B2B markets, sourcing has been considered as an strategic activity that allows the access to new resources and knowledge that enables innovation in the buyer company (Spekman, 1988; Nudurupati et al., 2015). In the context of sustainable business models, the role of the purchaser has gained in importance (Grimm et al., 2014).

In past literature (Spekman, 1988), the role of the purchaser appears to be strictly prescriptive. The purchaser was limited to establish a set of requirements, and looking for a competent supplier able to fulfil them. The criteria of supplier selection in that context were the classical triad quality, price and delivery time (Spekman, 1988). In that context, the purchaser adopted an "adversary approach" face of its suppliers, using the power positioning to get the best cost-benefit relation in the business transaction (Spekman, 1988). In the current industrial context, the role of the purchasing function has been drastically transformed (Schiele, 2006; Nudurupati et al., 2015). The purchaser is facing a context in which the price is not the only element of the negotiation with its key suppliers, entailing a discussion about perceived value from diff t actors' perspective (Nudurupati et al., 2015). Besides, external exigencies, related to the management of the environmental impacts and the strategic need of being socially responsible, push companies to transform the sourcing strategies in B2B contexts (Walker and Preuss, 2008; Seuring and Gold, 2013; Chen et al., 2017). This panorama makes it possible to entail a conversation around the innovation as a source of sustainability.

In the context of collaborations, the purchaser takes the role of "integrator" or "mediator" in the interactions between the actors along the value network (Hallikas et al., 2014). The integrator is at the centre of the collaborative project, being able to coordinate the relationships and the information sharing during the entire process of co-creation. In B2B relationships, the purchasing function is the direct link between suppliers and manufacturers with the customer needs (Kang and Kang, 2014). The integrators should have the skills to manage the project at the relational level, which means to establish a dialogue between actors from diff t domains of expertise, facilitating the alignment of their objectives. In this context, the role of the purchaser requires the ability to identify innovative suppliers and provoke an opportunity for collaboration (Schiele, 2006). Identifying innovative suppliers is a necessary but not sufficient condition. The purchaser should be also a facilitator of the fi to integrate and exploit external knowledge and resources.

In this context, the activity of sourcing becomes a central element in the organisational strategy to achieve sustainable value (Grimm et al., 2014). For these authors, managing sourcing appropriately increases the efficiency of innovation development. Some of the aspects to be considered in sourcing strategies in the context of collaborative innovation are summarized as follows:

- **Considering the offer life cycle:** from a supply management perspective, it allows increasing the knowledge about the functioning of the actors in the supply chain, enabling the design a robust and holistic prescription (Nudurupati et al., 2015).

- **Identifying actors interdependencies:** concerns to the primary tasks of objective alignment between the diff t actors. The collaborative relationship should be based on declared interdependencies and not in one sense dependency. This aspect avoid, for example, the technical dependency of the purchaser to a single supplier (Nudurupati et al., 2015; Matinheikki et al., 2017).

- **Dynamic supplier selection:** instead of having a static panel of suppliers, the purchasing function should be and perform a fl and extended panel of stakeholders depending on a specific purpose. This leads to the management of multiple stakeholders sourcing strategies (Rohrbeck et al., 2013; Grimm et al., 2014).

- **Integrative role:** instead of the traditional and exclusive negotiation role, the purchaser should be an mediator of the collaboration process, integrating a heterogeneous panel of stakeholders into a common goal. The purchasing focus should change from a cost-benefit discussion to a value-based one (Hallikas et al., 2014; Huizingh, 2011; Kang and Kang, 2014).

## 3.7 Conclusions

Pursuing sustainable value creation needs the collaboration between multiple actors in a orchestrated network. Through this chapter, we mobilized an important amount of literature addressing the notion of collaborative innovation from four diff t research streams: value creation, innovation management, supply chain management and sustainable oriented innovation. The classical theories infl the current literature on collaborative innovation are the stakeholder theory (Freeman et al., 2010) and the resource-based view (Barney, 1991). Some insights contributing to research questions guiding this chapter are summarized as follows:

- *RQ1. Why do companies collaborate in B2B?*. Adopting a collaborative approach is motivated by the access to resources and knowledge. The aim is to perform radical and systemic innovations, oriented towards sustainable solutions, at the offer, process or organisational level, that a single company cannot achieve.

- *RQ2. What is the meaning of collaborative innovation in B2B?*. In B2B markets, collaborative innovation means value co-creation between economic and non-economic actors in the value network. It implies the strategic alignment of goals, resources and knowledge between several actors into a business ecosystem.

- *RQ3. How do companies collaborate in B2B?*. Collaboration in B2B needs to takes into account preliminary, internal collaboration, and external collaboration requisites. The main requisite for a successful collaboration concerns to the strategic alignment of actors' goals. Several forms of collaboration can take place depending on the trigger of innovation (i.e., technology push or demand pull), the type of actor involved in the collaborative process (i.e., public actors, manufacturers, ONG's, research centres, among others), and the quality of the relationships between them.

- *RQ4. How does collaboration enable the creation of sustainable value in B2B?*. In the context of collaborative innovation, sustainable value is defi as the improvements in the offer, process, or organisation that simultaneously create economic, environmental, social, relational and functional value. The aim is ensuring economic growth and advanced social well-being. In B2B markets, the role of the purchasing function becomes central, being the key actor in sustainable sourcing strategies.

For the development of the chapters corresponding to the proposed framework (Part III; chapters 5 and 6), the elements retained from this chapter can be summarize as follows:

- Adopting a focus on the collaborative innovation at the supply chain level.

- The external triggers of collaborative innovation (demand-pull and technology-push) and its impacts on the organisation.

- The requisites for entailing a process of collaborative innovation with external actors, classified as preliminary, internal and external.

- The three main phases of the collaborative innovation process: inception, ignition, and implementation.

- The role of the purchaser as integrative actor in the process of collaboration.

# Chapter 4

# Decision making in multidimensional and multi-stakeholder value creation

## Contents

# 4.1 Introduction

Sustainable value creation is a major issue in current industry (Thabrew et al., 2009; Boström et al., 2015; Schöggl et al., 2016; Brown et al., 2019). The systemic nature of sustainability requires multifaceted knowledge, only achieved through the collaboration between several economic and non-economic actors (Govindan et al., 2014). As shown in chapters 2 and 3, achieving sustainable value creation implies two major issues, on the one hand, it is concerned with multiple dimensions of value creation (defined in chapter 2 as economic, environmental, social, relational, and functional); on the other hand, it faces the multiple perspectives of the set actors involved in the collaborative process (Reypens et al., 2016). The current business environment is characterised by actor's interdependences and conflicting objectives, leading to complex group decision making processes (Baudry et al., 2018). This problem can be addressed from two levels of analysis, fi level and system level. The fi level is concerned with the set of value expectations each actor has with respect to the collaborative process. The system level refers to the interdependences (generated from the value exchanges) and conflicts between the actors in the collaborative process. The major issue at the fi level is the individual defi of the value expectations, while at the system level is the fair distribution of the value created among all the actors, in a way to achieve a consensus. To determine whether value has been created or not for a given actor, it is necessary to implement value assessment mechanisms (Baldassarre et al., 2017). Many authors have approached the problem of sustainable value creation as a multi-stakeholder and multi-criteria decision problem (Ueda et al., 2009; Hajkowicz, 2008; García-Melón et al., 2016; Schillo et al., 2017; Baudry et al., 2018). Moreover, a mandatory aspect dealing with complex decision problems is adopting a systemic vision, including all the relevant elements to the decision, and representing the best the complexity of the decision situation (Roy, 1991; Norese, 2006; Bruno et al., 2016). The objective of this chapter is to provide the conceptual basis to address the problem of sustainable value creation in the context of multiple value dimensions and multiple stakeholders. The research questions guiding this chapter are the following:

- *RQ1. What are the existing approaches addressing multi-stakeholder and multi-criteria decision situations in industry?*
- *RQ2. How to represent multi-stakeholder and multi-criteria decision situations in the context of sustainable value creation?*
- *RQ3. How to achieve a consensus between multi-stakeholder expectations in collaborative decisions?*

To answer these questions, a literature review is conducted, seeking for multi-criteria and multi-stakeholders decision methods successfully implemented in industrial cases. Then, these methods are analysed according to the specific context of sustainable value creation. Figure 4.1 shows the principal elements to be explored in this chapter and the linkage with the previous chapters (i.e., chapters 2 and 3).

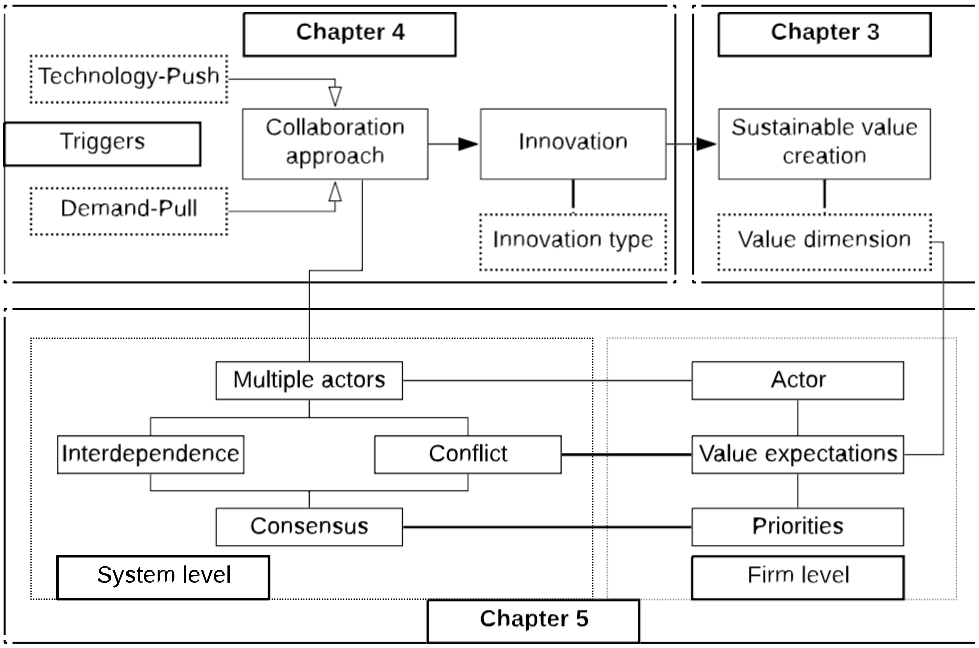


Figure 4.1: Research framework.

## 4.2 Literature review methodology

Firstly, we performed a research using the key words “multi-criteria decision” AND “multi-stakeholder*” OR “multi-actor*”. The research was performed for titles, abstract and keywords in Web of Sciences (WOS) between 2010 and 2019. We obtained a fi sample of 789. Then, we fi the contributions choosing only peer-reviewed journals in the fi of engineering, management, environmental sciences, and computer science, obtaining a sample of 128 research works. Starting with the base of the 128 articles, we performed a fi process by reading titles, keywords and abstracts. 17 papers were retained for further analysis. Three articles correspond to literature reviews (Chai et al., 2013; Kumar et al., 2017; Santos et al., 2019), and highlight the strengths, weaknesses and application areas of the most used MCDA methods in industry. 14 articles present the application of MCDA methods for multi-stakeholder decisions through specific case studies (Table 4.2). To address specifically MCDA in the context of multiple stakeholders, some insights were taken from a prominent literature review conducted in the fi of decision making (Chai et al., 2013). The authors analysed 123 articles between 2008 and 2012 related to decision making techniques. This work has a great infl in the fi of supply chain management concerning strategic sourcing decisions. Chai et al. (2013) classify existing methods for decision making into multi-criteria techniques, mathematical programming techniques, and artificial intelligence techniques. Our research is positioned in the fi group. In table 4.1, eight of the most infl tial methods in this category are listed from the most to the least used in real industrial cases (see for instance Kumar et al. (2017)). Regarding the 14 papers selected for our literature review, only SMART method is not longer evoked in recent researches. Instead, another multi-criteria method well used in the context of sustainable value creation is the life cycle assessment (LCA) (Ren et al., 2015; Liu and Qian, 2019; Santos et al., 2019) (Table 4.2).

Table 4.1: Most used multi-criteria decision making techniques according to Chai et al. (2013) and Kumar et al. (2017).

| N | Multi-criteria decision making techniques | Abbreviation |
|---|---|---|
| 1 | Analytic hierarchy process | AHP |
| 2 | Technique for order performance by similarity to ideal solution | TOPSIS |
| 3 | Analytic network process | ANP |
| 4 | Elimination and choice expressing reality | ELECTRE |
| 5 | Multi-criteria optimization and compromise solution | VIKOR |
| 6 | Decision making trial and evaluation laboratory | DEMATEL |
| 7 | Preference ranking organization method for enrichment evaluation | PROMETHEE |
| 8 | Simple multi-attribute rating technique | SMART |

Table 4.2: MCDA methods and applications of the reviewed articles.

| N | Reference | Journal | Method | Application context |
|---|---|---|---|---|
| 1 | Erdoğmuş et al. (2006) | *Renew Sust Energ Rev* | ANP | Energy policy development |
| 2 | Norese (2006) | *Land Use Policy* | ELECTRE III | Incinerator location |
| 3 | Lin et al. (2010) | *Expert Syst Appl* | ANP - ISM | Industrial vendor selection |
| 4 | Macharis et al. (2012) | *Decis Support Syst* | AHP - PROMETHEE | Transport project evaluation |
| 5 | Govindan et al. (2014) | *J Clean Prod* | Fuzzy DEMATEL | Policy identification in mining industry |
| 6 | Ren et al. (2015) | *Int J Life Cycle Assess* | LCA-AHP-VIKOR Fuzzy theory | Bio-ethanol production |
| 7 | Igoulalene et al. (2015) | *Expert Syst Appl* | Fuzzy TOPSIS | Supplier selection problem |
| 8 | Bruno et al. (2016) | *Expert Syst Appl* | Fuzzy AHP | Supplier selection problem |
| 9 | Schillo et al. (2017) | *Energy policy* | QFD - AHP | Energy policy development |
| 10 | Baudry et al. (2018) | *Eur J Oper Res* | Range-based AHP-PROMETHEE | Biofuel selection |
| 11 | Chen and Ren (2018) | *J Air Trans Manag* | Fuzzy ANP - Fuzzy grey relational analysis | Aviation fuel evaluation |
| 12 | Mathivathanan et al. (2018) | *Resour Conserv Recy* | DEMATEL | Identification of sustainable supply management practices |
| 13 | Liu et al. (2019) | *J Clean Prod* | Fuzzy DEMATEL | Innovation design |
| 14 | Liu and Qian (2019) | *J Clean Prod* | Social-LCA | Construction project evaluation |

In the following the theoretical background of MCDA approaches is presented, pointing out on the key elements, multi-stakeholder related elements, MCDA process, and existing methods.

## 4.3 Multi-Criteria Decision Analysis (MCDA)

In general, multi-criteria decision approaches are concerned with the understanding, modelling and solution of complex decision problems, generally supported by a mathematical basis (Saaty, 1990; Roy, 1991). Nevertheless, diff t visions have been developed in parallel from the origin of multi-criteria decision theories, deriving in two main streams (Roy, 1991). The fi one oriented to the selection of “the best” solution for a given problem (multi-criteria decision making - MCDM), while the other one oriented to guide the decision process (multi-criteria decision aiding - MCDA). In line with Baudry et al. (2018) and Macharis et al. (2012), both approaches can be considered as complementary, resulting into comprehensive methodological frameworks for guiding the entire decision process (multi-criteria decision analysis). In this sense, MCDA approaches should satisfy both methodological and operational requirements, always considering the context of application (Baudry et al., 2018). The fi requirement for implementing MCDA is problem structuring, which involves a systemic vision of relevant actors, their value systems and their interactions in the decision situation (Roy, 1991; Keeney, 1996). From the literature review, it is possible to distinguish fi , the basic elements required to perform a MCDA; secondly, the characteristics of multi-stakeholder decision problem, thirdly, the general pathways to their implementation for solving a given decision problem; fi , the existing MCDA methods, their strengths and weaknesses.

### 4.3.1 Basic elements in MCDA

Three elements are fundamental to perform a MCDA approach: actors, criteria and alternatives.

**Actor.** Most of the reviewed papers defi an “actor”, designated as “stakeholder” in the business context, according to the Stakeholder Theory of Freeman (1984) (Norese, 2006; Macharis et al., 2012; Govindan et al., 2014; Igoulalene et al., 2015; Bruno et al., 2016; Schillo et al., 2017; Liu and Qian, 2019). The “actor” or “stakeholder” is defi as any group or individual, who can affect or be affected by the achievement of organizational goals. The stakeholder has inherent interests and goals expected to be achieved thought a given decision (cf. Chapter 3).

**Criterion.** It is a reference element through which an alternative can be judged. In MCDA a criterion can have either qualitative or quantitative nature. The characteristics of an adequate set of criteria to perform a MCDA approach are: completeness, non-redundancy, operationality, minimality and homogeneity (Roy, 1991; Macharis et al., 2012). Completeness implies that all the relevant points of view are taken into account during the decision process. Operationality refers to the meaningfulness of each criterion regarding the decision context, and the ability to measure it. The non-redundancy means that two or more criteria should not express the same idea, or one criterion should not be contained into another one. The minimality suggest that the problem should be kept simple enough to be understood and treatable, but representative of the real problem. Finally, the homogeneity means that a given set of criteria shares the same level of detail, enabling a specific level of analysis.

**Alternative.** It represents a possible solution to the decision problem. It is the element being judged by the actors according to the predefi criteria. According to Roy (1991), alternatives can be partial (need to be combined with other partial alternatives to fulfi the entire decision problem) or complete (provides by itself a comprehensive solution to the decision problem).

### 4.3.2 Elements in multi-stakeholder MCDA

In the application of a MCDA approach, the following elements characterise a decision situation involving multiple stakeholders.

**Value system.** Values are highly abstract concepts that explain the interest of the actors participating in a decision. The value system represents the set of principles and global objectives of an actor, guiding its decisions. The value system can be observed in individuals, organizations or societies (Keeney, 1996).

**Preference.** The preference is the result of a value judgement emitted by a stakeholder when comparing two or more elements. It depends on the stakeholder value system and indicates the relative importance of an element with respect to another under a common criterion (Saaty, 1990; Keeney, 1996).

**Conflict.** A common characteristic of multi-stakeholder decision making processes is the presence of conflicting objectives (Macharis et al., 2012; Dowling et al., 2016; Baudry et al., 2018). Conflicts arise due to the existence of opposite objectives between two or more stakeholders. Mathematically, a conflict arises when no alternative reaches the Pareto efficiency, which means, there is no a single alternative that allows improving one objective without degrading another one. To solve conflicting situations, a trade-off between stakeholders' priorities is necessary, achieving a form of consensus.

**Consensus.** It represents a major issue in multi-stakeholder decision making (Macharis et al., 2012; Dowling et al., 2016). It can be defi as the agreement between all the stakeholder with respect to a decision. Mathematically, a consensus means the aggregation of stakeholders' preference functions, looking for a global satisfaction (Igoulalene et al., 2015; Li et al., 2016; Schillo et al., 2017; Baudry et al., 2018). MCDA literature provides some valuable insights to achieve a consensus through mathematics modelling techniques. For instance, Schillo et al. (2017) propose the use of Quality Function Deployment (QFD) in order to capture the "voice of the stakeholder", leading to stakeholders' importance factors. Similarly, Macharis et al. (2012) argue that each stakeholder should defi its own value structure and criteria independently, then, aggregating their preferences through a stakeholders' weighting procedure. AHP and ANP solve the question of consensus through two diff t methods, the *aggregation of individual judgements* (AIJ) and the *aggregation of individual priorities* (AIP) (see for instance Basak and Saaty (1993), more detailed in section 4.6).

**Complexity.** Refers to the degree of diffi y in analysing and solving a decision situation. Complexity is a inherent characteristic of multi-stakeholder decision processes, characterised by diverse and conflicting objectives (Igoulalene et al., 2015; Macharis et al., 2012; Bruno et al., 2016; Schillo et al., 2017; Baudry et al., 2018). Depending on the decision problem nature, the complexity comes from various sources. It could be linked to a lack of clarity on the main decision objective, incompleteness or overwhelming amount of information, highly heterogeneity of actors (associated to competencies, power asymmetries, culture, etc.), among others (see for instance Keeney (1996)).

### 4.3.3 MCDA process

MCDA is above all a global logic based on human rationality, aiming at facilitating decision making in complex situations, in which several criteria and actors are considered (Roy, 1991). As presented in table 4.2, many MCDA methods are available in literature (Kumar et al., 2017), all of them proposing their own implementation procedure. For instance, Saaty (1990) proposes the well known pathway of AHP method corresponding to three main steps: 1) structuring the decision problem into a hierarchy of objectives, criteria and alternatives, 2) performing pairwise comparison in each level, and 3) calculating alternatives priorities, leading to a decision. Besides, Macharis et al. (2012) propose a comprehensive and methodological MCDA framework called MAMCA, which includes seven steps: 1) problem scope defi n, 2) alternatives and criteria identifi 3) criteria weights allocation, 4) alternatives performance assessment, 5) decision method application and consensus, 6) results analysis, and 7) decision recommendations. Those are diff t procedures, however, the underlying logic is very similar. The seminal works on decision making for complex problems (see for example Roy (1991); Keeney (1996); Friend and Hickling (1987)), and provide a systemic view of the MCDA process, in which actors (with their corresponding value systems), alternatives and criteria interact within a system. For these authors, in order to help individuals make good decisions in a complex environment, it is necessary to follow a generic framework, guiding the entire decision process. Particularly, Friend and Hickling (1987) propose an iterative process for strategic decision aid called the Strategic Choice Approach (SCA). This framework is composed by four generic steps necessary to perform any MCDA approach (figure 4.2):

Four modes of the decision process are explained in the SCA framework. 1) In the shaping mode, the stakeholders structure the decision situation, setting the main objective and identifying the key actors and values. 2) The designing mode allows to

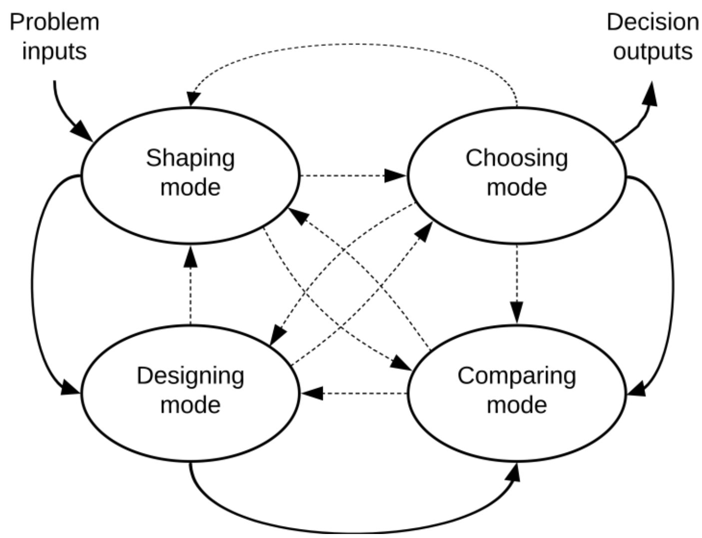


Figure 4.2: Generic decision process according to Friend (1987).

represent the decision situation into a model, in which the elements, their relations and possible combinations are represented. At this stage, consequence analysis of the alternatives is performed. 3) The comparing mode refers to the modelling of actors preferences respect to the designed alternatives. Finally, 4) the choosing mode corresponds to the generation of actor's priorities, consensus process, and recommendation for the fi decision.

### 4.3.4 Holding consensus in multi-stakeholder decisions

Particularly, in the case of multi-stakeholder decision making processes, the satisfaction of the actors with the fi decision should be considered, which implies a search for consensus (Li et al., 2016; Dowling et al., 2016). Baudry et al. (2018) identify two diff t ways to hold group decisions, one is a normative approach, in which a powerful actor (for instance, an authority entity) makes the fi decision. The second approach is the consensus one, seeking for a trade-off between all the actors points of view (Li et al., 2016; Dowling et al., 2016). As a partial answer to the question of consensus, mathematical aggregation techniques are available in the literature (for instance, Aczél and Saaty (1983)).

Multi-stakeholder decision processes are particularly complex for large and heterogeneous groups. Several authors have tried to overcome this problem combining both mathematics and social techniques (Macharis et al., 2012; Li et al., 2016; Igoulalene et al., 2015; Dowling et al., 2016). Moreover, achieving a consensus requires fi to identify the conflicting points (Li et al., 2016). Conflicts, instead of being a negative aspect, reflect the positioning of a determined actor or group of actors with respect to the decision problem. Thus, conflicts can be seen as an important source of knowledge, necessary for succeeding any decision process. Regarding the literature, some authors approach the consensus process, or more precisely, the conflict identification process, through the implementation of clustering techniques (Zahir, 1999; Giordano et al., 2007; Srdjevic et al., 2013). In the context of decision making, these techniques provide the operational support for analysing actors' preferences.

### 4.3.5 MCDA methods

MCDA methods can be classified into three subcategories: i) Multi-attribute utility methods (also known as value measurement methods); ii) Outranking methods; and iii) Compromise-oriented methods (Chai et al., 2013). The fi subcategory aims at assigning an utility value to each of the alternatives being evaluated. The utility value is the mathematical representation of the actors' preferences, leading to the choice of the best alternative within a set of alternatives. AHP and ANP are widely used multi-attribute utility methods (Erdoğmuş et al., 2006; Lin et al., 2010; Macharis et al., 2012; Ren et al., 2015; Bruno et al., 2016; Schillo et al., 2017; Baudry et al., 2018; Chen and Ren, 2018). Outranking methods as ELECTRE and PROMETHEE, assume that the stakeholders know in advance the weights of the evaluation criteria as well as the performance values of the alternatives being evaluated (Chai et al., 2013). The aim of these methods is to rank alternatives establishing a binary outranking relation between them (i.e., alternative *a* is as good as alternative *b* with no enough evidence to affirm the opposite). The result of these methods is the ranking of the alternatives rather than the choice of the best one (Norese, 2006; Macharis et al., 2012; Baudry et al., 2018). Compromise-oriented methods include TOPSIS and VIKOR (Ren et al., 2015; Igoulalene et al., 2015). In this case, the best solution is the one with the shortest distance to an ideal solution, which is an existing or imagined reference model, which can be modelled. Finally, there exist other MCDA techniques as DEMATEL and LCA, which are out of the above main categories. DEMATEL aims at the identification of cause-effect relations between complex evaluation criteria, establishing the interdependence relationships between them (Govindan et al., 2014; Mathivathanan et al., 2018; Liu et al., 2019). LCA is a method broadly used in environmental evaluation. Despite it is implemented as a MCDA method in some research papers (Thabrew et al., 2009; Liu and Qian, 2019), it is rather a methodological guideline for a very detailed evaluation of the environmental impacts.

## 4.4 Problem structure modelling in multi-stakeholder MCDA

Most of the authors highlight the need for developing consistent models at the early stages of the MCDA process, more precisely in the case of unstructured or ill-defi decision problems (Roy, 1991; Norese, 2006; Bruno et al., 2016; Macharis et al., 2012; Igoulalene et al., 2015; Schillo et al., 2017; Baudry et al., 2018). In contrast, well-defined problems can be solved through mathematical modelling, implementing traditional Operational Research techniques (Mingers and Rosenhead, 2004; Chai et al., 2013). A suitable model should represent the principal elements in the decision process: actors, criteria, and alternatives, and their interrelationships. In this aspect, Bruno et al. (2016) use stakeholder map to represent the key actors and their value exchanges (i.e., money, knowledge, resources, among others). Lin et al. (2010) propose a relational map performed thought the Interpretive Structural Modelling (ISM) technique, which allows representing the interrelationships between the elements of the decision problem and determining their correlation. Norese (2006) recommends the use of a cognitive map with the aim of delimiting the problem and representing actors points of view, identifying both shared and conflicting objectives.

The above modelling methodologies are framed into a literature stream known as Problem Structuring Modelling (PSM), which focuses on unstructured or ill-defi decision problems (Mingers and Rosenhead, 2004). These types of problems are characterised by the multiple actors, conflicting objectives, incommensurable criteria and multiple sources of uncertainty (Keeney, 1996; Mingers and Rosenhead, 2004). These approaches seek for problem representation, based on actors as the central element (Keeney, 1996; Macharis et al., 2012; Govindan et al., 2014). Furthermore, the importance of adopting an standard language is highlighted, since it allows the capitalisation and reproducibility of knowledge. The main objective of PSM methodologies are mapping stakeholders, representing their values, and their shared and conflicting objectives in a systemic way (Mingers and Rosenhead, 2004). Some frameworks from the fi of system engineering have addressed the problem of multi-stakeholder modelling. For instance, Goal Modelling (GM) is an approach of requirement engineering developed to capture the intentions of diff t actors interacting in a system. A well-used GM framework is *i** (*i-star*), which models organisational collaboration based on actors' dependence relationships (Yu, 2009; Yu et al., 2011). This framework has been developed in the fi of system engineering to analyse and model stakeholders' requirements in early stages of system development, focusing on intentions and strategic goals.

# 4.5 MCDA application in the context of sustainable value creation

## 4.5.1 Choosing a MCDA method

The selection of a proper MCDA method to hold complex decisions is an important preoccupation for analysts, experts and stakeholders at the beginning of any decision process (Erdoğmuş et al., 2006; Macharis et al., 2012; Bruno et al., 2016; Schillo et al., 2017; Baudry et al., 2018). Certainly, there is not a MCDA method that fi with any decision situation. The selection of a particular method should be in line with the context of application and the nature of the problem (Baudry et al., 2018). An appropriate MCDA method has the ability to provide a structured and realistic representation of the problem being treated, capturing its complexity in a way to be understandable for all the actors (Macharis et al., 2012). De Montis et al. (2005) propose a list of criteria based on the common preoccupations in sustainability related problems (table 4.3).

Table 4.3: Comparative analysis of multi-criteria decision techniques based on the quality criteria proposed by De Montis et al. (2005).

| N | Criteria | AHP | ANP | ELECTRE | PROMETHEE | TOPSIS | VIKOR | DEMATEL | LCA |
|---|---|---|---|---|---|---|---|---|---|
| | **Operational aspects** | | | | | | | | |
| 1 | Weights transparency | X | X | | | | | | |
| 2 | Considers interdependencies | | X | | | | | X | |
| 3 | Combination with other methods | X | X | | X | X | X | | |
| 4 | Robustness analysis | | | X | X | | | | X |
| 5 | Trade-off oriented results | | | | | X | X | | |
| | **Usability** | | | | | | | | |
| 6 | Efficiency (cost and time) | X | X | | | X | X | | |
| 7 | Stakeholder participation | X | X | X | X | | | | |
| 8 | Problem structuring | X | X | X | | | | | X |
| 9 | Mathematical simplicity | X | | | | X | X | X | |
| | **Data characteristics** | | | | | | | | |
| 10 | Scale heterogeneity | X | X | X | X | | | | X |
| 11 | Qualitative and quantitative data | X | X | X | X | X | X | X | |
| 12 | Information incompleteness | X | | | | | | | |
| 13 | Consideration of uncertainties | | | X | X | | | | |
| 14 | High amount of data processing | | | X | X | X | X | X | X |

Three main categories of the criteria are proposed according to identified needs in sustainability related problems. Firstly, the operational aspects refer to the theoretical foundations of the method. It is concerned with the construction of the evaluation criteria, the weighting procedures, the mathematical robustness, among others. Secondly, the usability deals with the ease of use of the method regarding the specific context, and the simplicity of mathematics operations to be done. For example, whether the method enables participation of multiple actors in a collaborative way, or the possibility for non experts to use the method. Thirdly, the data characteristics, which is an important aspect in the context of sustainability, refer to data heterogeneity (i.e., quantitative and qualitative data, incomplete data, uncertainties, etc.), type of measurement scales, amount of data, among others.

### 4.5.2 MCDA domains of application

Decisions concerning sustainability can be approached as multi-criteria decision problems, and require the participation of several actors (Macharis et al., 2012; Baudry et al., 2018). Literature review reveals that MCDA approaches have been largely implemented to solve diff t problems in relation with sustainability. For instance, supplier selection for sustainability (Lin et al., 2010; Igoulalene et al., 2015); energy policy development (Erdoğmuş et al., 2006; Schillo et al., 2017); energy production assessment (Ren et al., 2015; Baudry et al., 2018; Chen and Ren, 2018); urban transport project evaluation (Macharis et al., 2012; Bruno et al., 2016); sustainable practices identification (Govindan et al., 2014; Mathivathanan et al., 2018); urban waste management (Norese, 2006); product-service systems development (Doualle et al., 2019; Liu et al., 2019); and project performance assessment (Medini et al., 2015; Liu and Qian, 2019).

Authors agree that these problems comprehend several dimensions related to the interests of the actors involved (see for instance Norese (2006); Macharis et al. (2012); Bruno et al. (2016)). In the consulted articles, multiple dimensions of value (i.e., also called macro-categories) are included in the problem modelling phase. For instance, economic, environmental, social, relational, functional (defined in chapter 2), and others as legal and political (Erdoğmuş et al., 2006; Norese, 2006; Macharis et al., 2012; Govindan et al., 2014). Particularly, most of the cases involving critical environmental and social issues involve non-economic actors as governmental entities and local communities (Norese, 2006; Govindan et al., 2014).

### 4.5.3 Implementing MCDA in industry

Using MCDA approaches goes beyond selecting a good alternative to solve a given problem. Instead, MCDA is considered as a powerful tool to structure complex problems and to facilitate the communication among a heterogeneous group of actors (Erdoğmuş et al., 2006; Norese, 2006; Macharis et al., 2012; Igoulalene et al., 2015; Bruno et al., 2016; Schillo et al., 2017; Liu and Qian, 2019). MCDA is useful to: structure a common vision with respect to a decision situation (Norese, 2006; Igoulalene et al., 2015); increase collective knowledge and skills for future decisions (Bruno et al., 2016; Schillo et al., 2017); enable transparency and mutual trust along the decision process (Schillo et al., 2017); among others. Applying MCDA in real cases in industry have both operational and methodological requirements (Medini et al., 2015). Operational requirements concern the identification of actors, criteria and alternatives, as well as technical requisites related to the selected MCDA method. From the methodological point of view, any MCDA method integrates two main phases, modelling and evaluation. Most of authors agree the modelling phase is fundamental to get realistic and useful results at the end of the decision process (Norese, 2006; Lin et al., 2010; Macharis et al., 2012; Schillo et al., 2017; Baudry et al., 2018; Liu and Qian, 2019).

Firstly, during the problem modelling, actors, alternatives and criteria should be identified. Actors are selected according to the context of decision, regarding the resources and knowledge needs. For instance, in complex contexts involving sustainability-related problems, the actors correspond to the supply chain, governmental entities, communities, research institutions, etc. Alternatives and criteria can be obtained by combining literature review and actors knowledge, performing interviews, workshops and meetings (Erdoğmuş et al., 2006; Norese, 2006; Macharis et al., 2012; Chen and Ren, 2018; Mathivathanan et al., 2018; Liu et al., 2019). Moreover, the criteria can be designed following two diff t approaches, top-down and bottom-up (Keeney, 1996; Baudry et al., 2018). In the former, the criteria are obtained after a consequence analysis of real or hypothetical alternatives, allowing identifying needs from the diff t actors perspectives. In the latter, the global goal is decomposed into macro-categories, then into refined objectives, leading to a criteria set.

Secondly, for the evaluation phase, Macharis et al. (2012) identify three diff t approaches that can be adopted: analyst approach, expert approach, and stakeholder approach. Depending on the selected approach, the analyst, the experts or the stakeholders are responsible for performing the evaluation process. They should be able to provide value judgements about the relative importance of criteria and alternatives. Most of the authors agree that stakeholder approach is the most suitable for defi and prioritizing criteria, while expert approach is preferred for carrying out an accurate evaluation process of the alternatives (Norese, 2006; Macharis et al., 2012; Govindan et al., 2014; Schillo et al., 2017; Mathivathanan et al., 2018; Liu et al., 2019).

## 4.6 Retained elements for proposal development

### 4.6.1 The Analytic Hierarchy Process (AHP)

**Motivations to use AHP in the context of sustainable value creation.** An evaluation of the eight consulted methods was performed using the criteria set proposed by De Montis et al. (2005), and the content analysis of the reviewed articles (Table 4.3). AHP and ANP are placed among the most suitable methods to be used in the context of sustainability related projects, followed by the outranking methods ELECTRE and PROMETHEE. The above affirmation is supported by the fi in the literature review, in which AHP and AND have been used alone or in combination with other methods in a plethora of domains (Erdoğmuş et al., 2006; Lin et al., 2010; Macharis et al., 2012; Ren et al., 2015; Bruno et al., 2016; Schillo et al., 2017; Baudry et al., 2018; Chen and Ren, 2018). The main aspects motivating the use of AHP and ANP in real contexts are: the simplicity of the evaluation process for non-experts, the consideration of subjectivity, the transparency of the weighting process and the detection of inconsistencies in actor's judgements (Macharis et al., 2012; Bruno et al., 2016; Schillo et al., 2017). Additionally, as shown in a recent literature review by Santos et al. (2019), AHP is one of the preferred MCDA methods in sustainability related problems. The authors found that between 2014 and 2018 this method have been largely implemented to guide decision in eco-design, product-life cycle management, sustainable supplier selection, assessment of manufacturing processes, among others, showing the fl y of the method. Similarly, Chai et al. (2013) perform a literature review between 2008 and 2012, and found out the preference to use AHP in the context of supply chain management instead of another MCDA technique. The authors highlight that one important motivations for using AHP is the possibility to be combined with other MCDA techniques.

**Theoretical background of AHP.** The Analytic Hierarchy Process (AHP) is a MCDA method introduced by Prof. Thomas Saaty (Saaty, 1990). The main base of AHP is psychological, seeking at integrating actors' judgement to the decision process. AHP aims at systematizing actors' subjectivity instead of eliminating it (Saaty, 1990). It consists on two main phases: modelling and evaluation. The modelling phase aims at structuring the problem into a hierarchy, involving the levels of goals, criteria and alternatives (figure 4.3). The bottom level of the hierarchy is constituted by the alternatives; the top level corresponds to the main decisional goal; the middle comprehends $n$ levels of criteria and sub-criteria, depending on the problem size, available information, and desired level of detail.

From the theoretical point of view, AHP is based on three main axioms:

1. *Homogeneity*: elements in the same category should be comparable.
2. *Hierarchy*: elements in each level of the hierarchy should be independent.
3. *Reciprocity*: expressed as $a_{ij} = 1/a_{ji}$

The evaluation phase performs a pair comparison between the elements of each level of the hierarchy, by using an ordinal scale proposed by Saaty (Table 4.4). The process of pair comparison takes into account the following mathematics rules: for $n$ elements, a matrix $A \in \mathbf{R}^{n\times n}$ of comparisons is obtained, which is positive and reciprocal. Only $n \times (n-1)/2$ comparisons $a_{ij}$ are needed, taking into account that $a_{ii} = 1$ and $a_{ij} = 1/a_{ji}, \forall i \in \{1, \cdots, n\}$. This process results in a set of judgements matrix $A$ for each category of comparison.

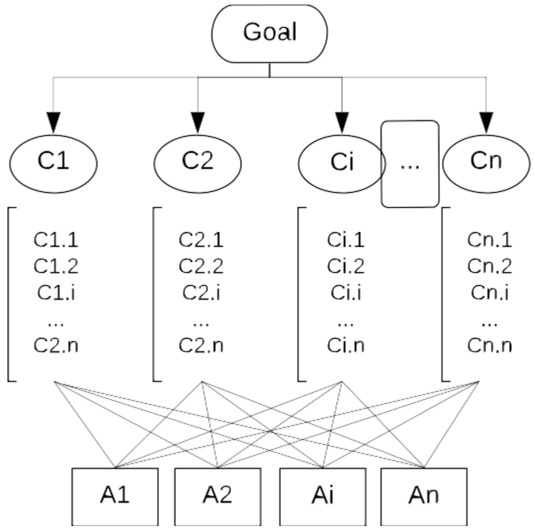


Figure 4.3: Hierarchical structure of AHP.

Table 4.4: Scale of preferences of AHP (Saaty, 1990).

| Importance level of *i* over *j* [a] | Verbal scale |
|---|---|
| 1 | *i* and *j* are equally preferred |
| 3 | Weak preference of *i* over *j* |
| 5 | Net preference of *i* over *j* |
| 7 | Very strong preference of *i* over *j* |
| 9 | Absolute preference of *i* over *j* |

[a] *with 2,4,6, and 8 as intermediary values.*

AHP deals with heterogeneous data, since it is based on an ordinal scale to express actors' value judgements 4.4. Furthermore, AHP allows integrating several actors in the decision process (Saaty, 1990). Thus, this method appears to be suitable for complex problems facing uncertainties, multiple actors, and diverse types of data. Using this method for preliminary decision analysis provides two main benefits: i) illustrating actors priorities (i.e., weighting evaluation criteria) and their compatibility, and ii) verifying the adequacy of the problem structuring (i.e., hierarchical model constituted by value dimensions, criteria, and alternatives).

### 4.6.2 Searching a consensus

From the perspective of the Stakeholder Theory (evoked in chapter 3), the consensus between actors goes beyond mathematical aggregation. It entails a discussion about the power interrelationships between actors and their infl in the fi decision (Li et al., 2016; Macharis et al., 2012; Schillo et al., 2017). To address this issue, two solutions found in literature are developed in the following.

**Priority aggregation with AHP.** Given the fl y of AHP, it has been broadly implemented for guiding group or multi-stakeholder decision problems (Basak and Saaty, 1993; Escobar and Moreno-jiménez, 2007). The central question in multi-stakeholder decisions is the achievement of a consensus (Macharis et al., 2012; Dowling et al., 2016; Li et al., 2016). Mathematically, it means the aggregation of stakeholders' preference functions (Saaty, 1990; Igoulalene et al., 2015; Li et al., 2016; Schillo et al., 2017; Baudry et al., 2018). In AHP, there are two techniques to aggregate individual results, *aggregation of individual judgements* (AIJ) and *aggregation of individual priorities* (AIP) (Aczél and Saaty, 1983). On the one side, performing the AIJ implies to build a group pair comparison matrix by aggregating the individual judgements. Such an aggregation should be done using the geometric mean of the value judgements for each pair of elements of the hierarchy (i.e., the geometric mean, in contrast to the arithmetic mean, guarantee the respect of the reciprocity condition in the matrices) (Aczél and Saaty, 1983). Then, the priority vector is calculated as in the normal procedure by using the group judgement matrix. On the other side, in the AIP approach, the individual priority vectors are aggregated by using two possibilities, the arithmetic mean or the geometric mean (Aczél and Saaty, 1983). These methods are simple and work well for small and homogeneous decision groups. Otherwise, an effect of compensation between two values mathematically very diff t occurs. Two major issues can be observed in these aggregation methods. Firstly, the effect of compensation can provide unrealistic results that do not represent properly any actor preference. Secondly, both methods assume the same importance for all the actors, which is not always the case on real decision problems.

**Similarity-based priority aggregation using clustering technique.** Several clustering techniques are available and there is not a single solution for a determined typology of problem (Jain, 2010). Instead, a clustering technique should be selected in function of the problem nature, the objective of the clustering process, and the *a priori* knowledge about the data (Zahir, 1999; Jain, 2010; Srdjevic et al., 2013). Two main techniques can be distinguished, partitioning and hierarchical clustering. In the fi category, the *k*-means algorithm is one of the most used given its efficiency (Jain, 2010). This technique requires the defi of the number of cluster to be formed, as well as a random value (cluster centroid) to initiate the partitioning process. Considering the randomness of the initial point, each iteration of the algorithm results in diff ent clustering results. The hierarchical clustering technique does not require the specification of the number of clusters. Particularly, in the agglomerative hierarchical clustering, the process starts by considering each element of the data frame as a single cluster. Then the clusters are aggregated by calculating the shortest distance between them, and the process stops when all the elements are assigned to a cluster (Jain, 2010). At the end of the process, the hierarchical clustering technique provides a unique configuration of clusters for a given data set, represented in a dendrogram or tree-like graph. This technique is more appropriated for multi-stakeholder decision problems than the partitioning one, since does not require the defi *a priori* of the number of clusters, favouring the transparency of the decisional process. Moreover, since the result obtained is unique for a given context, it is more appropriated to analyse actors preferences.

**Actors' prioritization.** Li et al. (2016); Macharis et al. (2012); Schillo et al. (2017) highlight the need for ranking stakeholders in some complex situations, according to their degree of infl over the final decision. In collaborative decision process, the power interrelationships between actors can infl e the fi decision (Li et al., 2016; Macharis et al., 2012; Schillo et al., 2017). These authors highlight the need for ranking stakeholders in some complex situations, according to their degree of infl nce over the fi decision. For instance, Schillo et al. (2017) claims that stakeholder weighting reflects the importance of a given stakeholder to achieve the strategic goals of the focal organisation. This author propose the use of a Liker scale to determine the weights, by directly asking to the focal company. Li et al. (2016) use the framework proposed by Mitchell et al. (1997), in which a stakeholder importance is determined according to three criteria: power (P), legitimacy (L), and urgency (U). Similarly to Schillo et al. (2017), Li et al. (2016) use a Liker scale to calculate the stakeholder weights. In mathematical terms, the stakeholder weighting should be included into the aggregation results obtained from the AHP, obtaining diff t results in function of the stakeholder importance. The interest of using the framework proposed by Mitchell et al. (1997) is the standard base to judge the stakeholder importance. Table 4.5 describes the criteria of stakeholder importance according to Mitchell et al. (1997).

Table 4.5: Criteria of stakeholder importance (Mitchell et al., 1997).

| **Criteria** | **Definition** |
|---|---|
| Power | A relationship among actors, in which one of them can push another one to do something without a declared opposition. |
| Legitimacy | A general perception that actions or judgements issued by an actor are right and proper within a social system of norms and values. |
| Urgency | Degree to which an actor claims immediateness regarding a situation, based on its criticality and time-sensitivity. |

### 4.6.3 *i** Goal Modelling framework for problem structure modelling

There is a need for developing structured frameworks to model collaborative relationships among actors in early stages of the decision process. A system engineering based methodology as *i** could be useful to develop consistent and reusable models. Moreover, since *i** is a called social-modelling framework (based on actors and goals), it is possible to combine it with some insights from Stakeholder Theory in order to provide a organisational-oriented tool for multi-stakeholders decision making. Goal Modelling (GM) is an approach to requirement engineering developed to model socio-technical problems. It has been applied to business-related problems, precisely to support knowledge generation involved in organisational transformation (Yu et al., 2011). GM aims at capturing stakeholders' intentions and modelling strategic relationships (of dependence) between them. The central elements in this framework are the actors and their intentional elements (i.e., goals, soft-goals, tasks and resources). The interaction between actors and their intentional elements results in a set of dependence relationships. Such dependencies suppose reciprocal relationships of gains and losses, which needs making strategic decisions.

Figure 4.4 illustrates the *i** meta-model.

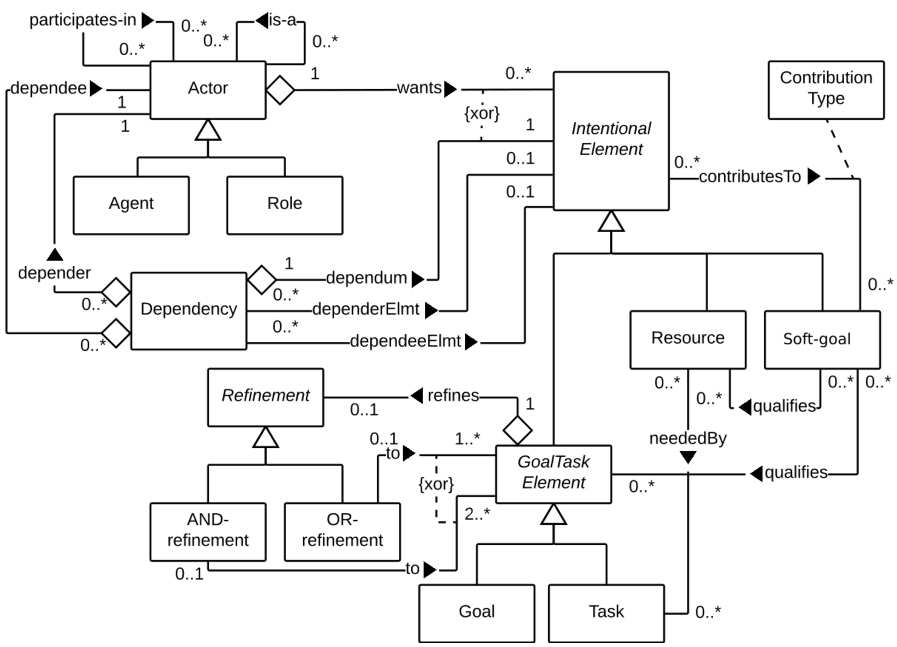


Figure 4.4: *i** meta-model (Yu et al., 2011).

**Elements on *i** framework.** It is composed by two abstract elements: intentional element, and actor. The intentional element is the abstract representation of goals, criteria, tasks and resources of a set of actors. The element actor represents the strategic stakeholders involved in the system and their relationships. Each actor has a corresponding role according to its function in the system. In the following, the main objects contained in the goal model are explained based on Dalpiaz et al. (2016).

- Agent: an actor with a concrete identity (e.g., an organisation, an individual)

- Role: the behaviour of an actor according to its specialized domain of competences.
- Goal: high-level intentions of strategic actors. What they want to achieve through the design of the system.
- Criterion: evaluates the level of accomplishment of a goal.
- Task: actions to be executed in order to achieve the determined goal.
- Resource: physical or informational elements required to perform a task.

**Notation on *i** framework.** There are two diff t notation families, one related to the element actor, and the other one to the intentional element. Actors association links can be *is-a* or *participates in*, and link a single actor to another single actor (figure 4.5). There exist dependence links between actors (figure 4.6) according to the type of *dependum* (goal, soft-goal, task or resource) (Dalpiaz et al., 2016). Intentional element are represented as shown in fi 4.7, and can be linked to another intentional elements (table 4.6, fi 4.8).

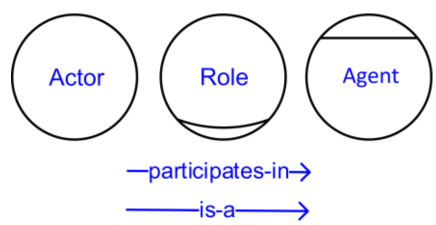


Figure 4.5: Actor notation and associations.

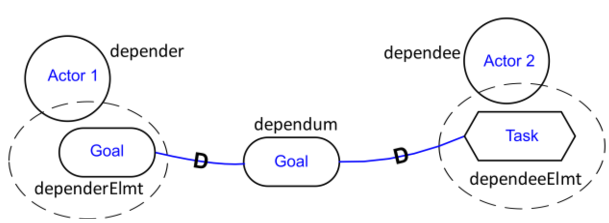


Figure 4.6: actors' dependence notation.


Figure 4.7: Intentional element notation.

Table 4.6: Associations between intentional elements.

| From/to | Goal | Soft-goal | Task | Resource |
|---|---|---|---|---|
| **Goal** | Refinement | Contribution | Refinement | n/a |
| **Soft-goal** | Qualification | Contribution | Qualification | Qualification |
| **Task** | Refinement | Contribution | Refinement | n/a |
| **Resource** | n/a | Contribution | NeededBy | n/a |

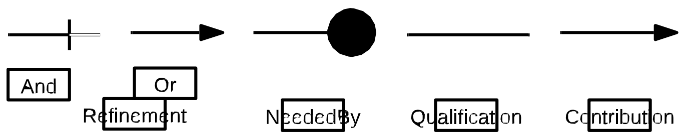


Figure 4.8: Representation of intentional element associations.

## 4.7 Conclusions

The objective of this chapter is to provide the conceptual basis to address the problem of sustainable value creation in the context of multiple value dimensions and multiple stakeholders. Based on the research questions guiding this chapter, the following conclusions are drawn out:

- *RQ1. What are the existing approaches addressing multi-stakeholder and multidimensional decision situations in industry?.* Several approaches to guide a multi-stakeholder and multi-criteria decision situation are available in the literature. In general, the existing methods are classified into multi-attribute utility, outranking and compromise oriented techniques. The selection of a method depends on the nature of the problem (i.e., choice, outranking, classification, etc.); the type of available data (e.g., whether alternatives, criteria, and actors are known from the beginning of the process or not; qualitative or quantitative data, etc.); and the power relationships between the actors (i.e., whether all the actors have the same importance in the decision process or not). The preferred methods are those easy to use, and which facilitate actors' learning and participation. Based on those criteria, one of the most used methods in the context of sustainability-related projects an supply chain management is the Analytic Hierarchy Process (AHP) (Saaty, 1990; Chai et al., 2013). This multi-attribute utility method is particularly interesting for modelling unstructured decision situations.

- *RQ2. How to model multi-stakeholder and multidimensional decision situations in the context of sustainable value creation?.* The literature reveals that most of the sustainability-related projects entails complex decision situations, including several actors and conflicting goals. This type of situations need to be modelled (i.e., visual representation) before applying a specific MCDA method, which allow the collective understanding, and reduce the probability to get incoherent decisions or results. It exists a literature stream known as Problem Structure Modelling (PSM), proposing techniques for modelling unstructured problems. Some of the PSM techniques are based on of system engineering, enabling knowledge capitalisation and transfer. For modelling unstructured problems, a system engineering-based framework called *i** (*i-star* appears to be suitable (Yu et al., 2011)). This framework allows capturing stakeholders' intentions and modelling their strategic relationships of dependence.

- *RQ3. How to achieve a consensus between conflicting multi-stakeholder expectations in collaborative decisions?.* Achieving a consensus is a major issue in multi-stakeholder MCDA, but also a big challenge. Mathematically, there exist several methods to aggregate individual priorities, obtaining almost satisfactory results. Nevertheless, the multi-stakeholder approach goes beyond arithmetic aggregation, and it is rather concerned with social agreement. To this end, the Stakeholder Theory provides some insights that enable the incorporation of stakeholder weighting into the selected MCDA method. Hence, the criteria of power, legitimacy, and urgency are adopted from Mitchell et al. (1997), with the aim of capturing the voice of the stakeholder in the decision process.

# Part III

# Proposal development

# Chapter 5

# Framework to support sustainable value creation in collaborative innovation

## Contents

## 5.1 Introduction

The preceding chapters presented the conceptual basis of this thesis work. This chapter aims at developing the methodological proposal for the analysis and decision-making around the creation of sustainable value in collaborative businesses. Following a step-by-step approach, the elements retained from the literature and adapted to the context of sustainable value creation are integrated into a holistic methodological framework presented in fi 5.1. Four main phases are included in the proposed framework: i) value creation analysis, ii) value alignment model, iii) preference modelling, and iv) consensus process. Each phase is refined into sub-stages, which are developed along the chapter.

The fi phase aims at performing an internal analysis of the focal company, considered as a system of value creation. Three levels of analysis are considered: external environment, strategical level, and operational level. Although, the value analysis is placed into the operational level of the company, it is infl by the strategic level and the external environment. Precisely, the notion of value is analysed following three elements: value proposition, value structure, and value creation. The output of this phase is the identification of relevant stakeholders, and the characterization of value creation in terms of needs of the focal company along the life cycle. The company needs are expressed as strategic objectives.

The second phase allows moving from the internal to a collaborative analysis. Here, the needs of the focal company are confronted with the external relevant actors. Then, a two-fold modelling methodology is performed to identify the convergence between customer needs (value expectations) and providers capabilities (value propositions). The output is a set of criteria supporting the measurement of strategic objectives of the focal company, and a set of feasible alternatives proposed by the providers.

The third phase uses as inputs the actors, the criteria, and the alternatives defi in the previous phases. With these elements, the Analytic Hierarchy Process (AHP) is implemented to model actors' priorities with respect to the criteria set and alternatives. The output of this phase corresponds to the declared priorities of the strategic actors regarding sustainable value creation model.

The fourth and last phase corresponds to a consensus process. Here a conflict analysis is approached through a clustering technique, and a process of actors' prioritization is proposed to guide the strategic decisions. Then, the degree of acceptance of the actors regarding the possible decisions is measured, and some recommendations are presented.

The proposal aims at contributing to the following research axes, introduced in detail at the beginning of this thesis work:

**Research axe 1** – Exploring sustainable value creation opportunities within a company and the effects on its internal and external organizations.

**Research axe 2** – Modelling the collaborative innovation process between multiple actors to enable sustainable value creation.

**Research axe 3** – Conducting value assessment in collaborative business models innovation.

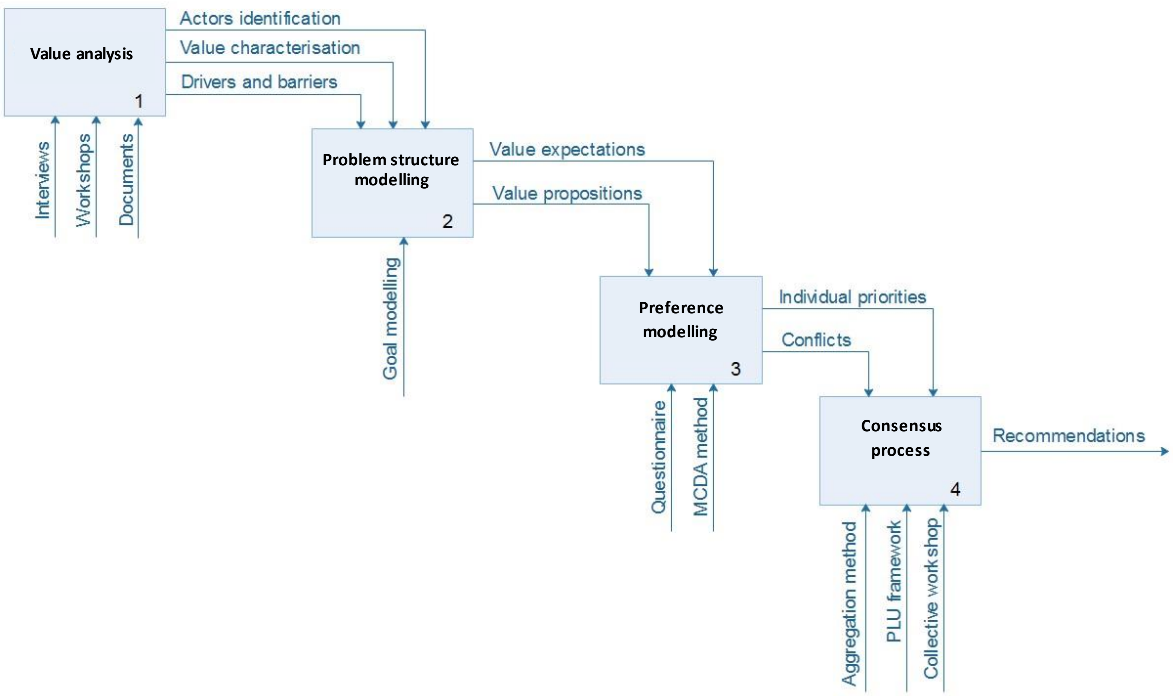


Figure 5.1: Overview of the proposal.

# 5.2 Value creation analysis

This phase has a threefold aim. Firstly, identifying external pressures that trigger sustainable value creation into a company. Secondly, analysing the infl of decision-makers on pursuing sustainable value creation. Thirdly, drawing out a set of value propositions and actors' configurations, which enable sustainable value creation.

## 5.2.1 Stakeholder analysis

This step aims at defi the set of relevant stakeholders that should be integrated to the collaborative project. According to the Stakeholder Theory (Freeman et al., 2010), stakeholders exist at three diff t levels, as follows:

- **Focal-firm level:** company's shareholders, managers and employees.
- **Operating environment:** suppliers, customers, competitors and fi intermediaries.

- **External environment:** sociocultural forces (e.g., local communities, activist groups), political/legal forces (e.g., governmental entities), and technological change (e.g., innovation entities).

In this stage of the methodology, the stakeholders should be identified for each stage of the life cycle, considering the context and the scope of the collaborative project. It should be noticed that the consideration of life cycle is a prerequisite for the development of sustainable innovative offerings, in contrast to traditional product-based ones (Vezzoli et al., 2014).

**Interest of the stakeholder analysis.** Including all the relevant stakeholders to the process of sustainable value creation has two main objectives, from the relational and instrumental points of view. From the relational perspective, it allows mitigating the resistance that some stakeholders can impose to the project development. From the instrumental perspective, it facilitates the access to new resources and knowledge necessary for the project development. Concerning this thesis work, the stakeholder theory contributes with its supporting framework to analyse stakeholders relationships, which have been largely accepted and tested in diff t industrial contexts. Moreover, it is suitable to innovative and sustainability related projects, since it integrates a strategic vision of the stakeholder management, with the aim of equitably creating value (Freeman et al., 2010).

### 5.2.2 Value characterisation

In this stage, the factors of value creation are analysed according to three elements: value proposition, value structure, and dimensions of value creation. The framework of Boons and Lüdeke-Freund (2013) has been enriched with literature on innovation and sustainability, resulting in a generalized framework for value analysis (figure 5.2). This conceptual framework allows analysing current and future value systems throughout the lens of value creation. There are three levels of analysis in the framework, external environment, strategic and operational levels.

**External environment.** Concerns the external pressures (market behaviour, legal context, etc.) the company is confronted with. It allows identifying the factors triggering the transformation of a given model of value creation. According to Freeman et al. (2010), external pressures can be legal, coercive, technological, or market-related.

- **Legal pressures:** come from the governmental stakeholders.
- **Coercive pressures:** are exerted by organisations and communities claiming specific rights in front of the business activity.
- **Technological pressures:** are induced by competitors or knowledge development in a specific industrial sector.

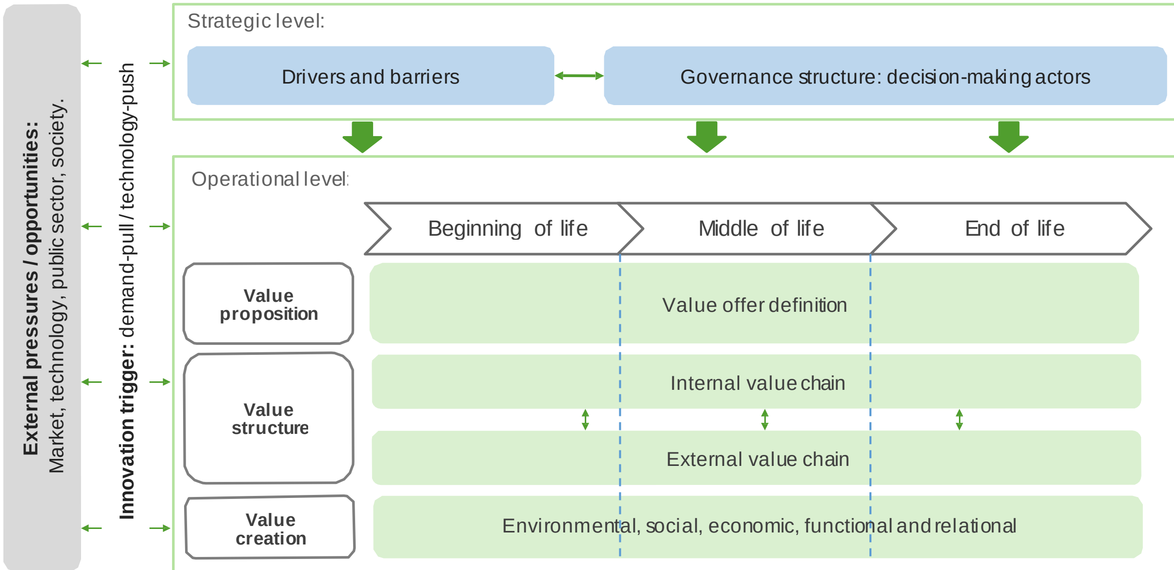


Figure 5.2: Sustainable value creation model framework (Orellano et al., 2018b,a).

- **Market pressures:** emerge with a change on the consumer behaviour, provoking new market needs.

Identifying the nature of external pressures guides the development of the company's strategy.

**Strategic level.** The internal strategic objectives, drivers, and barriers conditioning the system of value creation are identified. Moreover, the governance structure (i.e., decision-makers) is defi This phase allows to defi the strategic objectives of the company to guide the operationalization of value creation. Particularly, it is necessary to include all the decision-makers, who are the promoters of the organizational transformation towards sustainability.

**Operational level.** It covers the value proposition, the value structure and the value creation, and their dynamics along the life cycle.

- **Value proposition:** is related to the offer developed to fulfil specific customer needs. We consider that at the beginning of life (BOL), the value proposition is likely to be a product-oriented offer, in which the product has an important role and it is surrounded by a set of services. At the middle of life (MOL) and at the end of life (EOL), the value proposition evolves, and services gain an important role.

- **Value structure:** refers to the set of internal and external actors involved in the required processes and the relationships between them. On the one side, the needs for intra-organisational collaboration (across the diff rent functions) should be identified.

  On the other side, the dynamic perspective induced by life cycle vision, allows designing collaborative actors' configurations following a modular logic. It means that for each phase of the life cycle, it could exists diff t partnerships according to the needs in terms of resources, skills, and activities. This analysis allows identifying the degree of integration of each actor according to the life cycle phases. It is conditioned by the degree of trust, maturity, and power positioning of the actors.

- **Value creation:** concerns the performance of the business activity along the life cycle, in terms of the fi e value dimensions defi in chapter 2 (i.e., economic, environmental, social, relational and functional). These dimensions of value evolve through the life cycle phases and depend on the actors involved.

The output of this phase is a global overview of the value creation from the focal company perspective. It is summarized in terms of expected value propositions, needs for internal and external actors' configurations, and needs for value creation expressed as company's strategic objectives.

**Interest of the value characterisation model** A dynamic vision of the value creation system contributes to frame the complexity, uncertainty and unpredictability of a given business sector. It helps to react to changes in the external environment (e.g., evolution of sustainability exigencies), in a faster and appropriate way. Furthermore, adopting the life cycle vision allows analysing the elements of the value creation model in each phase, and enabling iterative feedbacks between them.

## 5.3 Problem structure modelling

### 5.3.1 Value alignment framework

This phase aims at confronting customer needs with providers' innovation capabilities. We propose a generic two-fold approach illustrated in fi 5.3. The model establishes the link between actors' strategic objectives (expressed here as value expectations), and operational capabilities of the provider network (value propositions), seeking for a strategic value alignment. Since this thesis work aims at supporting early stages of innovative offers development, there is neither a set of well-defined value propositions (alternatives), nor a predefi set of criteria to evaluate them. The aim of this step is to represent and generate suitable alternatives for sustainable value creation, based on the customer needs. The elements of the model are explained in the following.

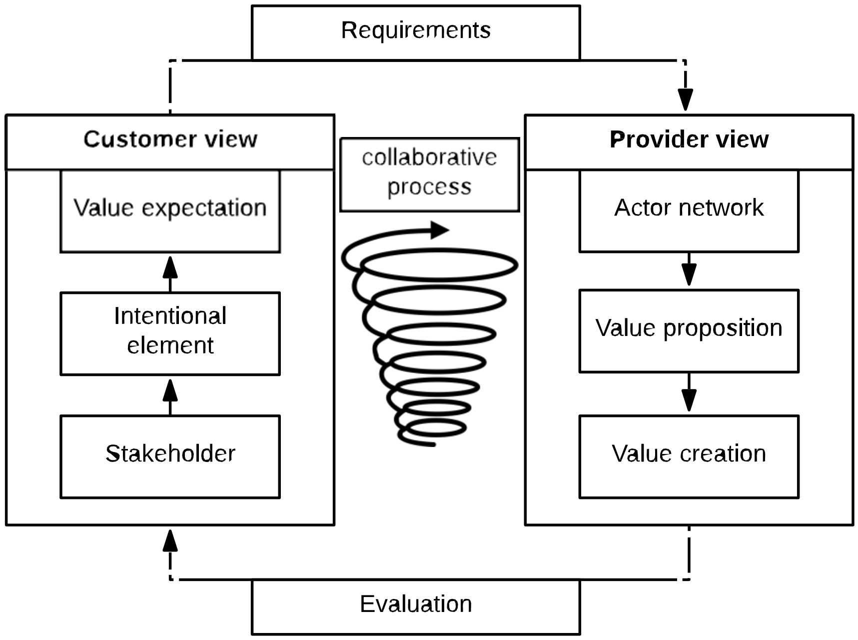


Figure 5.3: Generic framework for collaborative offer development (Orellano et al., 2019a).

**Customer view.** The left side of the model contains the customer view of the value co-creation process. It covers three elements: value expectation, intentional element, and actor. The element value expectation represents the benefits that the customer expects from the innovative offer development. The intentional element is the abstract representation of strategic goals of the customer in relationship with the offer development. Finally, the element actor represents the decision-makers involved in the collaborative process. The output of the goal model are the customer value expectations, translated into strategic objectives.

**Provider view.** The right side of the model represents the operational view of the process of value co-creation, deployed by the providers. The core element is the set of value propositions enabling the fulfilment of customer needs or value expectations. Value propositions are the means to achieve value creation, decomposed into the fi e dimensions of value.

**Collaborative process.** The collaborative process between customer and providers takes place in three main stages corresponding to the innovation development: inception, ignition, and implementation (reported in chapter 3). Each actor has a boundary space and a shared space of interaction determined by the interdependence relationship. Our framework is positioned in the inception and ignition phases of the collaborative process, the early stages of innovation development from the strategic point of view. The operational development of the offer corresponds to the next stages, which are not covered in this thesis work.

The value alignment framework is operationalized throughout a formal system modelling language belonging to the Goal Modelling methodologies. A specific modelling framework called *i** has been selected to visualize actors interdependence relationships (introduced in chapter 4). The *i** modelling process is carried out with the aid of the software OpenOME. The resulting models allows to identify the set of criteria refining the strategic objectives of the customer, as well as the feasible alternatives matching those criteria. The following sections describe the process for building criteria and alternatives.

**Interest of the value alignment model and the goal modelling framework.** The main idea behind the proposed two-fold logic of the value alignment model is to confront customer needs to provider capabilities, leading to feasible value propositions or alternatives. The modelling framework helped to visualize the information coming from the diff t actors in early steps of the offer development. This visualization enabled to have more informed decisions and facilitated a transparent communication between the actors.

### 5.3.2 Criteria definition

Based on the outputs from the value analysis and the value alignment model, the evaluation criteria can be defi According to the decision-aiding principles (Keeney, 1996), and to recent empirical research (see for instance, Baudry et al. (2018)), criteria can be defi following two main approaches:

- **Bottom-up:** consists on analysing the consequences of real or hypothetical alternatives, which elucidate the necessity to consider a determined set of criteria.
- **Top-down:** the process is carried out from prior defi strategic objectives, which are gradually refined into criteria.

We consider both approaches as complementary, and adopt a stakeholder-based approach for the criteria defi performed through focus group methodology (Brown et al., 2019). Hence, the key internal stakeholders (customer view) should defi the criteria based on two inputs: i) a consequence analysis of the current model, from the company knowledge and supported by literature review, and ii) a refinement of the company's strategic objectives into evaluation criteria, sub-criteria... indicators (i.e., depending on the level of available information). Table 5.1 presents the methodological guide to be completed by the participants.

The participants in the focus group should design a set of criteria following the rules of completeness, non-redundancy, operationality, minimality and homogeneity (detailed

Table 5.1: Criteria building template.

| **Value dimension** | **Consequence analysis** | **Strategic objectives** | **Criteria** | **Sub-criteria** | **Indicator** |
|---|---|---|---|---|---|
| (E) Economic | List of negative impacts of current model | $SO-1$<br>$SO-i$<br>...<br>$SO-n$ | $C-1$<br>$C-i$<br>...<br>$C-n$ | $SC-1.1$<br>$SC-1.i$<br>...<br>$SC-1.n$ | $I-1.1.1$<br>$I-1.1.i$<br>...<br>$I-1.1.n$ |
| (N) Environmental<br>(S) Social<br>(R) Relational | : | : | : | : | : |
| (F) Functional | : | : | : | : | : |

in chapter 4). The fi e dimensions of value defi in chapter 2 constitute the starting basis for criteria defi

### 5.3.3 Alternative identification

In this step, a participatory approach is suitable to generate the alternatives or value propositions (allowing interaction between the customer and the provider). Based on insights from innovation literature (reported in chapter 3), this approach is pertinent in the context of offer innovation, taking as starting point the customer unmet needs, and collaboratively building possible solutions (Calabrese et al., 2018).

The customer criteria, built in the previous step, are the input to start alternatives generation process, as follows:

- Each criterion is translated in terms of innovation type (i.e., offer-oriented, technological, or organisational).
- A brainstorming of value propositions is conducted, regarding customer criteria and innovation type.
- The potential value propositions are analysed in terms of maturity and barriers for further development, depending on their current state (i.e., idea, prototyping, or production).
- Finally, the feasible value propositions are selected through an agreement between the customer and the providers.

Table 5.2: Alternative generation template.

| VD[a] | Customer criteria | Innovation needs | | | Value propositions | Innovation stage | | |
|---|---|---|---|---|---|---|---|---|
| | | Offer | Tech. | Org. | | Idea | Prototyping | Production |
| E | $C-1$ | to be marked as "X" | | | $VP-1$ | to be marked as "X" | | |
| | $C-i$ | | | | $VP-i$ | | | |
| | ... | | | | ... | | | |
| | $C-n$ | | | | $VP-n$ | | | |
| N | ⋮ | ⋮ | | | ⋮ | ⋮ | | |
| S | | | | | | | | |
| R | | | | | | | | |
| F | ⋮ | ⋮ | | | ⋮ | ⋮ | | |

[a] VD = Value dimensions; E=Economics; N=Environmental; S=Social; R=Relational; F=Functional

## 5.4 Preference modelling

This phase is deployed by using a multi-criteria decision analysis method (MCDA). The selected method to perform the preference modelling is the Analytic Hierarchy Process (AHP). This method is suitable for three main reasons: i) systematic calculation of criteria priorities, ii) consideration of subjective information in a systematic way, and iii) possibility to be coupled with other MCDA methods, enabling fl y (further detailed in chapter 4).

This phase seeks for the analysis and quantification of the actors' preferences with respect to the elements considered on the decision situation, namely, criteria and alternatives. The preferences about the criteria express the basis from which actors desire to evaluate the alternatives. The preferences about the alternatives express the global degree in which an alternative *i* satisfies the set of criteria.

To perform the preference modelling, it is necessary to determine a sub-set of actor named "evaluators", and the means to collect the information about their preferences (i.e., verbally expressed for pragmatic ease). These elements are detailed in the following sections.

### 5.4.1 Preparation

**Actors selection.** This stage aims at selecting key actors to perform the evaluation process, named "evaluators". At a prerequisite, the actors should belong to one of the stakeholder groups defi ed at in the fi phase: focal-firm, operating environment, or external environment (see chapter 5, subsection 5.2.1). Then, the selection of evaluators is performed based on two criteria: i) strategic positioning on the project development, and ii) expertise on the decisional domain (experimental or academic knowledge).

**Questionnaire building.** The questionnaire approach has been selected as a viable methodology to collect the information from the evaluators. An on-line questionnaire represents a suitable option, since it enables an easy diffusion, data capitalization, and data transfer (e.g., ability to use and to process the data with other informatics tools).

To successfully implement AHP in and industrial context, the questionnaire should: i) follow the hierarchical structure of AHP in the questions, and ii) use only the verbal scale for the pairwise comparison process.

### 5.4.2 Performing the evaluation process

**Pairwise comparison matrices.** Following the AHP theory, the evaluation phase consists on a pairwise comparison between the elements of each level of the AHP hierarchy. To this end, the ordinal scale proposed by Saaty (Saaty, 1990) is implemented, resulting into a set of judgements $a_{ij} \in \{1, 9\}$ (reported in 4).

To remind, the pairwise comparison process takes into account the following mathematics rules:

- For $n$ elements, a matrix $A \in \mathbf{R}^{n \times n}$ of comparisons is obtained, which is positive and reciprocal.
- Only $n \times (n-1)/2$ comparisons are needed, taking into account that $a_{ii} = 1$ and $a_{ij} = 1/a_{ji}, \forall i \in \{1, \cdots, n\}$. Where $a_{ij} \in \{1, 9\}$ is the relative importance of the element $i$ over the element $j$ with respect to an element $k$ in the next level up on the hierarchical model.

$$A = \begin{pmatrix} 1 & a_{ij} \\ 1/a_{ij} & 1 \end{pmatrix}$$

This process results in a set of judgements matrices $A \in \mathbf{R}^{n \times n}$ for each level of the hierarchical model and for each individual actor.

**Priority calculation.** To calculate the priorities, it is necessary to normalize the values on the columns of each matrix $A$, then calculate the average of the rows, obtaining the called *eigenvector* or priority vector Saaty (1990). The vectors are obtained from equation 5.1.

$$w_i = \frac{\sum_{j=1}^{n} \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}}{n}, \forall i \in \{1, \cdots, n\} \tag{5.1}$$

Then, given an alternative $j \in \{1, \cdots, m\}$ with a priority vector $\mathbf{v}_j$, its global priority $P$ is calculated from the following equation 5.2:

$$P = \sum_{i=1}^{n} w_i \times \mathbf{v}_j, \forall j \in \{1, \cdots, m\} \tag{5.2}$$

At the end of this process, the individual priorities of criteria and alternatives are obtained for each actor $j$.

**Verifying consistency ratio of comparison matrices.** Once the priorities are calculated, the consistency of the matrices should be verified. To this end, AHP proposes the *eigenvalue* method Saaty (1990). The consistency ratio ($CR$) is calculated from equation 5.3, and using the random consistency indexes established for reciprocal matrices ($RI$), presented in table 5.3.

$$CR = \frac{\frac{\lambda_{max}}{n-1}}{RI}, \tag{5.3}$$

where $n$ is the number of compared elements, and $\lambda_{max}$ is the maximum value among the eigenvalues of the judgement matrix $A \in \mathbf{R}^{n \times n}$, and can be obtained from equation 5.4.

$$\lambda_{max} = \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} \times w_j \tag{5.4}$$

where $a_ij$ is the initial judgement value between the elements $i$ and $j$, and $w_j$ is the priority of the element $j$.

Table 5.3: Random indexes of reciprocal matrices.

| $n$ | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| $RI$ | 0,58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 |

A judgement matrix is consistent when $CR \leq 0.1$ (Saaty, 1990). In case of inconsistent matrices, the corresponding evaluations should be either repeated or rejected from the fi analysis. Typically, inconsistencies reflect unclear or poor modelling of the decision problem, a lack of knowledge from the evaluator, or a lack of accuracy during the evaluation process.

Given the exploratory nature of innovation problems related to sustainability, we consider important to keep inconsistency matrices as an input for further analysis of the decision situation. For instance, information provided by inconsistent matrices can be useful to discuss the limits of the decision model and improve it (e.g., criteria clarity, elimination or inclusion of new alternatives, among others), but also to develop training programs for industrial actors.

## 5.5 Researching a consensus

This phase presents a guideline to facilitate the consensus process between industrial actors, considering the context of collaboration for sustainable value creation. As introduced in chapter 4, in multi-stakeholder MCDA problems, a fundamental aspect is achieving a consensus between divergent points of view. AHP proposes two simple methods, the aggregation of individual judgements (AIJ), and the aggregation of individual priorities (AIP). Nevertheless, the main disadvantage of these methods is the effect of compensation between two values mathematically very different. To deal with this issue, we propose on the one side an analytical approach based on a clustering technique to support further consensus building. Then, on the other side, a pragmatic approach based on actors' prioritization through weighted arithmetic mean.

**Interest of adopting a stakeholder-approach in the consensus process.** Considering individual actor positioning during the consensus process evokes the perspective of the Stakeholder Theory of Freeman et al. (2010) (chapter 3). Here, the consensus between actors' priorities goes beyond a mathematical aggregation. It entails a discussion about power interrelationships between actors and the individual infl ce on the fi decision (Li et al., 2016; Macharis et al., 2012; Schillo et al., 2017). In the following, two ways to facilitate a form of consensus are described.

### 5.5.1 Clustering process

This step is related to the problem of conflict analysis stated in the literature about group decision-making (Li et al., 2016; Dowling et al., 2016). The aim of the clustering process is to reveal actors' positioning with respect to a determined set of sustainability-oriented strategies.

**Building similarity matrices.** Before performing the clustering process, it is necessary to build a set of similarity matrices, which are the input to perform the clustering procedure. Each similarity matrix is built from the pairwise comparison between the individual priority matrices of the actors. The process is applied to each level of the hierarchical model. The similarity is be calculated by applying the following equation (Giordano et al., 2007):

$$S_{ijk} = 1 - |w_{ik} - w_{jk}|, \tag{5.5}$$

where $S_{ijk}$ is the similarity degree between the priorities of actor $i$ and actor $j$ regarding the element $k$. And, $w_{ik}$ and $w_{jk}$ are the priorities of the element $k$ judged by the actors $i$ and $j$, respectively. Here, $0 \leq S_{ijk} \leq 1$, being 1 the maximum value of similarity between two actor's priorities, representing equal opinions. A set of symmetric matrices $B \in \mathbf{R}^{n\times n}$ are obtained, with $n$ being the number of actors compared. Then, an aggregated similarity matrix is generated, calculating the arithmetic mean of the set of similarity matrices for the elements being judged (e.g., criteria and alternatives). The resulting matrix is:

$$B = \begin{bmatrix} \overline{S}_{11} & \cdots & \overline{S}_{1n} \\ \vdots & \ddots & \vdots \\ \overline{S}_{n1} & \cdots & \overline{S}_{nn} \end{bmatrix}, 0 \leq S_{ij} \leq 1$$

**Applying clustering technique.** The hierarchical clustering technique has been selected to perform this step. As reported in chapter 4, this technique is more appropriated for multi-stakeholder decision problems than the partitioning one, since does not require the defi *a priori* of the number of clusters, favouring the transparency of the decisional process. Moreover, since the result obtained is unique for a given context, it is more appropriated to analyse actors preferences.

Firstly, using the aggregated similarity matrix, a distance matrix should be calculated. This can be computed automatically using *R Studio*, throughout the following steps:

- Generating the distance matrix.
- Implementing agglomerative hierarchical clustering technique to generate the clusters.
- Calculating the distance in each clustering iteration using the ward's minimum variance method or any other desired method (see chapter 4).
- Finally, the clusters can be represented as a dendrogram (tree-like graph).

Using the dendrogram representation, one can identify the actors' sub-groups. The dendrogram is interpreted based on the $y - axis$, which represents the distance at which two points are assigned to a cluster (Jain, 2010). The shortest distance, the biggest similarity between the two points. The simplest rule to choose the number of clusters from the dendrogram consists on drawing an horizontal line at a height in which the maximum distance up and down is reached without intersecting any merging point (Jain, 2010). However, selecting the number of clusters depends also on the knowledge about the problem and the data.

**Identifying decisional profiles based on sustainability.** The resulting clusters can be compared and assigned to one of the three sustainability decisional profi supported by literature on sustainability (Pope et al., 2004; Vezzoli et al., 2014), aforementioned in chapter 2: eco-efficiency, societal, and triple bottom line (TBL).

- **DP1- Eco-efficiency:** the vision of sustainable value creation is product-oriented, focusing on the functional dimension of value as a means to achieve environmental sustainability.

- **DP2- Societal:** in this decisional profi environmental and social dimensions are the priority along the innovation process. Sustainable value creation corresponds to the global standards related to environmental protection and social well-being.

- **DP3- Triple bottom line (TBL):** in sustainability literature, this profi can be aligned to the weak sustainability approach. It allows the compensation between the diff t dimensions of value, which supposes achieving gains on one dimension by degrading another one.

**Priority aggregation according to the sustainability decisional profile.** All the priorities of the actors belonging to a specific decisional profi should be aggregated by using one of the two aggregation methods of AHP, namely AIJ or AIP. It corresponds to the geometric mean of the judgements or the arithmetic mean of the priorities, respectively. Then, a priority vector $\boldsymbol{v}_p$ is generated for each decisional profi $p$.

**Interest of sustainability-oriented decisional profiles.** The decisional profi provide a characterisation of actors' interests, which can be considered as a base for further discussion and negotiation. In any case, the decision-makers should take a specific positioning guiding the fi decision, seeking for the highest possible collective acceptance. It is possible to obtain some clusters out of the three decisional profi Such a case probably reflects a lack of engagement of a given actor or group of actors with respect to the sustainability goals. Thus, "isolated" actors profi can provide precious information about the weak points in the CSR (Corporate Social Responsibility) strategy of a given company. For instance, it can be useful to design communication strategies or training programs related to sustainability for the company employees.

## 5.5.2 Actors' prioritization

**Calculating preferences based on heterogeneous actor prioritization.** Considering the case of heterogeneous actor importance, we propose to use the $(P, L, U)$ framework proposed by Mitchell et al. (1997) (introduced in chapter 4), derived from the stakeholder theory. This framework defi the stakeholder importance according to the level of power ($P$), legitimacy ($L$), and urgency ($U$) in relation to the decision problem. For instance, according to the three decisional profi defi above, the actors can be prioritized diff tly.

The importance of each actor can be calculated using a 1 to 5 licker scale (where 1 = very low and 5 = very high) as suggested and applied by Li et al. (2016); Schillo et al. (2017). The importance coefficient $\mu_i$ of the actor $i$ is calculated from equation 5.6:

$$\mu_i = \frac{P_i + L_i + U_i}{\sum_{j=1}^{n} (P_j + L_j + U_j)}, \forall i \in \{1, \cdots, n\} \tag{5.6}$$

Finally, the aggregated priority of a given element $j$, considering all the actors, is calculated through equation 5.7.

$$P_j = \sum_{i=1}^{n} \mu_i \times p_{ji}, \forall j \in \{1, \cdots, n\}, \tag{5.7}$$

where, $p_{ji}$ is the individual priority of the element $j$ judged by the actor $i$.

## 5.6 Conclusions

This chapter presented a methodological framework supporting sustainable value creation in collaborative business contexts. The proposal is described following a step-by-step approach, which favours the clear understanding and the reproducibility in diff t industrial contexts. Two main objectives guided the development of this chapter, on the one side, describing the diff t methods supporting the proposal, and on the other side, exhibiting the harmony between the diff t phases of the methodological framework.

The proposal covers four main phases, which are divided into specific stages. Each phase is supported by diff ent frameworks issued from the literature review and an analytical effort to consolidate them into a holistic framework. First, a called *value analysis* phase helps to characterise the elements of value creation, namely value proposition, value structure and value dimensions. Moreover, it enables the identification of value creation opportunities from the point of view of the focal company. Then, the second phase named as *Problem structure modelling* introduces a two-fold modelling framework aiming at confronting customer needs with providers' capabilities, resulting in the selection of feasible value propositions. The third phase corresponding to the *preference modelling* is supported on the Analytic Hierarchy Process (AHP), and aims at capturing actors' subjective preferences with respect to a set of criteria and alternatives. Finally, the fourth phase consists on a *consensus process*, allowing to take into consideration individual opinions, favouring the negotiation process. Specially, in this phase, different decisional profi have been identified from literature review on sustainable value creation, crossed with the preference modelling results to get rigorous insights.

The result of this holistic proposal is a powerful tool facilitating knowledge generation and decision aiding in complex innovation projects, specifically oriented towards sustainability issues. The entire methodology helps to structure a decision situation from the very beginning of customer's needs expression. Furthermore, it provides a systematic set of coupled methods that help to reduce the problem complexity until the achievement of a satisfactory solution. The proposal is useful to support the early development stages of innovative offerings from a strategic perspective. The scope of the proposal does not address the operational development of the offers.

In the next chapter, the holistic framework is applied to a real case of innovation development, illustrating the framework applicability and usefulness for guiding strategic decisions.

# Chapter 6

# Framework application to the case of ICOVET project

## Contents



## 6.1 Introduction

Chapter 5 presented the methodological development of the proposed framework. In this chapter, the framework is applied to the case of EDF (*Electricité de France* in French), a large-sized company in France, involved in a collaborative project of innovation for sustainability. EDF is the main producer and distributor of energy in France. In 2017, the company launched a two-years innovation project called ICOVET concerned with the transformation of its safety clothing system. The aim of the project is to move from a product-based offer towards a global solution. The problem faced in ICOVET project is a non-typical example of innovation development for three major reasons. Firstly, the innovation in this case is triggered by the customer (EDF) instead of the provider, corresponding to the demand-pull approach to innovation (see chapter 3). Secondly, since the desired offer is not available in the market, it pushes EDF to develop a radical innovation in collaboration with current and potential providers. Thirdly, the expected offer seeks for the creation of sustainable value. Considering the above characteristics, the decision problem faced by EDF is a complex strategic problem that implies a global management of its safety clothing supply chain. Moreover, the collaborative dimension is essential to the project, integrating economic and non-economic actors.

## 6.2 ICOVET project description

EDF (*Electricité de France*, in French) is the main producer and distributor of energy in France, and a leading company on the world in the energy sector. Given the safety risks associated to the company's activity, one of the most important support processes of the company is the provision of safety clothing to the employees. About 44000 employees of EDF-France wear safety clothes and should be re-provisioned each year. It represents near six millions € of purchasing and almost 300 tons of material at the end of life per year (data obtained from EDF purchasing reports).

From a general perspective, the textile industry is one of the largest on the world in terms of production and contribution to the global employment (Karthik and Gopalakrishnan, 2014). The textile supply chain is categorised as a global supply chain, since it includes several actors geographically dispersed. According to ADEME (*Agence de l'Environnement et de la Maîtrise de l'Energie*, in French), at 2010, 60% of the textile consumption in the European Union (EU) has been imported from China, Turkey, India, Bangladesh, and Tunis [1]. This implies critical issues concerning sustainability and business ethics at the three stages of the life cycle. According to Karthik and Gopalakrishnan (2014), the production of safety clothing, primarily in cotton, is characterised by the consumption of huge amounts of water, energy and a variety of chemical products that pollute air and water. Furthermore, the consumption in developed countries as France implies long-circuits transportation, translated into a high carbon footprint. Finally, the principal mechanisms at the end of life of safety clothing in France is the incineration, which involves sanitary risks for the surrounding communities. [1]To mitigate the inherent risks linked to the textile value chain, the Ministry of ecology, sustainable development and energy of France launched a decree on 2017 to improve the regulation of textile waste treatment [2]. Other requirements regard the beginning of life, in which the main determinants comprehend the use of sustainable fi best production practices, limited use of dangerous substances, and extension of the products lifespan. Certainly, these legal aspects impact the functioning of European companies engaged in Corporate Social Responsibility (CSR) policies.

Considering the above panorama, the purchasing direction of EDF launched a two-years project of innovation called ICOVET (*Innovation Collaborative des Vêtements de Travail*,

[1] http://www.ademe.fr/ecolabel eu

[2] for further information, see: https://www.legifrance.gouv.fr/

in French), over the period 2017-2019. The aim of the project is to transform the current system of safety clothing by considering its entire life cycle. Pragmatically, the company aims at moving from traditional product purchasing towards the acquisition of a global solution, which fi the best the CSR strategy of the company. The project involves several members of EDF group, some of them are Enedis, *Electricité de Strasbourg*, and EDF luminus, and the direction of purchasing is the project leader.

## 6.3 Research methodology

The research-intervention framework proposed by David (2000) has been adopted to guide the deployment of ICOVET project. In this approach the knowledge is generated from the iterative confrontation between theory and reality. The empirical research starts by setting the customer needs and corresponding objectives, then identifying key actors, and fi , drawing out a set of possible alternatives in collaboration with the providers. Then, Problem Structure Modelling (PSM) and Analytic Hierarchy Process (AHP) are applied. Finally, several points of view of actors resulted on divergent results, which are analysed and conciliated following a consensus process, completing the holistic framework application.

Hence, the theoretical effort presented in Part II has been developed in parallel with an empirical work in EDF, structured in three main phases: i) context analysis, ii) defi of the future model, and iii) transformation of the purchasing strategy.

### 6.3.1 Development phases

**Context analysis (Sept. 2017 – March 2018).** the aim of this phase is the identification of key internal and external actors, the characterisation of the value creation and the understanding of the key actors' expectations. Firstly, a workshop with the employees from the departments of purchasing, prescription, sustainable development, human resources, and research & development (R&D) was conducted, with the aim of setting their objectives and expectations. Secondly, a workshop with key contractual and potential providers belonging to the fi of confection, transportation, washing and end of life treatment was deployed. The aim was to understand providers' expectations, interest to participate in the project, and capabilities to meet EDF needs throughout their value propositions.

**Definition of the future model (April 2018 – March 2019).** the aim of this phase is to identify possible models for the evolution of the current model of safety clothing towards a sustainable solution. Collaborative workshops between internal and external actors were carried out to identify alternatives responding to the EDF needs, to formalize and prioritize evaluation criteria, and to perform an evaluation process of the selected alternatives.

**Transformation of the purchasing strategy (April 2019 – Dec. 2019).** this phase aims at delivering some recommendations for the improvements the purchasing strategy throughout the inclusion of CSR criteria. A single workshop with internal actors was carried out to validate the results obtained from the previous phases. Moreover, it is expected to incentive new configuration of the supply chain in terms of actors and collaborative relationships in the horizon 2025.

Furthermore, an internal mechanism of governance was implemented to coordinate the project development. The three phases were piloted by an internal steering committee, composed by the internal strategic actors of the project.

### 6.3.2 Managerial objectives

ICOVET project has been launched to satisfy the following managerial objectives defi by the direction of EDF purchasing department.

- Identifying the conditions to stimulate the development of radical innovation in both the offer and the organisation of the actors implied in the safety clothing value chain
- Enhancing the global performance of the purchasing function concerning the CSR strategy
- Improving the corporate image of the company throughout the inclusion of sustainability criteria on the purchasing strategy
- Encouraging long-term relationships with the providers along the offer life cycle.

## 6.4 Development of the proposed framework

### 6.4.1 Value creation analysis

#### Stakeholder analysis

Given the holistic nature of the problem, the project involves several internal and external actors, classified according to the following categories:

- **Focal-firm level:** two groups are identified, strategic actors and users. the former comprehends the departments of purchasing (project leader), prescription, sustainable development, human resources and research & development (R&D). The latter is composed by operational employees, who wear safety clothes to develop their daily activities.
- **Operating environment:** it comprehends the supply chain actors: confectioners, logistics providers, washing service providers, and end of life service providers. The actors belonging to the manufacturing processes are excluded from the project given

the geographical distance (principally India, China and North Africa), however their activities are considered thought the confectioners' information. Moreover, other buying companies are integrated into the project with the perspective of reaching large volumes of safety clothing at the end of life, but also to explore circular economy opportunities.

- **External environment:** it comprehend two categories, economic and non-economic actors. The fi category Non-economic actors (e.g., research institutions, recycling entities and social organizations) are integrated to the project with the aim at identifying sustainable-oriented opportunities (e.g., innovative fi development, circular economy, short-circuits transport models, among others).

Figure 6.1 illustrates the current supply chain of safety clothing in EDF, while fi 6.2 represents the key stakeholders considered within the scope of ICOVET project.

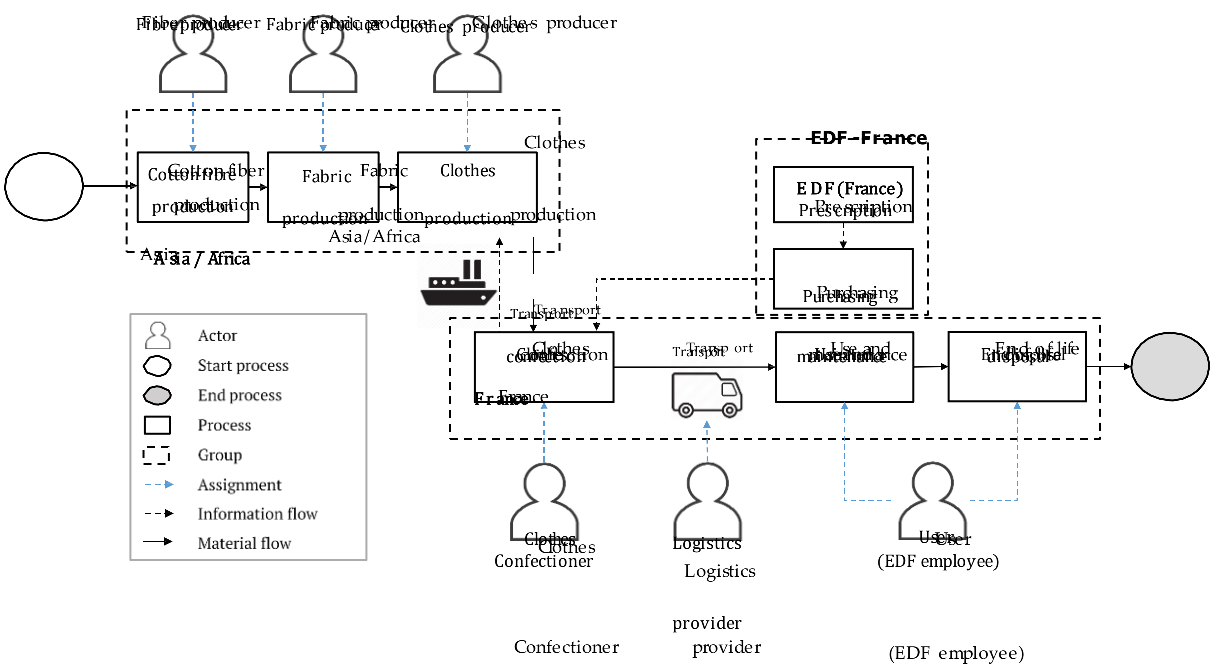


Figure 6.1: Current stakeholders in the supply chain of safety clothing of EDF.

The key stakeholders were analysed through an semi-structured interview approach. The analysed sample have diverse profi s, for instance, operative employees, managers and CEOs of the implied organizations. In the following the data collection and analysis techniques are described.

**Data collection.** Primary and secondary data were exploited. The former was collected throughout workshops and semi-structured interviews (see Annex A and B,

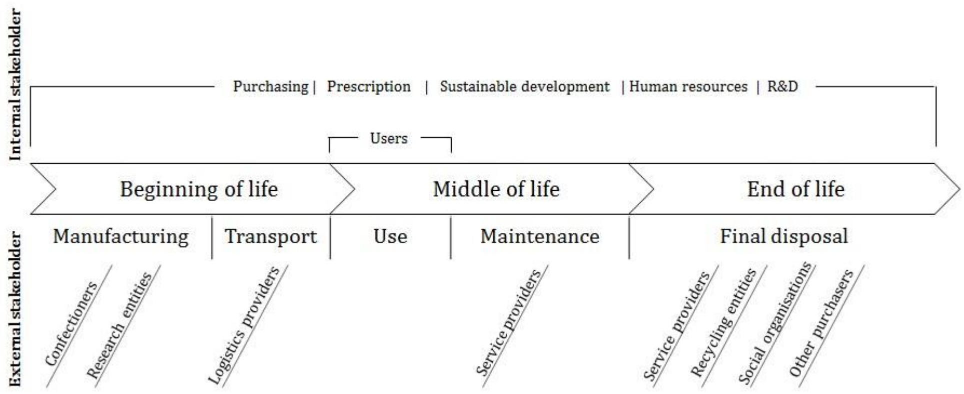


Figure 6.2: Key stakeholders included in ICOVET project.

V). The latter comprehends corporative documents of EDF. The interviews were addressed to the three main groups of actors in the diff t phases of the project (tables 6.1 and 6.2).

Table 6.1: Interviews conducted during 2017 with internal and external actors in ICOVET project.

| Internal actors | Date | Function | Time (hh/mm/ss) |
|---|---|---|---|
| **1** | 31/10/2017 | Purchasing department (group interview) | 01:34:23 |
| **2** | 31/10/2017 | Purchasing | 00:47:39 |
| **3** | 31/10/2017 | Purchasing - distribution | 00:48:19 |
| **4** | 31/10/2017 | Purchasing - Nuclear safety clothing | 00:49:01 |
| **5** | 14/11/2017 | Sustainable development direction | 00:56:25 |
| **6** | 14/11/2017 | R&D engineering | 00:40:10 |
| **7** | 14/11/2017 | Sustainable development direction | 00:47:44 |
| **8** | 14/11/2017 | Prescription (Industrial security) | 00:51:39 |
| **9** | 14/11/2017 | Human Resources | 01:38:48 |
| **10** | 14/11/2017 | Prescription | 00:45:52 |
| **11** | 14/11/2017 | Prescription- Waste management | 01:41:46 |
| **12** | 27/11/2017 | Social dialogue direction - CSR | 00:39:53 |
| **13** | 04/12/2017 | Human resources - Normative expert | 00:30:28 |
| **External actors** | | | |
| **14** | 05/12/2017 | Confectioner | 00:44:55 |
| **15** | 05/12/2017 | Logistics provider | 00:40:17 |
| **16** | 05/12/2017 | Washing service provider | 00:45:18 |
| **17** | 05/12/2017 | Logistics, washing and location service provider | 00:46:55 |
| **18** | 05/12/2017 | Waste management - energy recovery | 00:18:30 |
| **19** | 19/12/2017 | Recycling organisation | 01:42:21 |
| **20** | 17/12/2017 | Security service provider | 00:46:00 |

The interviews were built based on literature review, starting by the identification of main topics, and then refined into questions. The interviews were structured into two major sections, one oriented to the study of the safety clothing market, and the other one considering the organizational impacts provoked by innovation development. The specific topics treated on the interviews were value creation factors, textile supply chain,

Table 6.2: Interviews with users and external actors in ICOVET project (2018).

| Users | Date | Function | Time (hh/mm/ss) |
|---|---|---|---|
| **1** | 17/09/2018 | Project management- environment | 00:34:45 |
| **2** | 17/09/2018 | Mechanic team management | 00:22:16 |
| **3** | 17/09/2018 | National preventer | 00:26:57 |
| **4** | 17/09/2018 | Operator - EDF renewable energy | 00:20:41 |
| **5** | 17/09/2018 | Operator - Enedis | 00:31:41 |
| **6** | 17/09/2018 | Operator - EDF renewable energy | 00:24:21 |
| **7** | 01/10/2018 | Operator - *Electricitè de Strasbourg* | 00:22:30 |
| **8** | 08/10/2018 | Operator - EDF group | 00:30:00 |
| **External actors** | | | |
| **9** | 11/12/2018 | Confectioner | 00:30:00 |
| **10** | 11/12/2018 | Confectioner | 00:30:00 |
| **11** | 11/12/2018 | Confectioner | 00:30:00 |
| **12** | 11/12/2018 | Confectioner | 00:30:00 |
| **13** | 11/12/2018 | Confectioner | 00:30:00 |
| **14** | 11/12/2018 | Confectioner | 00:30:00 |
| **15** | 11/12/2018 | Confectioner | 00:30:00 |
| **16** | 11/12/2018 | Confectioner | 00:30:00 |
| **17** | 11/12/2018 | Confectioner | 00:30:00 |
| **19** | 11/12/2018 | Logistics, washing and location service provider | 00:30:00 |
| **18** | 11/12/2018 | Recycling organisation | 00:30:00 |

and actors relationships. The interviews were recorded and transcribed *ad verbatim*. Finally, a lexical analysis was performed by using the software ALCESTE.

**Data analysis.** ALCESTE is an statistics-based tool that allows performing qualitative data analysis. The software calculates *n* clusters that represent the major topics associated to a specifi group of interviewed actors, by the means of keywords analysis. Figure 6.3 shows an example of clustering extracted from the internal actors interviews. The main aim of this study was to confront actors' perspectives regarding the main issues treated in the project. Table 6.3 summarizes the obtained results.

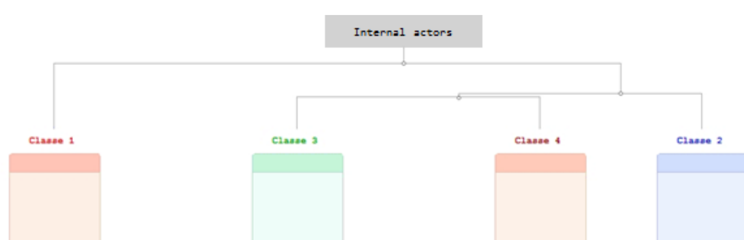


Figure 6.3: Clustering of internal actors interviews obtained from ALCESTE.

## Value characterisation

Since EDF is interested in reviewing the entire value chain associated to the safety clothing, the problem has been broken down into the three stages of the offer life cycle:

Table 6.3: Actors' perceptions of major topics in ICOVET project.

| Topic | Internal actors | Users | External actors |
|---|---|---|---|
| **Innovation project development** | The transformation of the business model is perceived as a project of sustainability, with a strong ecological and social orientation. Moreover, it represents a political and collaborative challenge.<br>The economic component is not perceived as an important aspect. | It is perceived as an environmental project of EDF group, but also as an opportunity to improve the employees satisfaction.<br>A possible barrier can be created from the suppression of the monetary aid given by EDF to the employees for managing the middle and end of life of the clothing. | The project represents high financial risks, however it could improve provider's corporate image.<br>The technical requirements of the future safety clothing system is a major issue, and could represent a strong constraint.<br>Ecological and social aspects are within the providers interests. |
| **Safety clothing as a product** | High volumes and standard purchasing of safety clothes is essential for maintaining EDF purchasing performance. Besides, the corporate image of EDF linked to the destine of the safety clothes at the end of life is a major preoccupation. | It is perceived as the way to guarantee the safety and comfort of employees.<br>The value of the safety clothing depends on the capability to fulfil users activities in complete comfort. | The safety clothes represent a physical way to provide services to EDF. |
| **Supply chain management** | There is a urgent need to develop analysis tools for the global monitoring of the processes.<br>Logistics related to washing and the end of life are the critical points of the project. | There is not a preoccupation about the life cycle of the safety clothes, linked to a lack of knowledge in this aspect. | Focus on distribution and logistics processes, but also in the opportunity to develop collaborative partnership, especially related to the economic aspect (e.g. sharing prototyping costs). |

beginning of life (BOL), middle of life (MOL) and end of life (EOL). The value characterisation comprehends the description of the value proposition, the value structure and the value creation of a given system or business model.

We implemented the sustainable value analysis framework with the aim of shaping current and future models of the safety clothing in EDF, from the internal point of view (figure 6.4 and 6.5, respectively).

**Current model.** The current model supporting the safety clothing system in EDF (figure 6.4) presents the following characteristics. At *the strategic* level the principal decision-maker is the prescription department, which defi the requirements, the quantity and the lead time for the safety clothing. Then, purchasing department is able to select the providers and to launch the command to the market. Besides, the department of human resources (HR) manages a premium assignment to the employees, which are responsible for the middle and end of life of the safety clothing.

Concerning the *operational level*, fi , the value proposition is defi as the annual endowment of the safety clothing, determined by the volume of purchased products at the beginning of life. The criteria to select a value proposition are the traditional triad price, quality and delivery time, with a special focus on the best possible price. Secondly, the value structure reveals an internal organisation by silos, in which each department work separately. Moreover, there are not specific procedures for managing the middle

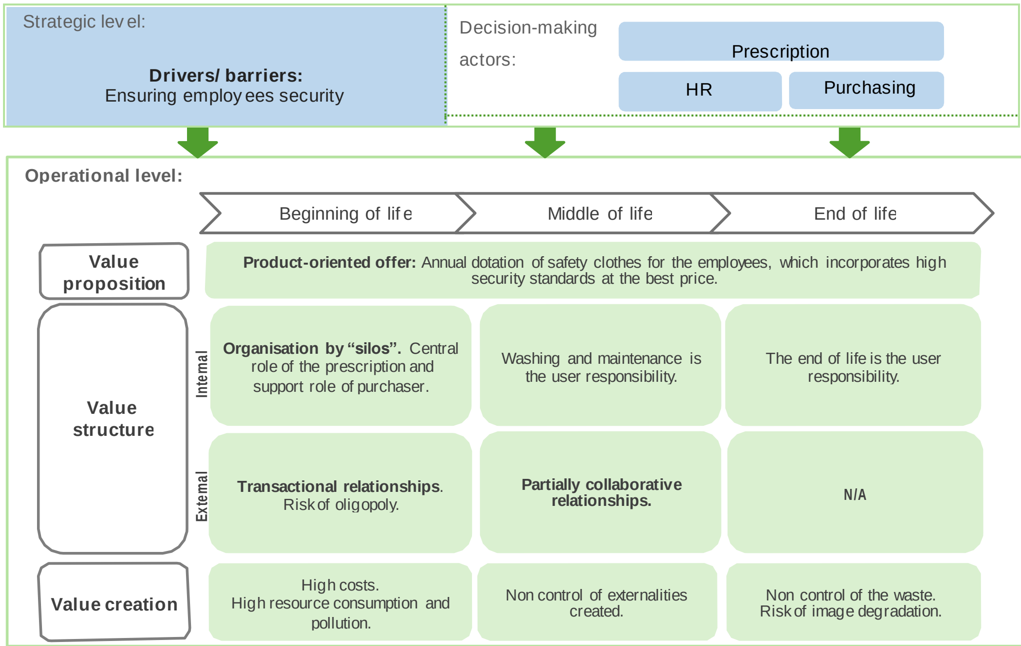


Figure 6.4: Current business model of the safety clothing between EDF and its providers.

and end of life of the clothing, which are entirely managed by the users. The external value structure shows a pure transactional relationship between EDF and their providers at the beginning of life, while a partial collaboration with the logistics providers thought the deployment of productivity partnerships (i.e., aiming at developing logistics service portfolios). At the end of life there is not any formal relationship with any provider, however, in some dependencies of EDF group (e.g., *Enedis*), a small percentage of the clothing is sent to social organisations for recycling, destined to charity. Thirdly, through the interviews, it has been found that value is being destroyed with the current system. It is evidenced through the high purchasing costs and the non control of environmental and social externalities.

**Expected model.** Concerning the expected model, the study reveals interesting points of evolution (figure 6.5). Firstly, *external pressures* trigger the evolution of the current model. It is concerned with the rising exigencies of the French legislation regarding waste management, precisely in relation with non-dangerous waste as textile. Besides the legal aspects, the actors highlight existent opportunities to develop new markets in France by the means of circular economy, using wasted safety clothing as a resource. The expected model conveys the transformation of both strategic and operational levels of the system. At the *strategic level*, new actors are expected to integrate the decision-making processes: besides prescription, purchasing, and human

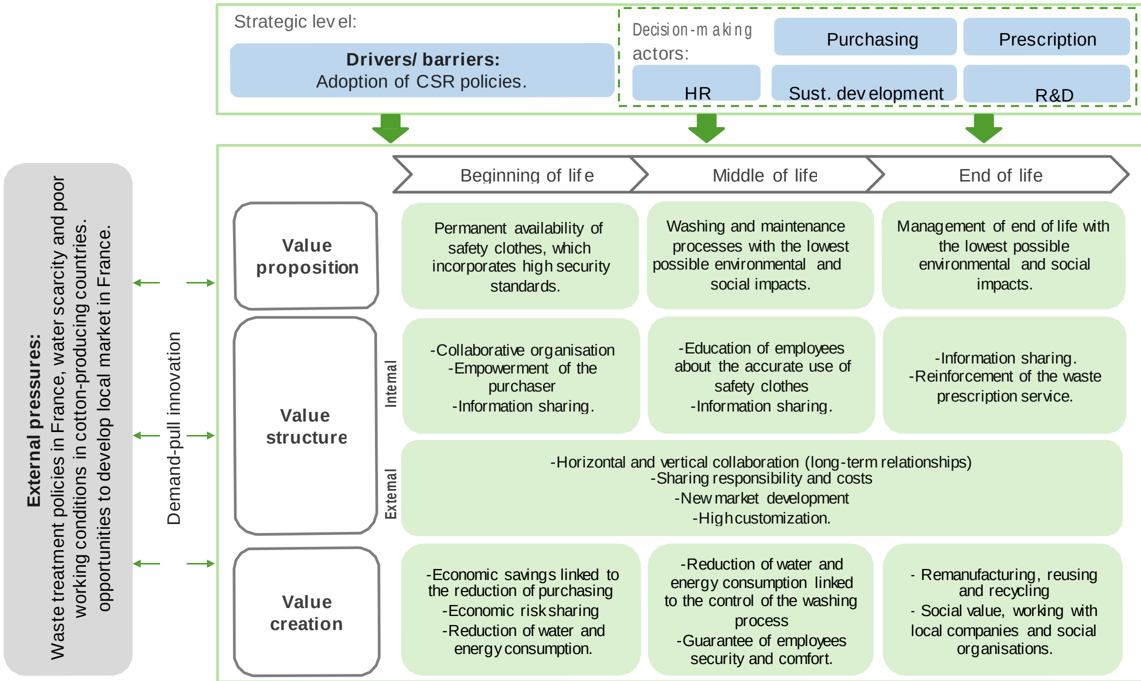


Figure 6.5: Expected business model of the safety clothing between EDF and its providers.

resources; the departments of sustainable development and R&D were found relevant for the construction of the new model. The main internal driver for the construction of the new model is the integration of sustainability exigencies contained into the Corporate Social Responsibility (CSR) strategy of EDF group. At the *operational level*, the value proposition should be transformed from a product purchasing to a global solution corresponding to the needs of each stage of the life cycle. The expected offer should focus on the availability of the safety clothing “as needed”, and the reduction of environmental and social impacts. The value structure is impacted in the following ways. The role of the purchaser becomes strategically important, since it is the integrative actor between the internal and external value chains. Moreover, there is a need for a cross-functional collaboration to redesign the offer, and the reinforcement of the prescription department regarding waste management aspects. Concerning the external value chain, horizontal and vertical partnerships should be formed to meet CSR criteria for the new offer. Vertical collaboration (i.e., between confectioners, research entities, service providers, socio-environmental organisations and EDF) is needed for innovation prototyping, reducing the risk of failure and sharing economic expenses. Horizontal collaboration between EDF and other buyer companies favours the achievement of important purchasing volumes, enabling the minimum production quantity required for the providers. Concerning value creation, table 6.4 details the actors vision in terms of value destroyed and opportunities along the life cycle.

Table 6.4: Consequence analysis along the life cycle of the current system of safety clothing in EDF (internal workshop 2017).

| Stage | Impacts / value destruction | Opportunities / value creation |
|---|---|---|
| **BOL** | | |
| Manufacturing | High consumption of water and energy.<br>Intensive use of pesticides (eco-toxicity).<br>Soil exhaustion and intensive land use.<br>Pollution of air and water.<br>Degradation of human health.<br>Poor work conditions (e.g., child labour).<br>Socio-economic dependency of producer countries on cotton cultivation. | Design for the end of life.<br>Experiment with innovative fibres (e.g., Linen, nettle, recycled fibres).<br>Relocation of production (territorial development). |
| Transportation | High emissions of $CO_2$ (e.g., use of the air-plane in case of urgent delivery).<br>Poor work conditions of conveyors (extensive work time).<br>Economic impacts linked to delay costs. | Development of short circuits<br>Local job generation. |
| **MOL** | | |
| Use | Attachment of users to the annual provision of safety clothes (resistance to change).<br>High storage costs.<br>Economic impact due to the risk of inventory obsolescence.<br>Non equilibrium between, comfort, ergonomics, safety and protection of the environment. | Changing allocation modalities: from annual allocation to "as needed".<br>Connected clothing.<br>Development of new features of the safety clothes to increase comfort.<br>Users training to best practices.<br>Involvement of trade union organisations. |
| Washing | Lack of traceability of the number of washes.<br>Risks of radioactive and chemical effluents into the washing water.<br>Health risks associated to chemical use.<br>Risk of the safety guarantee related to non-professional washing processes. | Standard washing procedure.<br>Traceability system.<br>On-site washing process.<br>Additional services contained in the offer (e.g., sewing, repair). |
| **EOL** | | |
| Disposal | Lack of internal skills to manage the end of life.<br>Risk of fraudulent use of clothing.<br>Uncertain volume of waste due to lack of traceability. | Turning clothes at the end of life into a resource (circular economy).<br>Creating new markets in France.<br>Developing solidarity economics (social organisations). |

## 6.4.2 Problem structure modelling

In the precedent sections, current and expected models of EDF's safety clothing system have been analysed throughout the lens of value creation from the EDF perspective. In this section, the situation is analysed from the collective vision between EDF and the external actors, implementing Goal Modelling framework to represent actors interdependencies and value expectations. The application of the goal modelling technique through the *i** framework, helps to structure EDF problem, and to illustrate the collaborative process for the development of the offer. From the goal modelling between customer and the different providers along the supply chain, the evaluation criteria and alternatives (i.e., value propositions) have been defi ed. Both elements represent the main input to start the MCDA process, and are detailed in the following.

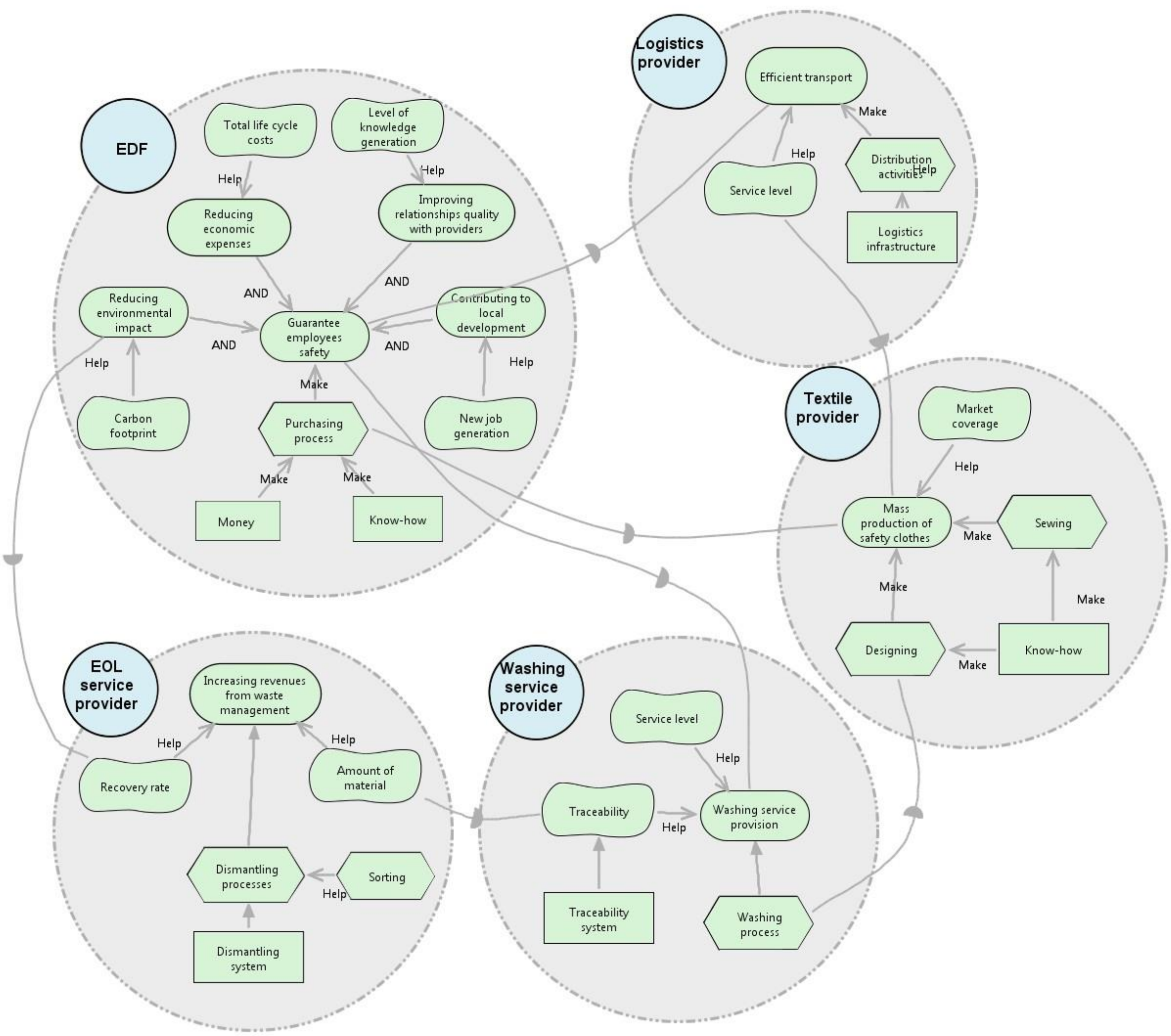


Figure 6.6: Extract of the Goal Modelling between EDF and the supply chain actors.

### Criteria definition

During the development of EDF's goal model, fi e strategic objectives where identified, corresponding to each dimension of value creation. Then, the strategic objectives were refined into criteria. To defi the criteria a combination between top-down and bottom-up approaches was implemented. Firstly, the consequence analysis of the current scenario allowed to identify the factors of value destruction, but also opportunities of value creation (see table 6.4). Secondly, the fi e dimensions of value were used to ask the internal actors their expected benefits throughout the project. The results of both analysis, enabled the defi n of EDF strategic objectives linked to each value dimension. Then, those objectives were refined into criteria (see fi 6.6). This constituted an iterative and extensive process carried out with the key internal actors. Each group identified a set of criteria for each value dimension, establishing the link with EDF's CSR strategy. The criteria were analysed and synthesized by the research group, and then validated with the participants.

The strategic objectives were defined regarding the stages of the life cycle, defi as follows:

**(E) Economics:** reducing the purchasing costs, suppressing the users' premium, and developing circular economy in France throughout the transforming of the wasted clothing into resource. The above suggests the consideration of risks, uncertainties and return on investments in long-term horizons.

**(N) Environmental:** EDF aims at implementing an environmental management plan over the entire system, pointing outs on providers management and waste treatment.

**(S) Social** : the social value for EDF is defi in terms of respect for the human rights in the manufacturing countries, dignifi conditions of employment, and development of the French economy.

**(R) Relational:** establishing long-term relationships with providers, sharing responsibilities and promoting innovation development.

**(F) Functional:** improving the lifespan of the safety clothes, establishing a system based on the availability "as needed" rather than the annual re-provisioning.

Table 6.5 details the criteria defi in collaboration with internal actors in EDF.

Table 6.5: Criteria for the evaluation of sustainable safety clothing offers.

| Value dimension | Criterion | Sense | Description |
|---|---|---|---|
| **Environmental(5)** | Environmental quality of the fibre | + | It includes a multiple criteria evaluation taking into account: the country of production, the feasibility of production, the possibility to recycle the fibre, the emissions to the air du to the transport of raw materials, water consumption, the use of chemical products, energy consumption and the price per kg of fibre. |
| | Environmental performance of providers | + | Provider performance category according to the auditory score. |
| | Carbon footprint | – | Corresponds to the quantity of $CO_2$ equivalent emitted to the air in the activities of transportation (from producer to the customer) and washing. |
| | Chemical use | – | Quantity of chemical used during the washing process, generating water pollution and possible health damages. |
| | Recycling capability | + | Capability of the system to enable recycling expressed as the percentage of recycled material at the end of life. |
| **Economic(2)** | Life cycle costs | – | Expected costs of the entire life cycle, including the cost of transforming waste. |
| | Purchasing cost | – | Cost to acquire a product or a service, including indirect costs. |
| **Social(4)** | Social performance of providers | + | Provider category assignment according to the auditory (bad, acceptable, good, very good). |
| | New job generation | + | Number of new jobs in relationship with the new system implementation (entire supply chain / life cycle of the offer). |
| | Employees resistance to change | + | Percentage of employees rejecting the new safety clothing system. |
| | Solidarity purchasing | + | Percentage of MOL and EOL services purchased to the *Secteur Adapté et Protegé*. |
| **Relational(2)** | Contribution to the brand image | + | Level of the positive impact on the image of EDF in relation to the adoption of sustainable alternatives. |
| | Level of innovation sharing | + | New knowledge (in terms of processes and competencies) acquired through the collaboration: high, medium, low, none. |
| **Functional(6)** | Guarantee of the fibre quality | + | Level of mechanic resistance of the fibre monitored through different type of tests (simulation, real-life). |
| | Availability of safety clothing | + | Level of service provided during the process of distribution. Considering the historical data from contractual providers. |
| | Guarantee of lifespan | + | Number of washing according to historical data from service providers at MOL. |
| | Comfort | + | Related to the ergonomics of safety clothes verified during the execution of the corresponding activities: breath-ability, adapted to weather conditions, adapted to activity, fitness with the employee needs. |
| | Efficiency level of the traceability | + | Level of service provided during the washing process. Considering the historical data with ancient providers. |
| | Waste upgrading level | + | Capability to dismantle the safety clothing and use it as a resource for a new productive cycle, measured as the percentage of recovered material. |

## Alternative identification

In the workshop taking place on December 2018, during the second phase of ICOVET project, internal and external actors worked collaboratively to generate ideas alternatives meeting EDF's criteria. Individual interviews were carried out with 11 providers (reported in table 6.2) to detail the offers. It was possible to draw out the decision focus for each stage of the life cycle.

**(BOL) Beginning of life:** the main decision concerns the type of fi used to manufacture the safety clothes. A critical aspect for the providers in terms of sustainability is the country of production, hence, a mix between Asian, North-African, and European production was considered. After a brainstorming integrating providers capabilities and EDF criteria for the future model, three fi options were retained.

- **Tencel**: it is a biodegradable artificial fi obtained from eucalyptus, mostly present in South Africa, but also found in European forests (e.g., Lenzing, Austria). Some of its properties include high resistance, breath-ability, and high absorption capacity. Concerning maintenance, high washing temperatures (up to 40°C ) can produce a shrinkage of the fabric. This fi is very convenient from the environmental point of view since eucalyptus cultivation has a lower consumption water with respect to cotton, and a profi ratio between production volume an soil occupation.
- **Poly-cotton**: the main strength of using a mix with polyester is its availability on the market. Polyester is the most widely produced synthetic textile fi around the world (about 70% of synthetic fi used in the clothing industry). Poly-cotton combines the benefits of natural fi re with those of synthetic fi being cheaper than pure cotton. In terms of maintenance, this fi is fast-drying, shrinkable, almost wrinkle-less, resistant to high washing temperatures, and has a good conservation of colours after washing.
- **Organic cotton**: contrary to conventional cotton production, it is grown with natural compost that replaces chemical fertilizers and pesticides. The water consumption required for its cultivation is very less compared to conventional cotton. In terms of process, organic farming ensures the maintenance or improvement of soil fertility, dying process is done without carcinogenic substances, the fi has same structural characteristics of conventional cotton (i.e., soft, breathable, resistant, dye absorbent, and can stand up against high washing temperatures.).

**(MOL) Middle of life:** decisions in this stage focus on the washing system (localised or centralised) and on the type of technology used for ensuring clothes traceability (RFID tag or bar code).

- **Localised washing**: distribution model comprehending several local nodes, favouring proximity with the customer in small, well-defined areas. Some of the advantages this system offers are a good level of service in terms of order processing time and customization, and the possibility of adjusting the functioning to local needs. The above can result in cost and time savings in terms of decision-making. Nevertheless, shipping to multiple distribution sites can negatively affect the global efficiency of the system.

- **Centralised washing**: in this model, the orders are assigned to a central base, or very few bases geographically dispersed. Fewer points of service make possible a higher level of standardization and, therefore, more efficient and easy to manage. Nevertheless, the ownership costs of large storage holds can be very high, and order processing time can be very long.
- **RFID tag**: it is an object-identification system based on non-optical proximity communication, and enables two-way communication (connected clothing). This system can be applied to inventory management, logistics, transportation, manufacturing, and product tracking. However, until nowadays the system entails some risks related to information privacy. Moreover, it presents some diffi related to the preservation of the RFID tag due to the special conditions of washing (high temperatures for the technical clothes).
- **Bar code**: this system is commonly used for product information management to perform inventory control. It requires an optical scanner for getting the product-related information. The amount of information stored in a bar code is lower compared to RFID, nevertheless, this system does not face the security risks. Concerning EDF, this system has been already tested successfully in pilot projects in some EDF divisions.

**(EOL) End of life:** decisions concern the system for waste upgrading and the opportunities to develop new markets in France by using the wasted textile. Three general options are drawn out from the providers interviews.

- **New product**: this category involves some alternatives as children overalls, tennis rackets, hand towels, and car seat covers, manufactured from the recycled fi of the wasted safety clothing. The most versatile fi in this case is the poly-cotton, since the polyester component can be recovered in the form of plastic granules.
- **New clothing**: second-life clothing is the most desirable alternative in terms of environmental sustainability, since the transformation process is less energy consumer than the manufacturing of a diff t product. Nevertheless, it can produce negative impacts on employees security, since the mechanic properties of the fi could be degraded. This alternative is suitable for safety clothes destined to low-risks activities. An important advantage of this option is the existent know-how, the available logistics and productive infrastructures, and the consolidated network of actors working on it (e.g., ADEME (*Agence de l'Environnement et de la Maîtrise de l'Energie*, in French), CETI (*Centre Européen des Textiles Innovants*, in French), French confectioners, among others).

- **Energy recovery**: it represents one of the most used practices in France for the re-valuation of non-dangerous waste. Some of the advantages of this alternative are the low cost and the possibility to treat high volumes with a high recovery rate. The disadvantages of this option are linked to air pollution and, subsequently, the increase of health risk for the surrounding communities.

### 6.4.3 Preference modelling

#### Preparation

Given the complexity of the problem treated in ICOVET project, it has been divided into three sub-problems corresponding to each stage of the life cycle, treated independently. Once the criteria and alternatives are defi the hierarchical models can be built. The fi level of the hierarchy is determined by the life cycle stage general decision. The second level is determined by the dimensions of value creation, designated as E (economic), N (environmental), S (social), R (relational), and F (functional). The third level comprehends the criteria designed for each value dimension. The last level is composed by the alternatives, introduced in the above section (see fi 6.7, 6.8 and 6.9).

Analytic hierarchy process (AHP) has been used to support purchasing decisions in several contexts (Santos et al., 2019). In the particular case of ICOVET project, AHP facilitated the task of experts in manifesting their preferences, and enabled a structure collaborative approach internally to EDF, and between the company and its external stakeholders. In this case, a common hierarchical model for each stage of the life cycle has been used to perform the evaluation. The respondent actors were selected considering two criteria: fi , a strategic positioning on the company and with respect to the project; and secondly, a high level of technical knowledge about the decisions treated in each stage of the offer life cycle. 16 respondents were retained for the evaluation (i.e., EDF internal actors belonging to the departments of purchasing, prescription, sustainable development, human resources, and R&D). The evaluation was performed by the means of an on-line questionnaire using the software *Sphinx*, which allows coding the collected information in Excel format for further analysis. The questionnaires were built and tested within an iterative improvement process in collaboration with the purchasing department, with the aim of ensuring the conceptual clarity and usability before launching it to the respondents. Moreover, the questionnaires were answered with the guidance of the research team involved in the project and supported by the corresponding documentation about the criteria and alternatives.

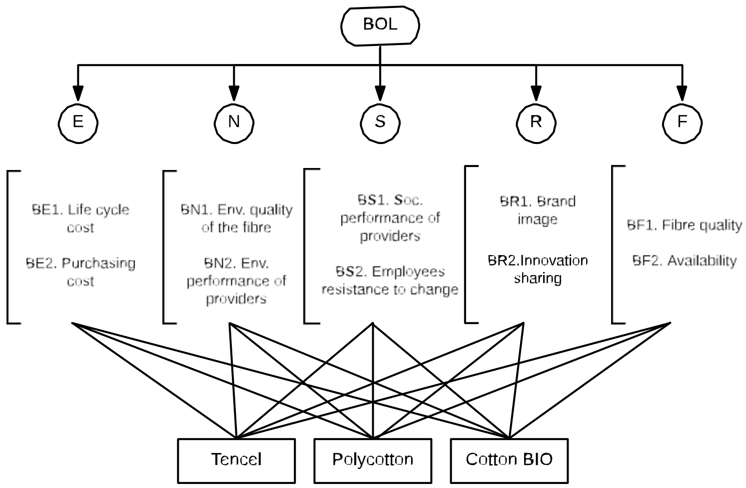


Figure 6.7: Hierarchical model of the Beginning of life (BOL).

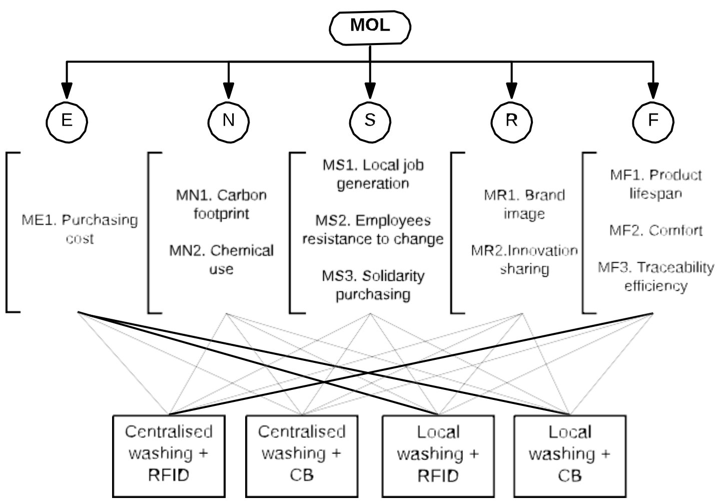


Figure 6.8: Hierarchical model of the middle of life (MOL).

## Performing the evaluation process

As described in chapter 5, the evaluation process consists on the pairwise comparison between elements in each level of the hierarchical model, using the Saaty scale (Saaty, 1990). Following the recommendations of the original AHP methodology proposed by Prof. Saaty, the evaluation was carried out from the bottom to the top of the hierarchy. Hence, the respondents started by comparing the alternatives between them with respect to each criteria. Then, the criteria were compared to each other with respect to their respective value dimension. Finally the value dimensions were compared between them

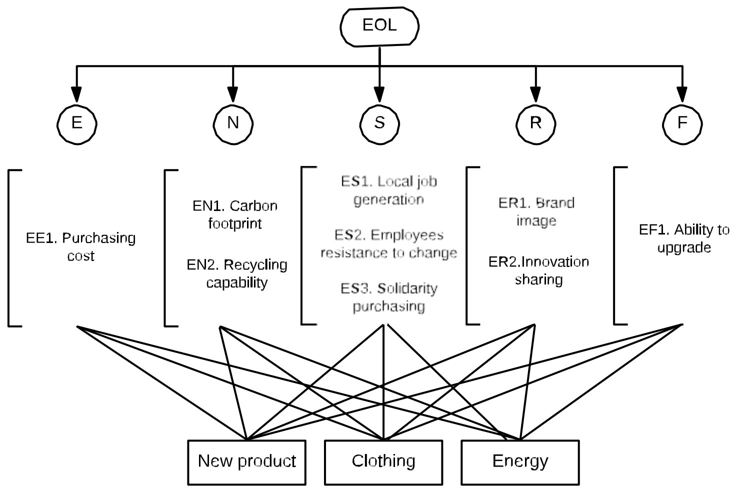


Figure 6.9: Hierarchical model of the End of life (EOL).

with respect to the main objective at the top of the hierarchical model. According to Saaty (1990), performing the evaluation from the bottom to the top facilitates the cognitive process on the respondents, since it consists on moving from the most concrete to the most abstract level of the hierarchy.

Once the evaluation was fi by all the participants, the consistency of the judgement matrices was verified throughout the calculation of the consistency ratio $CR$. After verification process, some of the evaluations were discarded as did not respect the threshold of acceptance in at least one of the comparison matrices. Among the 16 evaluations, 9, 12, and 8 were retained for the BOL, MOL, and EOL, respectively, since they were fully consistent ($CR < 0.1$) (see Annex D, V). The retained evaluations per stage of the life cycle represent at least one member of each key department (a fi condition to perform the collective analysis).

The weights were calculated for each stage of the life cycle. Tables 6.6, 6.8, and 6.10 show the results of the actors priorities with respect to value dimensions and criteria. Besides, tables 6.7, 6.9, and 6.11 present the global priorities of the alternatives defi ed for each stage of the life cycle. Since the evaluations were based on a common set of criteria, the aggregation of individual priorities method (AIP) (see chapter 4 for further explanation) was used to obtain the group results for value dimensions, criteria, and alternatives.

From the individual evaluations, the following insights were obtained. At the beginning of life, seven out of nine actors agree that environmental and social dimensions are a priority for the purchasing strategy regarding safety clothes (tables 6.6 and 6.7). The two remaining actors adopted a functional positioning, arguing that security should be the priority. In general economic and relational dimensions are the less important for the actors when regarding decision related to the fi Moreover, the alternative

Table 6.6: Relative importance of the value dimensions and criteria at the beginning of life of the safety clothing system.

| Criterion | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | AIP |
|---|---|---|---|---|---|---|---|---|---|---|
| **Economic** | **10%** | **5%** | **8%** | **12%** | **9%** | **9%** | **8%** | **7%** | **17%** | **9,4%** |
| Life cycle costs | 83% | 88% | 50% | 88% | 50% | 88% | 88% | 88% | 75% | 77,3% |
| Purchasing cost | 17% | 13% | 50% | 13% | 50% | 13% | 13% | 13% | 25% | 22,7% |
| **Environmental** | **45%** | **15%** | **42%** | **31%** | **40%** | **27%** | **44%** | **34%** | **32%** | **34,5%** |
| Fibre quality | 75% | 50% | 50% | 75% | 83% | 83% | 25% | 50% | 83% | 63,9% |
| Provider performance | 25% | 50% | 50% | 25% | 17% | 17% | 75% | 50% | 17% | 36,1% |
| **Social** | **28%** | **21%** | **15%** | **19%** | **21%** | **49%** | **25%** | **22%** | **32%** | **25,6%** |
| Social performance | 88% | 75% | 50% | 17% | 83% | 83% | 17% | 88% | 17% | 57,4% |
| User resistance | 13% | 25% | 50% | 83% | 17% | 17% | 83% | 13% | 83% | 42,6% |
| **Relational** | **14%** | **25%** | **8%** | **5%** | **18%** | **6%** | **19%** | **22%** | **12%** | **14,3%** |
| Brand image | 50% | 83% | 50% | 88% | 50% | 50% | 88% | 83% | 50% | 65,7% |
| Innovation | 50% | 17% | 50% | 13% | 50% | 50% | 13% | 17% | 50% | 34,3% |
| **Functional** | **4%** | **34%** | **27%** | **33%** | **11%** | **10%** | **4%** | **15%** | **7%** | **16,2%** |
| Fibre quality | 83% | 50% | 83% | 88% | 75% | 25% | 88% | 75% | 13% | 64,4% |
| Availability | 17% | 50% | 17% | 13% | 25% | 75% | 13% | 25% | 88% | 35,6% |

[a]A= Actor; AIP= Aggregation of Individual Priorities; SAP = Solidarity purchasing

Table 6.7: Relative importance of the alternatives at the beginning of life.

| Alternative | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | AIP |
|---|---|---|---|---|---|---|---|---|---|---|
| Tencel | 56% | 48% | 35% | 35% | 45% | 43% | 55% | 36% | 43% | **44,1%** |
| Poly-cotton | 21% | 36% | 38% | 37% | 27% | 29% | 14% | 20% | 25% | 27,5% |
| Cotton BIO | 23% | 16% | 27% | 28% | 27% | 28% | 31% | 44% | 32% | 28,5% |

[a]A= Actor; AIP= Aggregation of Individual Priorities

"Tencel" appears to be the most suitable regarding all the criteria and all the actors, while organic cotton is the less preferred. Nevertheless, for the two actors taking a functional positioning, the poly-cotton is the preferred alternative since it is the most available fi on the market. At the middle of life, results vary considerable from one actor to another (tables 6.8 and 6.9). A fi group of actors considers environmental and social dimensions as the priority; a second group prefers economic, functional and environmental dimensions; and the third group is rather neutral, considering that all the dimensions have a similar importance. Here, actors' opinions are very conflicting regarding the prioritization of value dimensions, however, all the actors consider that the alternative "localised washing system " is the most suitable to respond the decision problem at the middle of life. Finally, at the end of life, the environmental, social, and

Table 6.8: Relative importance of the value dimensions and criteria at the middle of life of the safety clothing system.

| Criterion | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | AIP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Economic** | **12%** | **5%** | **10%** | **26%** | **11%** | **12%** | **10%** | **16%** | **13%** | **8%** | **14%** | **25%** | **13,6%** |
| **Environmental** | **49%** | **21%** | **41%** | **16%** | **25%** | **49%** | **53%** | **19%** | **38%** | **30%** | **22%** | **6%** | **30,8%** |
| Carbon footprint | 50% | 50% | 50% | 83% | 17% | 83% | 88% | 13% | 90% | 50% | 83% | 50% | 58,9% |
| Chemical use | 50% | 50% | 50% | 17% | 83% | 17% | 13% | 88% | 10% | 50% | 17% | 50% | 41,1% |
| **Social** | **24%** | **31%** | **32%** | **12%** | **24%** | **28%** | **18%** | **25%** | **10%** | **27%** | **49%** | **55%** | **28,0%** |
| Local job | 45% | 24% | 14% | 43% | 49% | 45% | 28% | 24% | 11% | 45% | 35% | 33% | 33,1% |
| User resistance | 9% | 28% | 49% | 14% | 37% | 9% | 6% | 21% | 11% | 9% | 9% | 33% | 19,7% |
| SAP purchasing | 45% | 48% | 37% | 43% | 14% | 45% | 66% | 55% | 78% | 45% | 6% | 33% | 43,0% |
| **Relational** | **12%** | **21%** | **8%** | **4%** | **23%** | **5%** | **14%** | **19%** | **12%** | **9%** | **5%** | **6%** | **11,5%** |
| Brand image | 25% | 50% | 88% | 83% | 50% | 13% | 88% | 17% | 13% | 75% | 75% | 50% | 52,1% |
| Innovation | 75% | 50% | 13% | 17% | 50% | 88% | 13% | 83% | 88% | 25% | 25% | 50% | 47,9% |
| **Functional** | **4%** | **23%** | **9%** | **42%** | **17%** | **5%** | **4%** | **19%** | **28%** | **27%** | **9%** | **6%** | **16,1%** |
| Lifespan | 26% | 14% | 45% | 13% | 33% | 66% | 21% | 49% | 20% | 44% | 7% | 33% | 31,1% |
| Comfort | 63% | 33% | 45% | 75% | 33% | 19% | 55% | 37% | 60% | 39% | 64% | 33% | 46,4% |
| Traceability | 11% | 52% | 9% | 12% | 33% | 16% | 24% | 14% | 20% | 17% | 28% | 33% | 22,5% |

[a]*A= Actor; AIP= Aggregation of Individual Priorities; SAP = Solidarity purchasing*

Table 6.9: Relative importance of the alternatives at the middle of life.

| Alternative | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | AIP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Centralised washing | 33% | 21% | 42% | 20% | 41% | 46% | 26% | 27% | 12% | 37% | 23% | 53% | 32,0% |
| Localised washing | 67% | 79% | 58% | 80% | 59% | 54% | 74% | 73% | 88% | 54% | 73% | 47% | **68,0%** |

[a]*A= Actor; AIP= Aggregation of Individual Priorities*

Table 6.10: Relative importance of the value dimensions and criteria at the end of life of the safety clothing system.

| Criterion | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | AIP |
|---|---|---|---|---|---|---|---|---|---|
| **Economic** | **10%** | **5%** | **21%** | **8%** | **20%** | **20%** | **19%** | **22%** | **15,7%** |
| **Environmental** | **46%** | **53%** | **21%** | **41%** | **20%** | **49%** | **17%** | **16%** | **32,7%** |
| Carbon footprint | 17% | 17% | 17% | 17% | 17% | 17% | 17% | 17% | 16,7% |
| Recycling | 83% | 83% | 83% | 83% | 83% | 83% | 83% | 83% | 83,3% |
| **Social** | **20%** | **13%** | **12%** | **38%** | **20%** | **7%** | **54%** | **40%** | **25,5%** |
| Local job | 63% | 66% | 41% | 72% | 7% | 45% | 18% | 41% | 44,1% |
| User resistance | 11% | 16% | 11% | 8% | 7% | 9% | 70% | 11% | 18,0% |
| SAP purchasing | 26% | 19% | 48% | 19% | 7% | 45% | 11% | 48% | 27,9% |
| **Relational** | **20%** | **13%** | **5%** | **6%** | **20%** | **7%** | **5%** | **10%** | **10,7%** |
| Brand image | 25% | 50% | 83% | 17% | 50% | 50% | 83% | 50% | 51,0% |
| Innovation | 75% | 50% | 17% | 83% | 50% | 50% | 17% | 50% | 49,0% |
| **Functional** | **4%** | **15%** | **41%** | **6%** | **20%** | **18%** | **5%** | **12%** | **15,3%** |

[a]*A= Actor; AIP= Aggregation of Individual Priorities; SAP = Solidarity purchasing*

Table 6.11: Relative importance of the alternatives at the end of life.

| Alternative | A1[a] | A2 | A3 | A4 | A5 | A6 | A7 | A8 | AIP |
|---|---|---|---|---|---|---|---|---|---|
| Other product | 65% | 37% | 60% | 27% | 39% | 39% | 39% | 37% | **43,0%** |
| New clothing | 18% | 49% | 12% | 61% | 51% | 29% | 39% | 46% | 38,2% |
| Energy | 17% | 14% | 28% | 11% | 10% | 32% | 22% | 16% | 18,9% |

[a] *A= Actor; AIP= Aggregation of Individual Priorities*

economic dimensions are the most important to take into account to evaluate the offer (tables 6.10 and 6.11). The economic dimension gained in importance with respect to the beginning and middle of life. This change reflects the actors' expectations to create new markets from circular economy strategies, but also the interest to pay as less as possible for services at the end of life, to avoid an important increase on the current purchasing costs. Concerning the alternatives, all the actors reject the energetic transformation of the safety clothes. Besides, transforming waste on a new product or on second-life safety clothing are both judged as good options by the actors, with a slightly preference by the latter.

## 6.4.4 Researching a consensus

### Clustering process

Firstly, the similarity matrices based on actors preferences were calculated (see Annex E, V), then, the corresponding clustering algorithm reported in 5 was executed by using *R Studio*. The procedure was applied to each stage of the life cycle, aiming at identifying actor's decisional profi if they exist. A *dendrogram* (tree-like graph) corresponding to each stage of the life cycle was obtained from the clustering method (see fi 6.10, 6.11, 6.12). We implemented the procedure to the criteria priority matrices, since they show conflicting preferences between the actors, while the alternatives priority matrices are rather consensual.

After applying the dendrogram rule for clustering selection, two or three clusters can be identified for each stage of the life cycle, detailed in the following.

At the beginning of life, two main clusters were identified. $C1_{BOL}$ formed by actors A2, A3 and A4; and $C2_{BOL}$ constituted by actors A1, A5, A6, A7, A8 and A9. The fi cluster comprehends actors whose priority is the functional dimension of the safety clothes, seen as a means to achieve environmental sustainability. The second cluster is formed by actors who consider environmental and social dimensions as the priority to select the type of fi The common characteristic observed among all the actors is the weak importance allocated to the economic dimension.

At the middle of life, four well defi clusters can be identified. The fi $C1_{MOL}$ composed by actors A1, A3, A6, and A7; $C2_{MOL}$ by actors A2, A5, and A8; $C3_{MOL}$ integrates A9, and A10; and $C4_{MOL}$ formed by actors A4, A11, and A12. Actors in

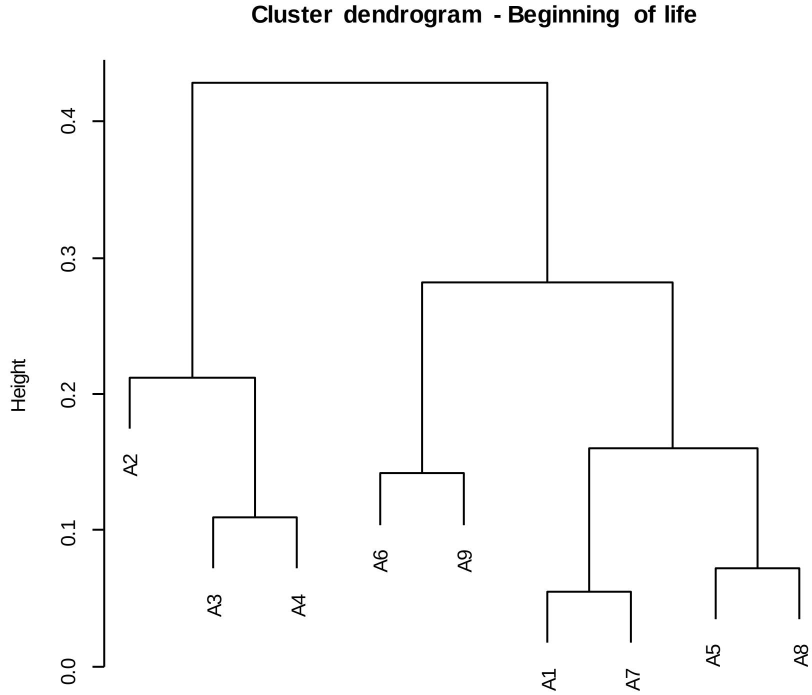


Figure 6.10: Cluster dendrogram of actors' priorities at the beginning of life.

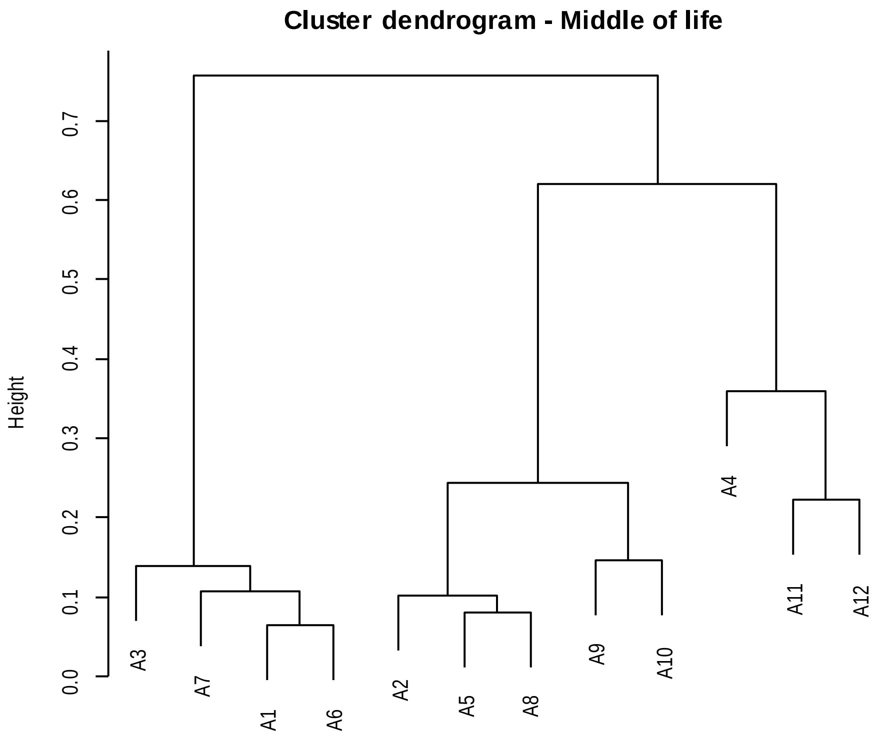


Figure 6.11: Cluster dendrogram of actors' priorities at the middle of life.

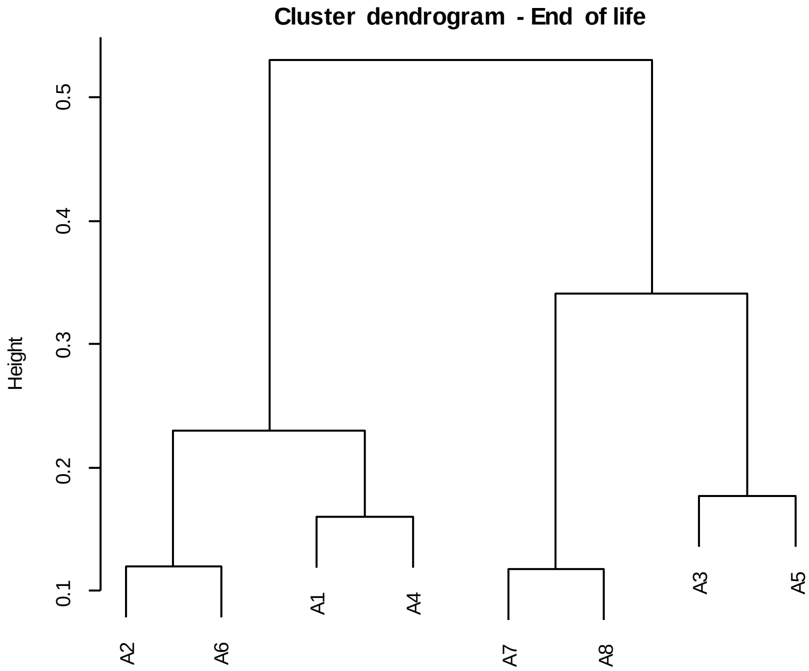


Figure 6.12: Cluster dendrogram of actors' priorities at the end of life.

$C1_{MOL}$ prioritize environmental and social dimensions. Actors in $C2_{MOL}$ allocate a similar importance to all the value dimensions, suggesting a trade-off between them. The actors in $C3_{MOL}$ consider the functional dimension as the main priority and as a means to favour environmental sustainability. Finally, $C4_{MOL}$ integrates actors with a particular and isolated positioning about the priorities, A11 mostly oriented to the socio-economical development; while A4 is an outlier element with respect to all the formed clusters.

At the end of life, two main clusters were identified, $C1_{EOL}$ formed by actors A1, A2, A4, and A6, characterised by a strong environmental positioning. $C2_{EOL}$ formed by actors A3, A5, A7 and A8, reveals an increased importance of the economic dimension in comparison with the results obtained at the beginning and middle of life.

**Decisional profiles in sustainable value creation** In the case of ICOVET, the resulting clusters can be assimilated to three decisional profi eco-efficiency, societal, and triple bottom line (TBL).

- **Eco-efficiency:** the identified clusters for this profi in the diff t phases of the life cycle are $C1_{BOL}$, $C3_{MOL}$, and $C2_{EOL}$.

  When adopting this profi EDF is willing to reduce environmental impacts only if the economic expenses are kept stable (i.e., in relation to the current model of safety clothing). Internally, this decisional profi is translated into the combined efforts of the purchasing and prescription departments, with the support of sustainable development. Concerning the relationship with the providers, EDF adopts a prescriptive positioning rather than collaborative, in which the purchasing function ask for eco-innovative products to the providers.

- **Societal:** in this profi clusters $C2_{BOL}$, $C1_{MOL}$, and $C1_{EOL}$ are positioned.

  This profi suppose strong internal transformation to EDF. For instance, the roles of sustainable development and human resources departments gain in importance in the defi of the purchasing strategy. Besides, the purchasing department should be able to cooperate with the providers of the entire supply chain in order to accomplish sustainability goals from a normative perspective. Such a collaboration should be a common effort to transform the supply chain practices and co-create sustainable offer portfolios covering the entire life cycle.

- **Triple bottom line (TBL):** here, only the cluster $C2_{MOL}$ is identified.

  In this case, EDF is willing to pay higher prices for the safety clothing washing services (i.e., degradation of economic dimension), while reducing the environmental and social impacts, and guaranteeing the traceability and the quality of the product (i.e., improvement of environmental, social, and functional dimensions).

In the case of EDF, these profi represent an input for the transformation of the purchasing strategy.

### Actors' prioritization

According to the three decisional profi the actors have been prioritized diff tly. In the societal profi sustainable development and human resources departments were allocated with the highest values in the three criteria Power (P), Legitimacy (L), and Urgency (U). Regarding the eco-efficiency profi prescription and purchasing departments were prioritized with the highest scores. As for the TBL profi all actors have the same priority, the aggregation results are the same as AIP (i.e., resulting from the arithmetic mean of all the actors' priorities).

The results are presented in tables 6.12, 6.13, and 6.14, corresponding to each stage of the life cycle. The results show a slight variability on the criteria priorities, corresponding to the defi of each profi For instance, the eco-efficiency profi reveals an increase on the priority of the functional dimension of value. In the societal profi the priorities of the environmental and social dimensions are improved. In contrast, the results regarding the alternatives on the diff t stages of the life cycle remains stable. The above is explained by the general agreement between the actors concerning the alternatives for all the stages of the life cycle.

Regarding the results, EDF is able to select between the more convenient profi and adopt accordingly its purchasing strategy. Nevertheless, it is recommended to evaluate the collective acceptance of the fi decision.

Table 6.12: Results aggregation at the beginning of life according to decisional profi

| Criterion | TBL | Eco-efficiency | Societal |
|---|---|---|---|
| **Economic** | **9%** | **10%** | **9%** |
| Life cycle costs | 77% | 75% | 83% |
| Purchasing costs | 23% | 25% | 17% |
| **Environmental** | **34%** | **34%** | **38%** |
| Fibre quality | 64% | 66% | 64% |
| Provider env. performance | 36% | 34% | 36% |
| **Social** | **26%** | **24%** | **30%** |
| Provider soc. Performance | 57% | 56% | 67% |
| User resistance | 43% | 44% | 33% |
| **Relational** | **14%** | **14%** | **14%** |
| Brand image | 66% | 65% | 62% |
| Innovation | 34% | 35% | 38% |
| **Functional** | **16%** | **17%** | **10%** |
| Fibre quality | 64% | 63% | 67% |
| Availability | 36% | 37% | 33% |
| **Alternatives** | | | |
| Tencel | 44% | 42% | 50% |
| Poly-cotton | 27% | 28% | 23% |
| Cotton BIO | 28% | 30% | 26% |

Table 6.13: Results aggregation at the middle of life according to decisional profi s.

| Criterion | TBL | Eco-efficiency | Societal |
|---|---|---|---|
| **Economic** | **14%** | **12%** | **12%** |
| **Environmental** | **31%** | **28%** | **40%** |
| Carbon footprint | 59% | 53% | 64% |
| Chemical use | 41% | 47% | 36% |
| **Social** | **28%** | **23%** | **24%** |
| Local job | 33% | 43% | 37% |
| User resistance | 20% | 17% | 12% |
| Solidarity purchasing | 43% | 40% | 51% |
| **Relational** | **12%** | **12%** | **13%** |
| Brand image | 52% | 63% | 39% |
| Innovation | 48% | 37% | 61% |
| **Functional** | **16%** | **24%** | **11%** |
| Lifespan | 31% | 32% | 30% |
| Comfort | 46% | 47% | 51% |
| Traceability | 22% | 22% | 19% |
| **Alternatives** | | | |
| Centralised washing | 32% | 34% | 31% |
| Localised washing | 67% | 65% | 69% |

Table 6.14: Results aggregation at the end of life according to decisional profi

| Criterion | TBL | Eco-efficiency | Societal |
|---|---|---|---|
| **Economic** | **16%** | **18%** | **11%** |
| **Environmental** | **33%** | **29%** | **41%** |
| Carbon footprint | 17% | 17% | 17% |
| Recycling | 83% | 83% | 83% |
| **Social** | **25%** | **22%** | **27%** |
| Local job | 44% | 44% | 63% |
| User resistance | 18% | 19% | 12% |
| Solidarity purchasing | 28% | 37% | 25% |
| **Relational** | **11%** | **8%** | **12%** |
| Brand image | 51% | 63% | 31% |
| Innovation | 49% | 37% | 69% |
| **Functional** | **15%** | **23%** | **9%** |
| **Alternatives** | | | |
| Other product | 43% | 48% | 46% |
| New clothing | 38% | 29% | 38% |
| Energy | 19% | 23% | 16% |

## 6.5 Conclusions

The main inte of lifnt of this chapter was to illustrate the applicability of the proposed framework, resulting from this thesis work. Hence, ICOVET project was analysed, an initiative of innovation triggered by EDF (*Electricité de France*, in French), seeking for the transformation of its safety clothing system by considering sustainability goals. The project involves the participation of current and potential providers of EDF belonging to the safety clothing supply chain. This project represents a non-typical case of sustainable innovation development, in which the initiative is triggered by the customer, without any previous knowledge about the possible solutions. Moreover, from EDF's perspective, ICOVET project represents a strategic sourcing problem, centred on innovation development from the initiative of purchasing department. The project is also a way to reinforce the relationships between EDF and its providers.

The case has been analysed following the four steps of the proposed methodological framework: i) value analysis, ii) problem structure modelling, iii) preference modelling, and iv) consensus process. Several methods were implemented in each step of the framework, and the main results were discussed and confronted with the company reality, deriving into some managerial recommendations. Firstly, the framework allowed representing hidden customer needs and encouraging the industrial transformation towards sustainable and innovative businesses. Secondly, from the cognitive point of view, the approach enabled an iterative process of knowledge generation and capitalisation between the internal and external actors. Thirdly, the approach helped to elucidate the priorities of the key actors in terms of value creation, analysing their compatibility, and proposing a process to reach a form of consensus. Finally, some conclusions can be highlighted regarding the managerial implications to EDF. Particularly, the analysis of decisional profi represent a base for the transformation of EDF's purchasing strategy.

# Part IV

# General conclusion

# Chapter 7

# Conclusions and research perspectives

**Contents**



## 7.1 Further discussion

This thesis work contributes to the literature on sustainability, innovation, and value creation. Precisely, the proposed framework contributes to the conceptualization, modelling and assessment of sustainable value creation in the contexts of collaborative innovation between industrial actors. The framework has been built from solid conceptual basis obtained from literature review in the domains of value creation, innovation management, system modelling, and decision-making. Our proposal is, thus, the result of the convergence between several disciplines, demonstrating the complexity that sustainable value creation conveys.

The framework is structured in four main phases: 1) value analysis, 2) problem structure modelling, 3) preference modelling, and 4) researching a consensus. Several methods were implemented in each phase, and the framework has been tested in a real case related to sustainability improvement through collaborative innovation. The adopted approach helped to structure the expectations of the key actors in terms of value creation, analyse actors' compatibilities, and propose a decision aid for consensus building. In the following, the main contributions derived from literature review, the proposed framework, and the case study are described according to the research axes reported on chapter 1.

## 7.2 Scientific contributions and implications

**Research axe 1 – Conceptualization of sustainable value creation.** This was addressed through the phase 1 of the proposal. Indeed, we propose a framework to characterise sustainable value into fi e dimensions namely, economics, environmental, social, relational, and functional. The fi e dimensions resulted from a deep analysis of the literature on the notion of value. This framework is useful to understand and to represent the value created in sustainability-oriented businesses (e.g., circular economy, product-service systems, industrial symbiosis, among others). The value framework was implemented in the ICOVET project, allowing representing hidden customer needs. This multidimensional characterisation of value allows overcoming the barriers of economic interests, enabling the representation of new benefits emerging from the collaboration (e.g., relational value creation throughout knowledge sharing). Furthermore, the value characterisation framework represents a tool to encourage the industrial transformation towards sustainable and innovative businesses.

**Research axe 2 – Modelling collaborative innovation processes.** This was addressed through the phase 2 of the proposal. Supported by Problem Structure Modelling (PSM) tools, a collaborative innovation approach was proposed. This approach, named in this work "value alignment generic model" aims at aligning customer value expectations with providers' value propositions. The generic model is implemented through goal modelling techniques. This approach allows to structure complex situations, which involve several dimensions of value creation and actors. Based on the value alignment modelling, it is possible to refine the value creation dimensions into criteria from the perspective of each actor. Then, from the criteria, feasible value propositions can be identified. This step of the framework allowed reducing the problem complexity, moving from a highly unstructured representation of actors expectations towards a structured set of criteria and alternatives. This step provided the required inputs for modelling actor's preferences, supported by a multi-criteria decision analysis method.

**Research axe 3– Value assessment in early phases of collaborative innovation.** This was addressed through the phases 3 and 4 of the proposal. Sustainable value creation in the context of collaborative innovation has been approached as a multi-stakeholder and multi-criteria decision problem in this thesis work. Then, the Analytic Hierarchy Process was selected to structure the complex decision situation, and to perform preference modelling. AHP was selected since it appears suitable for unstructured and very complex problems. Moreover, it allows capturing actor's subjectivity and knowledge lacking, which are typical characteristic of radical innovation problems. From the cognitive point of view, AHP helped to perform an iterative process of knowledge generation and capitalisation between the actors. From the practical point of view, the approach was supported by the development of an on-line questionnaire, reproducible over other decision situations beyond the safety clothing system.

Furthermore, we proposed to enrich AHP with actors' importance issued from the Stakeholder Theory, and to couple it with a clustering technique. The clustering technique allows to identify actors' positioning, that can be crossed with a set of named "sustainability profi decisional profi were proposed, based on the literature in sustainability. The output of this process provides a base for discussion and negotiation between several stakeholders, enabling a form of consensus.

## 7.3 Managerial contributions and implications

Considering the managerial objective described in 6.3.2, subsection 6.3.2, the main implications derived from the proposed framework are the following:

**Identifying the conditions to stimulate the development of radical innovation in both the offer and the organisation of the actors implied in the safety clothing supply chain.** During the fi phase of the ICOVET project, several seminars were developed with internal and external actors. The main results allowed identifying the internal and external conditions to develop a radical innovative offering. For instance, internal conditions can be summarized into the following points: inter-department collaboration; transforming of the internal culture towards sustainability (i.e., eliminating the resistance to change of the employees); re-orienting the purchasing strategy overcoming the *value for money* mindset; improving internal skills with respect to sustainability practices; moving from the purchasing focus towards supply management focus. Besides, external conditions mainly evokes the following aspects: creating a market for innovative offer development; sharing costs of innovation (e.g., prototyping, technology upgrading, logistics configuration, among others); deploying vertical and horizontal collaboration schemes (i.e., integrating economic and non-economic actors); guaranteeing long-term relationships between the customer and the providers; and ensuring the willingness to pay for innovation.

**Enhancing the global performance of the purchasing function concerning the CSR company strategy.** the collective effort carried out along the ICOVET project resulted on a fi st step towards the transformation of EDF's purchasing strategy. The results obtained after the two years of the project revealed an increase of the maturity on the purchasing function. The above is reflected on a declared willingness to pay a higher price in exchange of a better offer in terms of environmental, social, and functional performance. Although, EDF is still constrained by the public procurement policies in France (i.e., any no provider can be privileged by arbitrary selection criteria). Nevertheless, the results of the ICOVET project provides a base for discussion and co-creation with the provider panel, encouraging the development of sustainable and innovative solutions. Moreover, the results represent a fi step towards the consolidation of new customer needs regarding the sourcing of safety clothing, which can be reproduced within other purchasing companies.

**Improving the corporate image of the company throughout the integration of sustainability criteria in the purchasing decisions.** With the development of ICOVET project, EDF acquired new skills and knowledge about radical innovation development, sustainability, and collaboration with external actors. Thus, the results of the project represent a collective learning process, in which internal and external actors discovered new ways to work together for improving collective progress. Although the results can not be incorporated immediately neither on the purchasing strategy nor in the textile supply chain, they constitute a powerful communication instrument that pushes the internal and external transformation towards sustainability. In concrete terms, the project triggered the acceleration of providers' innovation processes, and promoted the consolidation of sustainability-oriented requirements regarding the safety clothing fi

**Encouraging long-term relationships with the providers along the life cycle.** One of the identified conditions stated by the providers to develop innovative solutions, is the guarantee of long-term relationships. After the project, new links were created between EDF and some economic and non-economic actors. Moreover the conditions to establish collaborative partnerships were discussed, concerning the contract duration, investments conditions, and knowledge sharing. However, nowadays there is no a concrete proposal from the providers to respond the emerging needs of EDF regarding the safety clothing. This fact reveals a lack of maturity of the textile industry to integrate sustainability-oriented requirements. Nevertheless, the providers consider this panorama as an opportunity to progress rather than a constraint. Certainly, further work is still needed in collaboration with the actors on the supply chain to reach concrete sustainable value propositions and collaborative agreements.

## 7.4 Limits of the study

The limits can be classified into two main categories, the fi one concerning to the methodological approach, and the second one regarding the implemented methods along the framework phases.

**The methodological approach.** Firstly, considering the empirical methodology, one major limit is about the analysis of an unique case study, making the results very context-dependant. As a perspective, the proposed framework should be implemented in diff t cases and industrial sectors, for further validation.

Secondly, the decision situation was addressed separately at each stage the life cycle of the offer development. Although this allowed holding complexity, the interdependencies between solutions at each stage of the life cycle have not been considered. Hence, as a research perspective, a combinatorial phase of analysis could enrich the decision process, providing comprehensive and more realistic results.

Thirdly, although many actors on the textile supply chain were included in the problem structuring phase, the decisional phase of the proposal was focused on EDF perspective.

For future research, the framework should be applied with a broader set of stakeholders, verifying its applicability in more complex situations.

**The implemented methods.** The main limits found in the proposed framework are related to the multi-stakeholder and multi-criteria decision analysis part. The fi major issue concerns the subjective evaluation, given the use of the Analytic Hierarchy Process (AHP). The subjectivity character of this method becomes a weakness when the evaluators are not experts in the concerned domain. Moreover, in the presence of incomplete information, the results are subject to high uncertainty, which makes it risky for strategic decisions. Moreover, the application of AHP can be very time-consuming for a high number of compared elements.

Some research perspectives are derived from these limits. For instance, combining AHP with quantitative methods helps to reduce the uncertainty of the fi decision. Moreover, when quantitative data is available, domain experts are not mandatory to perform the evaluation process.

The second point concerns the consensus process. Here, the major diffi y consists on meeting all actor's preferences. In realistic situations, only partial consensus can be reached. A research perspective in this direction is the integration of a satisfaction measure to evaluate the appropriateness of a given solution with respect to each actor.

# Scientifi productions

## International conference articles

- Towards an integration of life cycle thinking into PSS business models. (Orellano et al., 2018b)
- The demand-pull approach to business model innovation through product-service systems: a case study. (Orellano et al., 2018a)
- A system modelling approach to collaborative PSS design. (Orellano et al., 2019a)
- A Multi-criteria Approach to Collaborative Product-Service Systems Design. (Orellano et al., 2019b)

## Poster presentations

- Sustainable Business Models design for Product Service Systems: a collaborative innovation approach. *Journée de la recherche ED-SIS 2019, Saint-Étienne, France.*

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# Part V

# Appendices

# Annex A: Interview guidelines Internal actors

**Interlocuteur** (Nom, fonction):

L'objet spécifique de cet entretien est de connaitre les processus internes d'achat, approvisionnement, entretien et fin de vie des vêtements de travail chez EDF et leurs relations avec les acteurs externes, ainsi que les opportunités d'innovation visées.

Parmi les points évoqués ce matin sur les questions d'impact et les opportunités d'amélioration au niveau de la valeur à chaque étape du cycle de vie, est-ce que vous avez des remarques, interrogations…. ? Voulez-vous revenir sur un élément ?

**Connaissance de l'Interlocuteur** (Nom, fonction, ancienneté…):

## I. Première phase : Diagnostic Marché des Vêtements de travail

### 1.1. Généralités du Marché / Développement de Filière innovante

*Question d'ouverture : Comment caractérisez-vous, décrivez-vous le marché du vêtement de travail ? (Stable, diversifié, hostile, coopératif ?)*

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Acteurs en présence | • Nombre, poids et caractéristiques, Intermédiaires<br>• Caractéristiques offre/demande<br>• Relations entre les acteurs | 1. Quelle est votre perception sur le marché ? Peut-on parler de marché dominé par quelques fournisseurs ?<br>2. Veillez-vous à ce que les acteurs impliqués sur les différentes étapes du processus de fabrication se connaissent ?<br>- Entretiennent-ils des relations collaboratives ? |
| Contexte et Evolution du Marché / nouveaux entrants | • Tendances du marché : passés, actuelles, futures<br>• Réglementation (évolution des normes et contexte légal)<br>• Evolutions technologiques<br>• Enjeux<br><br>SWOT<br>• Opportunités<br>• Contraintes<br>• Menaces | 1. A votre avis, quelles sont et seront les tendances du marché ? *(Les acteurs, les prix, les évolutions des fibres, ennoblissement, l'ergonomie, la sécurité, l'usage, customisation.)*<br>2. Quels sont les besoins d'innovation produit en fonction des priorités chez EDF ?<br>- Y-a-t-il dans le marché actuel des offres qui répondent à ces besoins ?<br>- Quelles sont les principales difficultés rencontrées ?<br>- Quels sont les obstacles à leur résolution ?<br>3. Y-a-t-il des nouveaux entrants au marché ? Sont-ils innovants ? quelles sont ses forces ? |
| Développement de nouvelles filières (Lin-chanvre, ortie) | • Opportunités<br>• Contraintes<br>• Menaces<br>• Enjeux | 1. La direction parle de filière lin-chanvre et d'autres, qu'en pensez-vous ?<br>2. A votre avis quelle serait la plus-value de cette filière ?<br>3. A quelle condition pourrait-elle représenter une plus-value ?<br>4. Quels seraient les freins à la prise en compte de cette filière lin-chanvre dans vos achats? les leviers pour les lever ? |

**1.2. Politique Produit - vêtements de travail**

*Question d'ouverture : En ce qui concerne les vêtements de travail, quel regard portez-vous ? Quels sont les éléments clés de la politique produit ?*

**1.3. Politique Fournisseur**

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Elaboration de la stratégie achats chez EDF | • Ethique, qualité, politiques produits et fournisseurs<br>• Gouvernance | 1. Vous choisissez vos prestataires sur une stratégie de mieux disance. Mais au final, est-ce que vous choisissez le moins cher ?<br>2. De quelle manière réalisez-vous un benchmark des pratiques des donneurs d'ordres ?<br>3. Quelles sont les ressources extérieures (les parties prenantes) que vous mobilisez pour vous aider à déterminer votre stratégie achats ?<br>4. Quel poids est accordé au critère monétaire ? et aux critères non monétaires (DD, innovation.) ? Avez-vous apporté des modifications sur ces critères ? lesquelles ? |
| Prix<br><br>Aspects contractuels | • Coût<br>• Marge<br>• Consultation<br>• Négociation<br>• Contractualisation | 1. Comment vous assurez-vous que les prix garantissent la pérennité économique des fournisseurs ?<br>1. Quelles sont les étapes clés du déroulement de la négociation ?<br>2. Quelles sont les améliorations qui ont pu être apportées dans le cadre des partenariats productivité ? |
| Nature des relations | • Plan Ethique<br>• Partage d'information,<br>• Transparence<br>• Interdépendance<br>• Index PCI (justice,, courage, tempérance, patience) | 1. Comment percevez-vous les relations entre EDF et ses fournisseurs (hors Bétrancourt)?<br>2. Quels sont les éléments déterminants dans la nature de ses relations ?<br>3. Y-a-t-il des difficultés chez les fournisseurs qui nuisent au processus achat?<br>4. Percevez-vous des opportunités de collaboration complémentaires avec les fournisseurs en place? |

**Conclusion de la première partie : Synthèse du diagnostic sur stratégie achat.**

## II. <u>Deuxième phase</u> : Diagnostic et identification des processus internes et de l'organisation

**2.1. Description du Processus (internes et externes) et acteurs concernés**

1. Qui sont les parties prenantes avec lesquelles vous êtes amenées à collaborer sur la question des vêtements de travails (internes, externes, …) ?
2. Comment qualifiez-vous les relations entretenues avec la prescription ? En phase de définition du besoin ? dans la phase de négociation ? Dans le suivi du marché ?
3. Pensez-vous à des acteurs externes qui seraient ou pourraient être impliqués dans la requalification du besoin ou sur la réalisation du marché ?

- *Quel est le processus de retour d'expérience*

1. Comment évaluez-vous la politique achats en matière de vêtements de travail ?
2. Comment mesurez-vous la performance achats ? Y-a-t-il des indicateurs spécifiques ?
3. Comment se formalise le retour d'expérience ?

**2.2. Identifications des opportunités et points d'amélioration**

- De votre point de vue, quelles sont les opportunités d'amélioration ?

**De façon globale, quelles difficultés majeures trouvez-vous dans les processus internes liés au vêtements de travail ? Quelles perspectives ?**

**Conclusion de la deuxième partie : Synthèse du diagnostic processus. Cartographie à demander.**

**III. Troisième phase : Diagnostic du marché et Développement d'une offre collaborative / innovante**

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Innovation de l'offre de VT (basé service) | • Motivations<br>• Freins et leviers<br>• Besoins de transformations organisationnelles | 1. Pourriez-vous reformuler votre besoin sous forme d'une unité fonctionnelle ? *(Besoin d'usage, performance.)*<br>2. Avez-vous déjà eu l'occasion d'expérimenter d'autres formes de mises à disposition des vêtements de travail (location, location-entretien ?...) Si oui, quelles ont été vos retours d'expériences par rapport à ces formes de prestations ?<br>- Quelles seraient vos motivations à (re)développer ce type de pratique VT chez EDF ?<br>3. Le numérique est-il de nature à améliorer les offres proposées ? Avez-vous déjà des propositions sur le sujet ?<br>4. Quelles seraient les transformations induites par une dotation à l'usure dans votre organisation ?<br>5. La mise en place d'un système produits-service pourrait-elle remettre en question les prestataires actuels ?<br>6. Quelle valeur ajoutée en attendre ?<br>7. Quels risques ?<br>8. Avez-vous déjà recensé des prestataires susceptibles de vous aider ? |
| Pratiques collaboratives | • Collaboration interne et externe actuel<br>• Besoins de collaboration pour le futur | **Comment appréciez-vous la qualité et le niveau de la collaboration en interne?**<br>- Comment les faire évoluer ?<br>- Sur quels points il sera difficile de les faire évoluer ?<br>**Et en externe**<br>- Qui sont **les autres PP** extérieures au groupe et aux prestataires avec qui vous collaborez sur ce thème ?<br>- Quels sont leurs rôles ? Quelle relation ? |
| Impact sur le service Achat | • Impact du changement du modèle dans le processus achats<br>• Impact sur la valeur de l'offre<br>• Impact sur votre métier d'acheteur | **1. Si vous deviez aujourd'hui repasser un marché, quelles seraient les améliorations ?**<br>- Vous proposeriez quel type de stratégie ?<br>- Quels bénéfices pour EDF, vous, les usagers… ? quelles difficultés ?<br>2. Comment voyez-vous évoluer votre métier d'acheteur ? Quelles sont ou quelles seraient les compétences à développer pour intégrer une offre SPS ? les changements de processus ? |

**Avez-vous d'autres éléments que nous n'avons pas abordés et qui vous viennent à l'esprit, vous paraissent importants de nous mentionner**.

**Conclusion globale finale.**

Merci de votre participation

L'objet spécifique de cet entretien est de connaitre la contribution du service DD chez EDF au marché et à la mise à disposition des vêtements de travail et de connaitre le positionnement du service DD face aux opportunités d'innovation visées.

Parmi les points évoqués ce matin sur les questions d'impact et les opportunités d'amélioration au niveau de la valeur à chaque étape du cycle de vie, est-ce que vous avez des remarques, interrogations…? Voulez-vous revenir sur un élément ?

**Connaissance de l'Interlocuteur** (Nom, fonction, ancienneté…):

**<u>Première phase</u> : Généralités politique de Développent Durable / Développement de Filière innovante**

Du point de vue du DD quel regard portez-vous sur le sujet des VT en lien avec la fonction achats du groupe ?

| Sous-thèmes | | Questions |
|---|---|---|
| Contribution au marché Vêtements | Comprendre le rôle actuel de l'acteur | - Quelle est **votre contribution** au marché du vêtement de travail ? Avec quelle **organisation** ?<br>o Depuis combien de temps travaillez-vous sur ce sujet ?<br>o Avec qui travaillez- vous ? Externe ? interne ?<br>o A quelles étapes ?<br>- Comment envisagez-vous les **innovations** en matière de textile ?<br><br>Avez- vous des **attentes** particulières ? |
| | Perception de la transformation de l'offre et rôle dans la transformation | - Une des **opportunités d'amélioration** réside dans le développement de nouvelles filières lin-chanvre, ortie, … Quel est votre regard à ce sujet ?<br>o Avez-vous pensé à d'autres alternatives ?<br>- Quelle pourrait être **votre contribution** ?<br>- Comment à votre avis peut être **modifiée la valeur**? Sur quels aspects du DD peut travailler ? Quelle valeur ajoutée ?<br>- Pour vous, la **transformation de l'offre s'accompagne t'elle d'un changement** au niveau de votre service ? lequel ?<br>- Quels **bénéfices** percevez-vous pour votre service, entreprise, usagers ? Quels **freins** au développement identifiez-vous?<br>- Quels **risques** ? |
| Stratégie de Développement Durable et les achats | | - EDF est engagé sur **Six objectifs de DD** (changement climatique, développement humain, précarité énergétique, efficacité énergétique, Dialogue et concertation, biodiversité) ....<br>- Quelle est la **contribution des achats à ces objectifs** ?<br>- Quels sont les **critères** que vous avez prescrits en matière d'achats de vêtements de travail ?<br>- Y-a-t'il des **indicateurs de performance** qui vous sont remontés sur ce marché ? |

| | |
|---|---|
| | - Sinon, comment évaluez-vous la **performance environnementale** et sociale en matière de vêtements de travail ?<br>- A votre avis, quels sont les **points critiques du parcours des VT** qui pourraient être améliorés en regardant la politique RSE-DD de EDF ?<br>Matières premières, tissage, distribution, usage, fin de vie...?<br>- Quels pourraient être les **freins** à l'amélioration de ces pratiques ?<br>- Comment **communiquez**-vous en interne les **changements** au niveau des axes du DD ? |

**Conclusion de la première partie : Synthèse du diagnostic sur stratégie RSE-DD en lien avec les achats.**

<u>**Deuxième phase**</u> **: Développement d'une offre collaborative / innovante**

| Sous-thèmes | | Questions |
|---|---|---|
| Innovation de l'offre de VT (basé service) | | - Pourriez-vous reformuler votre **besoin** sous forme d'une unité **fonctionnelle**? J'ai besoin d'un vêtement conçu pour X …. Et Y utilisations ? et **comportementale** ? qui va servir à quoi ? pourquoi ?<br>- Avez-vous déjà eu l'occasion d'**expérimenter** d'autres formes de mises à disposition des vêtements de travail (location, location-entretien ?...) Si oui, quels ont été vos **retours d'expériences** par rapport à ces formes de prestations ? |
| Condition de collaboration | Condition de collaboration intra-organisationnelles | - Comment qualifiez-vous la **qualité de la collaboration** avec les acteurs internes au groupe qui interviennent sur le vêtement de travail ?<br>Avez-vous l'occasion de **travailler avec les usagers** ? |
| | Condition de collaboration avec les prestataires ? | - Avez-vous l'occasion de rencontrer **les acteurs impliqués** dans la fourniture des produits ou les prestations de service ? Quelle est votre perception sur ces prestataires ?<br>- Avez-vous l'occasion de rencontrer **d'autres acteurs** qui ne sont pas titulaires de ces marchés mais qui pourraient l'être à l'avenir ?<br>- Ces offres peuvent-elles être de nature à changer la représentation du besoin ?<br>- Comment appréciez-vous la **qualité de la relation avec les prestataires** avec lesquels vous êtes en contact ? |
| | Conditions de collaboration avec les autres PP | - Qui sont **les autres PP** extérieures au groupe et aux prestataires avec qui vous collaborez sur ce thème ?<br>- Quels sont leurs rôles ? Quelle relation ? |

**Avez-vous d'autres éléments que nous n'avons pas abordés et qui vous viennent à l'esprit, vous paraissent importants de nous mentionner**.

Merci de votre participation

# Annex B: Interview guidelines External actors

Interlocuteur (Nom, fonction):

## Première phase : Diagnostic Marché des Vêtements de travail

### 1.1. Généralités du Marché / Développement de Filière innovante

*Question d'ouverture : Comment caractérisez-vous, décrivez-vous le marché du vêtement de travail ? (Stable, diversifié, hostile, coopératif ?)*

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Acteurs en présence | • Nombre, poids et caractéristiques, Intermédiaires<br>• Caractéristiques offre/demande<br>• Relations entre les acteurs | 1. Quelle est votre perception sur le marché ? Peut-on parler de marché dominé par quelques fournisseurs ?<br>2. Comment vous positionnez-vous ?<br>3. Avez-vous des contacts avec l'ensemble des acteurs de la filière (culture, tissage, ennoblissement, confection, logistique, mise à disposition, fin de vie ?)<br>-Qui ? Où ils se trouvent ?<br>4. Comment qualifiez vous :<br>- la qualité de la relation ? (Rythme, fréquence, projets collaboratifs, …) |
| Contexte et Evolution du Marché / nouveaux entrants | • Tendances du marché : passés, actuelles, futures<br>• Réglementation (évolution des normes et contexte légal)<br>• Evolutions technologiques<br>• Enjeux<br><br>SWOT<br>• Opportunités<br>• Contraintes<br>• Menaces | 1. A votre avis, quelles sont et seront les tendances du marché ? *(Les acteurs, les prix, les évolutions des fibres, ennoblissement, l'ergonomie, la sécurité, l'usage, customisation, la réglementation)*<br>2. Quels sont les nouveaux besoins que vous ressentez de la part de vos clients ?<br>3. Où vous positionnez vous par rapport à ces nouvelles tendances ? Avez-vous déjà fait des expériences d'innovation ? lesquelles ? Dans quel contexte ?<br>4. Y-a-t-il des nouveaux entrants au marché ?<br>Sont-ils innovants ? quelles sont ses forces ? |

### 1.2. Politique Fournisseur

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Elaboration de la stratégie achats chez EDF | • Ethique, qualité, politiques produits et fournisseurs<br>• Gouvernance | 1. Quelle place occupe EDF dans votre portefeuille de clients ?<br>2. Est-ce que EDF a des exigences, des modes de travail spécifiques par rapport aux autres grands comptes ? Comment percevez-vous la politique achats EDF en termes de CDC et critères de sélection ?<br>3. Quelles sont les difficultés que vous rencontrez à leur égard (relationnelles, contractuelles, techniques, tarifaires…) |
| Prix | • Coût<br>• Marge | 1. Est-ce que les prix vous permettent d'assurer votre pérennité économique en tant que fournisseurs ? |
| Aspects contractuels | • Consultation<br>• Négociation<br>• Contractualisation | 1. Etes vous soumis à des partenariats de productivité ?<br>2. Si oui, quels sont les bénéfices que vous tirez d'un tel dispositif ? Quelles améliorations souhaiteriez voir appliquées à ce partenariat ? |
| Nature des relations | • Collaboration interne et externe actuel<br>• Plan Ethique<br>• Partage d'information,<br>• Transparence<br>• Interdépendance<br>• Index PCI (justice, courage, tempérance, patience) | 1. Depuis combien de temps travaillez-vous avec EDF ?<br>2. Avec quels acteurs internes êtes-vous en contact ?<br>3. Avec quels services de chez EDF êtes-vous amené à collaborer ?<br>4. Comment percevez-vous les relations avec EDF ? Comment appréciez-vous la qualité et le niveau de la collaboration avec EDF ?<br>5. Observez vous des différences de comportement significatives entre les différents publics auxquels vous êtes confrontés (prescripteurs, acheteurs, autres acteurs de la chaîne de valeur, …).<br>6. Quelles sont les difficultés auxquelles vous pouvez être confrontés ?<br>7. Quels sont les éléments déterminants dans la nature de ses relations ?<br>8. Percevez-vous des opportunités de création de valeur supplémentaires avec EDF? |

Conclusion de la première partie : Synthèse du diagnostic sur stratégie achat.

## I. Deuxième phase : Développement d'une offre collaborative / innovante

| Sous-thèmes | Informations à recueillir | Questions |
|---|---|---|
| Innovation de l'offre de VT (basé service) | • Motivations<br>• Freins et leviers<br>• Besoins de transformations organisationnelles | 1. EDF s'intéresse à de nouvelles filières (filière lin-chanvre) et d'autres, qu'en pensez-vous ?<br>- Pourriez-vous prendre en compte ces nouvelles attentes dans votre processus et répondre aux attentes EDF?<br>2. Aviez-vous déjà entendu parler de l'économie de fonctionnalité ?<br>3. Aviez-vous déjà entendu parler des systèmes produits-services ?<br>4. Avez-vous déjà eu l'occasion d'expérimenter d'autres formes de mises à disposition des vêtements de travail (location, location-entretien ?...) Si oui, quelles ont été vos retours d'expériences par rapport à ces formes de prestations ?<br>- Quelles seraient vos motivations à (re)développer ce type de pratique VT chez EDF ?<br>- Percevez vous les transformations à mener dans votre organisation pour y parvenir ?<br>- Quelles sont les difficultés que vous pourriez rencontrer dans la transformation de votre modèle économique ?<br>- Sentez vous un risque ou une opportunité à développer cette offre avec EDF ?<br>5. Le numérique est-il de nature à améliorer les offres proposées ? Avez-vous déjà des propositions sur le sujet ?<br>6. Avez-vous déjà recensé des prestataires susceptibles de vous aider ? |
| Co-création de valeur | | 1. A votre avis, quelle est la valeur ajoutée lors du développement d'une offre innovante ?<br>2. Quels sont les bénéfices et sacrifices que vous percevez en relation au développement d'une telle offre par rapport à l'offre ancienne ?<br>- Pouvez-vous préciser par rapport aux bénéfices et sacrifices tangibles et non tangibles ?<br>3. Chez vous, quelles conditions seront nécessaires pour créer une telle valeur ajoutée ? |
| Innovation collaborative | • Besoins de collaboration pour le futur | 1. **Avez-vous le besoin de collaborer différemment avec EDF pour répondre aux enjeux d'innovation attendus ?**<br>2. Ressentez-vous le besoin de développer des collaborations avec d'autres acteurs de la chaîne de valeur ? lesquels ? |
| Impact sur les processus actuels | • Impact du changement du modèle dans les processus actuels de l'entreprise<br>• Impact sur la valeur de l'offre<br>• Impact sur votre métier | 1. Si vous deviez aujourd'hui répondre à un marché, quelles seraient les avantages de votre offre? Que pourriez vous mettre en avant ?<br>- Quels bénéfices pour EDF, vous, les usagers... d'autres acteurs ? quelles difficultés ?<br>2. Comment voyez-vous évoluer votre métier? Quelles sont ou quelles seraient les compétences à développer pour intégrer une offre SPS ? quels changements dans le processus ? |

Avez-vous d'autres éléments que nous n'avons pas abordés et qui vous viennent à l'esprit, vous paraissent importants de nous mentionner. Conclusion globale finale.

# Annex C: Template for alternative generation

GRILLE ANALYSE PROCESSUS INNOVATION COLLABORATIVE – Entretiens fournisseurs du 11 décembre 2018

NOM DU FOURNISSEUR – NOM ET FONCTION DE L'INTERLOCUTEUR :

………………………………………………………………………………………………………………………….

| | SOLUTIONS POTENTIELLES PROPOSEES PAR LE FOURNISSEUR | CONDITIONS DE COLLABORATION TOUT AU LONG DE LA CHAINE DE VALEUR | LES OPPORTUNITES DE CREATION DE VALEUR |
|---|---|---|---|
| Les attendus | - Temporalité (capacité à répondre dans le délais imparti)<br>- Capacité à répondre sur les différents sites géographiques et en termes de volume<br>- Opportunité de répondre dans le cadre normatif et réglementaire d'un marché public<br>- Accompagnement de EDF dans la gestion de projet | - Connaissances des acteurs impliqués dans la chaîne de valeur amont et aval<br>- Capacité à évaluer les risques et les impacts dans un logique cycle de vie<br>- Capacité à garantir une traçabilité tout au long de la chaîne de valeur<br>- Compétences pour engager une collaboration dans une perspective d'économie circulaire | - Conditions de financement du dispositif d'innovation<br>- Mesure de la création de valeur sur les thématiques de la grille multicritères (fonctionnelle, relationnelle, sociale, économique, environnementale) |
| Les réponses du fournisseur | | | |
| Risques et leviers | | | |

# Annex D-1: Evaluation matrices Beginning of life

# Actor A1

I. ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 1 : LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 2/3 | 0,555555556 | 0,692307692 | 0,63334572 | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | 0,106156324 | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

SUBCRITERION 2 : Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/3 | 1 | 0,2 | 0,217391304 | 0,142857143 | 0,186749482 | 0,563008972 |
| Poly Coton | 3 | 1 | 5 | 0,6 | 0,652173913 | 0,714285714 | 0,655486542 | 2,004554865 |
| Coton BIO | 1 | 1/5 | 1 | 0,2 | 0,130434783 | 0,142857143 | 0,157763975 | 0,475610766 |
| Total | 5 | 1 1/2 | 7 | | | | lmax | 3,043174603 |
| Priority vector | 0,186749482 | 0,655486542 | 0,157763975 | | | | CI | 0,021587302 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,037219485 |

CRITERION 2 : Environmental

SUBCRITERION 1 : Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 0,692307692 | 0,63334572 | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | 0,106156324 | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

SUBCRITERION 2 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 3 | 0,428571429 | 0,454545455 | 0,333333333 | 0,405483405 | 1,22991823 |
| Poly Coton | 1 | 1 | 5 | 0,428571429 | 0,454545455 | 0,555555556 | 0,47955748 | 1,45983646 |
| Coton BIO | 1/3 | 1/5 | 1 | 0,142857143 | 0,090909091 | 0,111111111 | 0,114959115 | 0,346031746 |
| Total | 2 1/3 | 2 1/5 | 9 | | | | lmax | 3,035786436 |
| Priority vector | 0,405483405 | 0,47955748 | 0,114959115 | | | | CI | 0,017893218 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,030850376 |

CRITERION 3 : Social

SUBCRITERION 1 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,625 | 0,666666667 | 0,64794686 | 1,948470209 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,130434783 | 0,125 | 0,111111111 | 0,122181965 | 0,366706924 |
| Coton BIO | 1/3 | 2 | 1 | 0,217391304 | 0,25 | 0,222222222 | 0,229871176 | 0,690217391 |
| Total | 1 1/2 | 8 | 4 1/2 | | | | lmax | 3,005394525 |
| Priority vector | 0,64794686 | 0,122181965 | 0,229871176 | | | | CI | 0,002697262 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,004650453 |

SUBCRITERION 2 : User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1/3 | 0,238095238 | 0,384615385 | 0,225806452 | 0,282839025 | 0,866162511 |
| Poly Coton | 1/5 | 1 | 1/7 | 0,047619048 | 0,076923077 | 0,096774194 | 0,073772106 | 0,222252607 |
| Coton BIO | 3 | 7 | 1 | 0,714285714 | 0,538461538 | 0,677419355 | 0,643388869 | 2,008310686 |
| Total | 4 1/5 | 13 | 1 1/2 | | | | lmax | 3,096725804 |
| Priority vector | 0,282839025 | 0,073772106 | 0,643388869 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 3 | 0,677419355 | 0,538461538 | 0,714285714 | 0,643388869 | 2,008310686 |
| Poly Coton | 1/7 | 1 | 1/5 | 0,096774194 | 0,076923077 | 0,047619048 | 0,073772106 | 0,222252607 |
| Coton BIO | 1/3 | 5 | 1 | 0,225806452 | 0,384615385 | 0,238095238 | 0,282839025 | 0,866162511 |
| Total | 1 1/2 | 13 | 4 1/5 | | | | lmax | 3,096725804 |
| Priority vector | 0,643388869 | 0,073772106 | 0,282839025 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

SUBCRITERION 2 : Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 3 | 3/5 | 0,6 | 0,6 | 0,6 | 1,8 |
| Poly Coton | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,6 |
| Coton BIO | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,6 |
| Total | 1 2/3 | 5 | 5 | | | | lmax | 3 |
| Priority vector | 0,6 | 0,2 | 0,2 | | | | CI | 0,00% |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,00% |

CRITERION 5 : Functional

SUBCRITERION 1 : fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 3 | 0,6 | 0,6 | 0,6 | 0,6 | 1,8 |
| Poly Coton | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,6 |
| Coton BIO | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,6 |
| Total | 1 2/3 | 5 | 5 | | | | lmax | 3 |
| Priority vector | 0,6 | 0,2 | 0,2 | | | | CI | 0,00% |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0% |

SUBCRITERION 2 : availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/3 | 0,111111111 | 0,130434783 | 0,076923077 | 0,106156324 | 0,31965812 |
| Poly Coton | 5 | 1 | 3 | 0,555555556 | 0,652173913 | 0,692307692 | 0,63334572 | 1,945621206 |
| Coton BIO | 3 | 1/3 | 1 | 0,333333333 | 0,217391304 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 9 | 1 1/2 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,106156324 | 0,63334572 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

## II.SUB-CRITERIA COMPARISON

**CRITERION 1 : Economic**

| | LCC | Purchasing cost | Priority vector | Global priority |
|---|---|---|---|---|
| LCC | 1 | 5 | 0,833333333 | **0,081278172** |
| Purchasing cost | 1/5 | 1 | 0,166666667 | **0,016255634** |
| **Total** | **1 1/5** | **6** | | |

**CRITERION 2 : Environmental**

| | Fiber quality | Provider performance | Priority vector | Global priority |
|---|---|---|---|---|
| Fiber quality | 1 | 3 | 0,75 | **0,335403832** |
| Provider performance | 1/3 | 1 | 0,25 | **0,111801277** |
| **Total** | **1 1/3** | **4** | | |

**CRITERION 3 : Social**

| | Social performance | User resistance | Priority vector | Global priority |
|---|---|---|---|---|
| Social performance | 1 | 7 | 0,875 | **0,24263727** |
| User resistance | 1/7 | 1 | 0,125 | **0,034662467** |
| **Total** | **1 1/7** | **8** | | |

**CRITERION 4 : Relational**

| | Brand image | Innovation | Priority vector | Global priority |
|---|---|---|---|---|
| Brand image | 1 | 1 | 0,5 | **0,067742685** |
| Innovation | 1 | 1 | 0,5 | **0,067742685** |
| **Total** | **2** | **2** | | |

**CRITERION 5 : Functional**

| | fiber quality | availability | Priority vector | Global priority |
|---|---|---|---|---|
| fiber quality | 1 | 5 | 0,833333333 | **0,035396648** |
| availability | 1/5 | 1 | 0,166666667 | **0,00707933** |
| **Total** | **1 1/5** | **6** | | |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/5 | 1 | 3 | 0,081081081 | 0,09953 | 0,04225 | 0,122 | 0,1429 |
| Environmental | 5 | 1 | 3 | 3 | 7 | 0,405405405 | 0,49763 | 0,6338 | 0,3659 | 0,3333 |
| Social | 5 | 1/3 | 1 | 3 | 5 | 0,405405405 | 0,16588 | 0,21127 | 0,3659 | 0,2381 |
| Relational | 1 | 1/3 | 1/3 | 1 | 5 | 0,081081081 | 0,16588 | 0,07042 | 0,122 | 0,2381 |
| Functional | 1/3 | 1/7 | 1/5 | 1/5 | 1 | 0,027027027 | 0,07109 | 0,04225 | 0,0244 | 0,0476 |
| **Total** | **12 1/3** | **2** | **4 3/4** | **8 1/5** | **21** | | | | | |
| **priority vector** | **0,097533806** | **0,447205109** | **0,277299737** | **0,13548537** | **0,042475977** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,558913014** | 0,519414563 | 0,602308381 | 0,621694435 | 0,52 | **0,56003772** |
| Poly Coton | **0,19771136** | 0,292856902 | 0,116130732 | 0,136886053 | 0,27 | **0,212562716** |
| Coton BIO | **0,243375626** | 0,187728536 | 0,281560887 | 0,241419512 | 0,21 | **0,227399564** |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,097533806** | **0,447205109** | **0,277299737** | **0,13548537** | **0,042475977** | |

| | LCC | PC | Economic |
|---|---|---|---|
| **Tencel** | 0,63334572 | 0,186749482 | 0,558913014 |
| **Poly Coton** | 0,106156324 | 0,655486542 | 0,19771136 |
| **Coton BIO** | 0,260497956 | 0,157763975 | 0,243375626 |
| **Priority** | **0,833333333** | **0,166666667** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| **Tencel** | 0,63334572 | 0,405483405 | 0,519414563 |
| **Poly Coton** | 0,106156324 | 0,47955748 | 0,292856902 |
| **Coton BIO** | 0,260497956 | 0,114959115 | 0,187728536 |
| **Priority** | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| **Tencel** | 0,64794686 | 0,282839025 | 0,602308381 |
| **Poly Coton** | 0,122181965 | 0,073772106 | 0,116130732 |
| **Coton BIO** | 0,229871176 | 0,643388869 | 0,281560887 |
| **Priority** | **0,875** | **0,125** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Tencel** | 0,643388869 | 0,6 | 0,621694435 |
| **Poly Coton** | 0,073772106 | 0,2 | 0,136886053 |
| **Coton BIO** | 0,282839025 | 0,2 | 0,241419512 |
| **Priority** | **0,5** | **0,5** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| **Tencel** | 0,6 | 0,11 | 0,517692721 |
| **Poly Coton** | 0,2 | 0,63 | 0,272224287 |
| **Coton BIO** | 0,2 | 0,26 | 0,210082993 |
| **Priority** | **0,833333333** | **0,166666667** | |

# Actor A2

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 :** Economic

**SUBCRITERION 1 :** LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 2 | 5 | 0,588235294 | 0,625 | 0,454545455 | 0,555926916 | 1,715129234 |
| Poly Coton | 1/2 | 1 | 5 | 0,294117647 | 0,3125 | 0,454545455 | 0,353721034 | 1,083444742 |
| Coton BIO | 1/5 | 1/5 | 1 | 0,117647059 | 0,0625 | 0,090909091 | 0,09035205 | 0,27228164 |
| Total | 1 2/3 | 3 1/5 | 11 | | | | lmax | 3,070855615 |
| Priority vector | 0,555926916 | 0,353721034 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

**SUBCRITERION 2 :** Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 2 | 5 | 0,588235294 | 0,625 | 0,454545455 | 0,555926916 | 1,715129234 |
| Poly Coton | 1/2 | 1 | 5 | 0,294117647 | 0,3125 | 0,454545455 | 0,353721034 | 1,083444742 |
| Coton BIO | 1/5 | 1/5 | 1 | 0,117647059 | 0,0625 | 0,090909091 | 0,09035205 | 0,27228164 |
| Total | 1 2/3 | 3 1/5 | 11 | | | | lmax | 3,070855615 |
| Priority vector | 0,555926916 | 0,353721034 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

**CRITERION 2 :** Environmental

**SUBCRITERION 1 :** Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 2 | 5 | 0,588235294 | 0,625 | 0,454545455 | 0,555926916 | 1,715129234 |
| Poly Coton | 1/2 | 1 | 5 | 0,294117647 | 0,3125 | 0,454545455 | 0,353721034 | 1,083444742 |
| Coton BIO | 1/5 | 1/5 | 1 | 0,117647059 | 0,0625 | 0,090909091 | 0,09035205 | 0,27228164 |
| Total | 1 2/3 | 3 1/5 | 11 | | | | lmax | 3,070855615 |
| Priority vector | 0,555926916 | 0,353721034 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

**SUBCRITERION 2 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 3 :** Social

**SUBCRITERION 1 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 :** User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 4 :** Relational

**SUBCRITERION 1 :** Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 7 | 0,744680851 | 0,714285714 | 0,777777778 | 0,745581448 | 2,257908364 |
| Poly Coton | 1/5 | 1 | 1 | 0,14893617 | 0,142857143 | 0,111111111 | 0,134301475 | 0,403534842 |
| Coton BIO | 1/7 | 1 | 1 | 0,106382979 | 0,142857143 | 0,111111111 | 0,120117078 | 0,360930188 |
| Total | 1 1/3 | 7 | 9 | | | | lmax | 3,022373394 |
| Priority vector | 0,745581448 | 0,134301475 | 0,120117078 | | | | CI | 0,011186697 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019287408 |

**SUBCRITERION 2 :** Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 2 | 5 | 0,588235294 | 0,625 | 0,454545455 | 0,555926916 | 1,715129234 |
| Poly Coton | 1/2 | 1 | 5 | 0,294117647 | 0,3125 | 0,454545455 | 0,353721034 | 1,083444742 |
| Coton BIO | 1/5 | 1/5 | 1 | 0,117647059 | 0,0625 | 0,090909091 | 0,09035205 | 0,27228164 |
| Total | 1 2/3 | 3 1/5 | 11 | | | | lmax | 3,070855615 |
| Priority vector | 0,555926916 | 0,353721034 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

**CRITERION 5 :** Functional

**SUBCRITERION 1 :** fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 2 | 7 | 0,608695652 | 0,636363636 | 0,466666667 | 0,570575318 | 1,761220905 |
| Poly Coton | 1/2 | 1 | 7 | 0,304347826 | 0,318181818 | 0,466666667 | 0,363065437 | 1,112867809 |
| Coton BIO | 1/7 | 1/7 | 1 | 0,086956522 | 0,045454545 | 0,066666667 | 0,066359245 | 0,199736495 |
| Total | 1 2/3 | 3 1/7 | 15 | | | | lmax | 3,073825209 |
| Priority vector | 0,570575318 | 0,363065437 | 0,066359245 | | | | CI | 0,036912604 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,063642421 |

**SUBCRITERION 2 :** availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/3 | 3 | 0,230769231 | 0,225806452 | 0,272727273 | 0,243100985 | 0,730606311 |
| Poly Coton | 3 | 1 | 7 | 0,692307692 | 0,677419355 | 0,636363636 | 0,668696895 | 2,015414693 |
| Coton BIO | 1/3 | 1/7 | 1 | 0,076923077 | 0,096774194 | 0,090909091 | 0,08820212 | 0,26476391 |
| Total | 4 1/3 | 1 1/2 | 11 | | | | lmax | 3,010784914 |
| Priority vector | 0,243100985 | 0,668696895 | 0,08820212 | | | | CI | 0,005392457 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,00929734 |

## II.SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 7 | 0,875 | **0,042537312** |
| Purchasing cost | 1/7 | 1 | 0,125 | **0,006076759** |
| Total | **1 1/7** | **8** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 1 | 0,5 | **0,077252432** |
| Provider performance | 1 | 1 | 0,5 | **0,077252432** |
| Total | **2** | **2** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 3 | 0,75 | **0,157760639** |
| User resistance | 1/3 | 1 | 0,25 | **0,05258688** |
| Total | **1 1/3** | **4** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 5 | 0,833333333 | **0,209278557** |
| Innovation | 1/5 | 1 | 0,166666667 | **0,041855711** |
| Total | **1 1/5** | **6** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 1 | 0,5 | **0,167699639** |
| availability | 1 | 1 | 0,5 | **0,167699639** |
| Total | **2** | **2** | | |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1/5 | 1/7 | 0,04761905 | 0,0217 | 0,07692 | 0,05405405 | 0,04273504 |
| Environmental | 5 | 1 | 1 | 1/2 | 1/5 | 0,23809524 | 0,1087 | 0,23077 | 0,13513514 | 0,05982906 |
| Social | 3 | 1 | 1 | 1 | 1 | 0,14285714 | 0,1087 | 0,23077 | 0,27027027 | 0,2991453 |
| Relational | 5 | 2 | 1 | 1 | 1 | 0,23809524 | 0,2174 | 0,23077 | 0,27027027 | 0,2991453 |
| Functional | 7 | 5 | 1 | 1 | 1 | 0,33333333 | 0,5435 | 0,23077 | 0,27027027 | 0,2991453 |
| Total | **21** | **9 1/5** | **4 1/3** | **3 5/7** | **3 1/3** | | | | | |
| priority vector | **0,04861407** | **0,154504863** | **0,210347519** | **0,251134269** | **0,335399279** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,555926916** | 0,444630125 | 0,333333333 | 0,713972359 | 0,41 | **0,48159538** |
| Poly Coton | **0,353721034** | 0,343527184 | 0,333333333 | 0,170871401 | 0,52 | **0,35632611** |
| Coton BIO | **0,09035205** | 0,211842692 | 0,333333333 | 0,11515624 | 0,08 | **0,16207851** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,04861407** | **0,154504863** | **0,210347519** | **0,251134269** | **0,335399279** | |

| | LCC | PC | Economic |
|---|---|---|---|
| Tencel | 0,555926916 | 0,555926916 | 0,555926916 |
| Poly Coton | 0,353721034 | 0,353721034 | 0,353721034 |
| Coton BIO | 0,09035205 | 0,09035205 | 0,09035205 |
| Priority | **0,875** | **0,125** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| Tencel | 0,555926916 | 0,333333333 | 0,444630125 |
| Poly Coton | 0,353721034 | 0,333333333 | 0,343527184 |
| Coton BIO | 0,09035205 | 0,333333333 | 0,211842692 |
| Priority | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| Tencel | 0,333333333 | 0,333333333 | 0,333333333 |
| Poly Coton | 0,333333333 | 0,333333333 | 0,333333333 |
| Coton BIO | 0,333333333 | 0,333333333 | 0,333333333 |
| Priority | **0,75** | **0,25** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Tencel | 0,745581448 | 0,555926916 | 0,713972359 |
| Poly Coton | 0,134301475 | 0,353721034 | 0,170871401 |
| Coton BIO | 0,120117078 | 0,09035205 | 0,11515624 |
| Priority | **0,833333333** | **0,166666667** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| Tencel | 0,570575318 | 0,24 | 0,406838152 |
| Poly Coton | 0,363065437 | 0,67 | 0,515881166 |
| Coton BIO | 0,066359245 | 0,09 | 0,077280683 |
| Priority | **0,5** | **0,5** | |

# Actor A3

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 :** Economic

**SUBCRITERION 1 :** LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Poly Coton | 5 | 1 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| Coton BIO | 1 | 1/5 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | **7** | **1 2/5** | **7** | | | | lmax | **3** |
| Priority vector | **0,142857143** | **0,714285714** | **0,142857143** | | | | **CI** | **0%** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0% |

**SUBCRITERION 2 :** Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Poly Coton | 5 | 1 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| Coton BIO | 1 | 1/5 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | **7** | **1 2/5** | **7** | | | | lmax | **3** |
| Priority vector | **0,142857143** | **0,714285714** | **0,142857143** | | | | **CI** | **0%** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0% |

**CRITERION 2 :** Environmental

**SUBCRITERION 1 :** Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1 | 0,454545455 | 0,625 | 0,4 | **0,493181818** | 1,554545455 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,090909091 | 0,125 | 0,2 | **0,138636364** | 0,421363636 |
| Coton BIO | 1 | 2 | 1 | 0,454545455 | 0,25 | 0,4 | **0,368181818** | 1,138636364 |
| Total | **2 1/5** | **8** | **2 1/2** | | | | lmax | **3,114545455** |
| Priority vector | **0,493181818** | **0,138636364** | **0,368181818** | | | | **CI** | **0,057272727** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,098746082 |

**SUBCRITERION 2 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1 | 0,454545455 | 0,625 | 0,4 | **0,493181818** | 1,554545455 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,090909091 | 0,125 | 0,2 | **0,138636364** | 0,421363636 |
| Coton BIO | 1 | 2 | 1 | 0,454545455 | 0,25 | 0,4 | **0,368181818** | 1,138636364 |
| Total | **2 1/5** | **8** | **2 1/2** | | | | lmax | **3,114545455** |
| Priority vector | **0,493181818** | **0,138636364** | **0,368181818** | | | | **CI** | **0,057272727** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,098746082 |

**CRITERION 3 :** Social

**SUBCRITERION 1 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1 | 0,454545455 | 0,625 | 0,4 | **0,493181818** | 1,554545455 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,090909091 | 0,125 | 0,2 | **0,138636364** | 0,421363636 |
| Coton BIO | 1 | 2 | 1 | 0,454545455 | 0,25 | 0,4 | **0,368181818** | 1,138636364 |
| Total | **2 1/5** | **8** | **2 1/2** | | | | lmax | **3,114545455** |
| Priority vector | **0,493181818** | **0,138636364** | **0,368181818** | | | | **CI** | **0,057272727** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,098746082 |

**SUBCRITERION 2 :** User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | 0,333333333 |
| Poly Coton | 7 | 1 | 7 | 0,777777778 | 0,777777778 | 0,777777778 | **0,777777778** | 2,333333333 |
| Coton BIO | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | 0,333333333 |
| Total | **9** | **1 2/7** | **9** | | | | lmax | **3** |
| Priority vector | **0,111111111** | **0,777777778** | **0,111111111** | | | | **CI** | **0** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0 |

**CRITERION 4 :** Relational

**SUBCRITERION 1 :** Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 1 | 0,466666667 | 0,636363636 | 0,428571429 | **0,510533911** | 1,600865801 |
| Poly Coton | 1/7 | 1 | 1/3 | 0,066666667 | 0,090909091 | 0,142857143 | **0,1001443** | 0,302851646 |
| Coton BIO | 1 | 3 | 1 | 0,466666667 | 0,272727273 | 0,428571429 | **0,389321789** | 1,2002886 |
| Total | **2 1/7** | **11** | **2 1/3** | | | | lmax | **3,104006047** |
| Priority vector | **0,510533911** | **0,1001443** | **0,389321789** | | | | **CI** | **0,052003023** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,089660385 |

**SUBCRITERION 2 :** Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1 | 0,454545455 | 0,625 | 0,4 | **0,493181818** | 1,554545455 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,090909091 | 0,125 | 0,2 | **0,138636364** | 0,421363636 |
| Coton BIO | 1 | 2 | 1 | 0,454545455 | 0,25 | 0,4 | **0,368181818** | 1,138636364 |
| Total | **2 1/5** | **8** | **2 1/2** | | | | lmax | **3,114545455** |
| Priority vector | **0,493181818** | **0,138636364** | **0,368181818** | | | | **CI** | **0,057272727** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,098746082 |

**CRITERION 5 :** Functional

**SUBCRITERION 1 :** fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | 0,333333333 |
| Poly Coton | 7 | 1 | 7 | 0,777777778 | 0,777777778 | 0,777777778 | **0,777777778** | 2,333333333 |
| Coton BIO | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | 0,333333333 |
| Total | **9** | **1 2/7** | **9** | | | | lmax | **3** |
| Priority vector | **0,111111111** | **0,777777778** | **0,111111111** | | | | **CI** | **0** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0 |

**SUBCRITERION 2 :** availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | **3** | **3** | **3** | | | | lmax | **3** |
| Priority vector | **0,333333333** | **0,333333333** | **0,333333333** | | | | **CI** | **0** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0 |

## II.SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 1 | 0,5 | **0,038855443** |
| Purchasing cost | 1 | 1 | 0,5 | **0,038855443** |
| **Total** | **2** | **2** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 1 | 0,5 | **0,211769126** |
| Provider performance | 1 | 1 | 0,5 | **0,211769126** |
| **Total** | **2** | **2** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 1 | 0,5 | **0,074451727** |
| User resistance | 1 | 1 | 0,5 | **0,074451727** |
| **Total** | **2** | **2** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,040885294** |
| Innovation | 1 | 1 | 0,5 | **0,040885294** |
| **Total** | **2** | **2** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 5 | 0,833333333 | **0,223397349** |
| availability | 1/5 | 1 | 0,166666667 | **0,04467947** |
| **Total** | **1 1/5** | **6** | | |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/3 | 1/3 | 1 | 1/5 | 0,07692308 | 0,1493 | 0,04 | 0,077 | 0,045455 |
| Environmental | 3 | 1 | 5 | 5 | 2 | 0,23076923 | 0,4478 | 0,6 | 0,385 | 0,454545 |
| Social | 3 | 1/5 | 1 | 1 | 1 | 0,23076923 | 0,0896 | 0,12 | 0,077 | 0,227273 |
| Relational | 1 | 1/5 | 1 | 1 | 1/5 | 0,07692308 | 0,0896 | 0,12 | 0,077 | 0,045455 |
| Functional | 5 | 1/2 | 1 | 5 | 1 | 0,38461538 | 0,2239 | 0,12 | 0,385 | 0,227273 |
| **Total** | **13** | **2 1/4** | **8 1/3** | **13** | **4 2/5** | | | | | |
| **priority vector** | **0,077710886** | **0,423538253** | **0,148903455** | **0,081770588** | **0,268076819** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,142857143** | 0,493181818 | 0,302146465 | 0,501857864 | 0,15 | **0,34572587** |
| Poly Coton | **0,714285714** | 0,138636364 | 0,458207071 | 0,119390332 | 0,70 | **0,38086346** |
| Coton BIO | **0,142857143** | 0,368181818 | 0,239646465 | 0,378751804 | 0,15 | **0,27341067** |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,077710886** | **0,423538253** | **0,148903455** | **0,081770588** | **0,268076819** | |

| | LCC | PC | Economic |
|---|---|---|---|
| **Tencel** | 0,142857143 | 0,142857143 | 0,142857143 |
| **Poly Coton** | 0,714285714 | 0,714285714 | 0,714285714 |
| **Coton BIO** | 0,142857143 | 0,142857143 | 0,142857143 |
| **Priority** | **0,5** | **0,5** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| **Tencel** | 0,493181818 | 0,493181818 | 0,493181818 |
| **Poly Coton** | 0,138636364 | 0,138636364 | 0,138636364 |
| **Coton BIO** | 0,368181818 | 0,368181818 | 0,368181818 |
| **Priority** | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| **Tencel** | 0,493181818 | 0,111111111 | 0,302146465 |
| **Poly Coton** | 0,138636364 | 0,777777778 | 0,458207071 |
| **Coton BIO** | 0,368181818 | 0,111111111 | 0,239646465 |
| **Priority** | **0,5** | **0,5** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Tencel** | 0,510533911 | 0,493181818 | 0,501857864 |
| **Poly Coton** | 0,1001443 | 0,138636364 | 0,119390332 |
| **Coton BIO** | 0,389321789 | 0,368181818 | 0,378751804 |
| **Priority** | **0,5** | **0,5** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| **Tencel** | 0,111111111 | 0,33 | 0,148148148 |
| **Poly Coton** | 0,777777778 | 0,33 | 0,703703704 |
| **Coton BIO** | 0,111111111 | 0,33 | 0,148148148 |
| **Priority** | **0,833333333** | **0,166666667** | |

# Actor A4

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 :** Economic

**SUBCRITERION 1 :** LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1/2 | 0,1 | 0,111111111 | 0,058823529 | **0,089978214** | 0,271023965 |
| Poly Coton | 7 | 1 | 7 | 0,7 | 0,777777778 | 0,823529412 | **0,767102397** | 2,397385621 |
| Coton BIO | 2 | 1/7 | 1 | 0,2 | 0,111111111 | 0,117647059 | **0,14291939** | 0,432461874 |
| Total | **10** | **1 2/7** | **8 1/2** | | | | **lmax** | **3,10087146** |
| Priority vector | **0,089978214** | **0,767102397** | **0,14291939** | | | | Consistency Index (CI) | **0,05043573** |
| | | | | | | | Random Consistency (RC) | 0,58 |
| | | | | | | | Consistency Ratio (CR) | 0,086958155 |

**SUBCRITERION 2 :** Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/4 | 1/3 | 0,125 | 0,157894737 | 0,076923077 | **0,119939271** | 0,36262933 |
| Poly Coton | 4 | 1 | 3 | 0,5 | 0,631578947 | 0,692307692 | **0,607962213** | 1,904014845 |
| Coton BIO | 3 | 1/3 | 1 | 0,375 | 0,210526316 | 0,230769231 | **0,272098516** | 0,8345704 |
| Total | **8** | **1 4/7** | **4 1/3** | | | | lmax | **3,101214575** |
| Priority vector | **0,119939271** | **0,607962213** | **0,272098516** | | | | **CI** | **0,050607287** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,087253944 |

**CRITERION 2 :** Environmental

**SUBCRITERION 1 :** Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 7 | 0,777777778 | 0,7 | 0,823529412 | **0,767102397** | 2,397385621 |
| Poly Coton | 1/7 | 1 | 1/2 | 0,111111111 | 0,1 | 0,058823529 | **0,089978214** | 0,271023965 |
| Coton BIO | 1/7 | 2 | 1 | 0,111111111 | 0,2 | 0,117647059 | **0,14291939** | 0,432461874 |
| Total | **1 2/7** | **10** | **8 1/2** | | | | lmax | **3,10087146** |
| Priority vector | **0,767102397** | **0,089978214** | **0,14291939** | | | | **CI** | **0,05043573** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,086958155 |

**SUBCRITERION 2 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 5 | 0,744680851 | 0,636363636 | 0,789473684 | **0,723506057** | 2,272591537 |
| Poly Coton | 1/7 | 1 | 1/3 | 0,106382979 | 0,090909091 | 0,052631579 | **0,083307883** | 0,251061244 |
| Coton BIO | 1/5 | 3 | 1 | 0,14893617 | 0,272727273 | 0,157894737 | **0,19318606** | 0,58781092 |
| Total | **1 1/3** | **11** | **6 1/3** | | | | lmax | **3,111463701** |
| Priority vector | **0,723506057** | **0,083307883** | **0,19318606** | | | | **CI** | **0,055731851** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,096089398 |

**CRITERION 3 :** Social

**SUBCRITERION 1 :** Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,428571429 | **0,428571429** | 1,285714286 |
| Poly Coton | 1/3 | 1 | 1/3 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Coton BIO | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,428571429 | **0,428571429** | 1,285714286 |
| Total | **2 1/3** | **7** | **2 1/3** | | | | lmax | **3** |
| Priority vector | **0,428571429** | **0,142857143** | **0,428571429** | | | | **CI** | **0** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0 |

**SUBCRITERION 2 :** User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1/5 | 0,142857143 | 0,2 | 0,130434783 | **0,157763975** | 0,475610766 |
| Poly Coton | 1 | 1 | 1/3 | 0,142857143 | 0,2 | 0,217391304 | **0,186749482** | 0,563008972 |
| Coton BIO | 5 | 3 | 1 | 0,714285714 | 0,6 | 0,652173913 | **0,655486542** | 2,004554865 |
| Total | **7** | **5** | **1 1/2** | | | | lmax | **3,043174603** |
| Priority vector | **0,157763975** | **0,186749482** | **0,655486542** | | | | **CI** | **0,021587302** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,037219485 |

**CRITERION 4 :** Relational

**SUBCRITERION 1 :** Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 0,692307692 | **0,63334572** | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | **0,106156324** | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | **0,260497956** | 0,790082167 |
| Total | **1 1/2** | **9** | **4 1/3** | | | | lmax | **3,055361493** |
| Priority vector | **0,63334572** | **0,106156324** | **0,260497956** | | | | **CI** | **0,027680747** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,047725425 |

**SUBCRITERION 2 :** Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 5 | 0,714285714 | 0,625 | 0,769230769 | **0,702838828** | 2,188644689 |
| Poly Coton | 1/5 | 1 | 1/2 | 0,142857143 | 0,125 | 0,076923077 | **0,11492674** | 0,346611722 |
| Coton BIO | 1/5 | 2 | 1 | 0,142857143 | 0,25 | 0,153846154 | **0,182234432** | 0,552655678 |
| Total | **1 2/5** | **8** | **6 1/2** | | | | lmax | **3,087912088** |
| Priority vector | **0,702838828** | **0,11492674** | **0,182234432** | | | | **CI** | **0,043956044** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,075786283 |

**CRITERION 5 :** Functional

**SUBCRITERION 1 :** fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/3 | 0,111111111 | 0,130434783 | 0,076923077 | **0,106156324** | 0,31965812 |
| Poly Coton | 5 | 1 | 3 | 0,555555556 | 0,652173913 | 0,692307692 | **0,63334572** | 1,945621206 |
| Coton BIO | 3 | 1/3 | 1 | 0,333333333 | 0,217391304 | 0,230769231 | **0,260497956** | 0,790082167 |
| Total | **9** | **1 1/2** | **4 1/3** | | | | lmax | **3,055361493** |
| Priority vector | **0,106156324** | **0,63334572** | **0,260497956** | | | | **CI** | **0,027680747** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0,047725425 |

**SUBCRITERION 2 :** availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1 | 1/7 | 1/7 | 0,142857143 | **0,142857143** | 0,428571429 |
| Poly Coton | 5 | 1 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| Coton BIO | 1 | 1/5 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | **7** | **1 2/5** | **7** | | | | lmax | **3** |
| Priority vector | **0,142857143** | **0,714285714** | **0,142857143** | | | | **CI** | **0%** |
| | | | | | | | **RC** | 0,58 |
| | | | | | | | **CR** | 0% |

II.SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 7 | 0,875 | **0,103319933** |
| Purchasing cost | 1/7 | 1 | 0,125 | **0,01475999** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 3 | 0,75 | **0,233127185** |
| Provider performance | 1/3 | 1 | 0,25 | **0,077709062** |
| **Total** | **1 1/3** | **4** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 1/5 | 0,166666667 | **0,031449967** |
| User resistance | 5 | 1 | 0,833333333 | **0,157249835** |
| **Total** | **6** | **1 1/5** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 7 | 0,875 | **0,043854308** |
| Innovation | 1/7 | 1 | 0,125 | **0,006264901** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 7 | 0,875 | **0,290731716** |
| availability | 1/7 | 1 | 0,125 | **0,041533102** |
| **Total** | **1 1/7** | **8** | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/2 | 1/3 | 3 | 1/3 | 0,107142857 | 0,164835165 | 0,0442478 | 0,15789474 | 0,11627907 |
| Environmental | 2 | 1 | 3 | 5 | 1 | 0,214285714 | 0,32967033 | 0,3982301 | 0,26315789 | 0,34883721 |
| Social | 3 | 1/3 | 1 | 5 | 1/3 | 0,321428571 | 0,10989011 | 0,1327434 | 0,26315789 | 0,11627907 |
| Relational | 1/3 | 1/5 | 1/5 | 1 | 1/5 | 0,035714286 | 0,065934066 | 0,0265487 | 0,05263158 | 0,06976744 |
| Functional | 3 | 1 | 3 | 5 | 1 | 0,321428571 | 0,32967033 | 0,3982301 | 0,26315789 | 0,34883721 |
| **Total** | **9 1/3** | **3** | **7 1/2** | **19** | **2 6/7** | | | | | |
| priority vector | **0,118079923** | **0,310836247** | **0,188699802** | **0,050119209** | **0,332264819** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,093723346** | 0,745304227 | 0,202898551 | 0,642032359 | 0,11 | **0,349995795** |
| Poly Coton | **0,747209874** | 0,086643048 | 0,179434092 | 0,107252626 | 0,64 | **0,368197069** |
| Coton BIO | **0,159066781** | 0,168052725 | 0,617667357 | 0,250715016 | 0,25 | **0,281807136** |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,118079923** | **0,310836247** | **0,188699802** | **0,050119209** | **0,332264819** | |

| | LCC | PC | Economic |
|---|---|---|---|
| **Tencel** | 0,089978214 | 0,119939271 | 0,093723346 |
| **Poly Coton** | 0,767102397 | 0,607962213 | 0,747209874 |
| **Coton BIO** | 0,14291939 | 0,272098516 | 0,159066781 |
| **Priority** | **0,875** | **0,125** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| **Tencel** | 0,767102397 | 0,723506057 | 0,745304227 |
| **Poly Coton** | 0,089978214 | 0,083307883 | 0,086643048 |
| **Coton BIO** | 0,14291939 | 0,19318606 | 0,168052725 |
| **Priority** | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| **Tencel** | 0,428571429 | 0,157763975 | 0,202898551 |
| **Poly Coton** | 0,142857143 | 0,186749482 | 0,179434092 |
| **Coton BIO** | 0,428571429 | 0,655486542 | 0,617667357 |
| **Priority** | **0,166666667** | **0,833333333** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Tencel** | 0,63334572 | 0,702838828 | 0,642032359 |
| **Poly Coton** | 0,106156324 | 0,11492674 | 0,107252626 |
| **Coton BIO** | 0,260497956 | 0,182234432 | 0,250715016 |
| **Priority** | **0,875** | **0,125** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| **Tencel** | 0,106156324 | 0,14 | 0,110743926 |
| **Poly Coton** | 0,63334572 | 0,71 | 0,64346322 |
| **Coton BIO** | 0,260497956 | 0,14 | 0,245792854 |
| **Priority** | **0,875** | **0,125** | |

# Actor A5

I. ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 1 : LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/3 | 1/5 | 0,111111111 | 0,076923077 | 0,130434783 | 0,106156324 | 0,31965812 |
| Poly Coton | 3 | 1 | 1/3 | 0,333333333 | 0,230769231 | 0,217391304 | 0,260497956 | 0,790082167 |
| Coton BIO | 5 | 3 | 1 | 0,555555556 | 0,692307692 | 0,652173913 | 0,63334572 | 1,945621206 |
| Total | 9 | 4 1/3 | 1 1/2 | | | | lmax | 3,055361493 |
| Priority vector | 0,106156324 | 0,260497956 | 0,63334572 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

SUBCRITERION 2 : Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 2 : Environmental

SUBCRITERION 1 : Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 5 | 0,744680851 | 0,777777778 | 0,714285714 | 0,745581448 | 2,257908364 |
| Poly Coton | 1/7 | 1 | 1 | 0,106382979 | 0,111111111 | 0,142857143 | 0,120117078 | 0,360930188 |
| Coton BIO | 1/5 | 1 | 1 | 0,14893617 | 0,111111111 | 0,142857143 | 0,134301475 | 0,403534842 |
| Total | 1 1/3 | 9 | 7 | | | | lmax | 3,022373394 |
| Priority vector | 0,745581448 | 0,120117078 | 0,134301475 | | | | CI | 0,011186697 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019287408 |

SUBCRITERION 2 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 3 : Social

SUBCRITERION 1 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 5 | 0,744680851 | 0,636363636 | 0,789473684 | 0,723506057 | 2,272591537 |
| Poly Coton | 1/7 | 1 | 1/3 | 0,106382979 | 0,090909091 | 0,052631579 | 0,083307883 | 0,251061244 |
| Coton BIO | 1/5 | 3 | 1 | 0,14893617 | 0,272727273 | 0,157894737 | 0,19318606 | 0,58781092 |
| Total | 1 1/3 | 11 | 6 1/3 | | | | lmax | 3,111463701 |
| Priority vector | 0,723506057 | 0,083307883 | 0,19318606 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

SUBCRITERION 2 : Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 5 | 0,744680851 | 0,636363636 | 0,789473684 | 0,723506057 | 2,272591537 |
| Poly Coton | 1/7 | 1 | 1/3 | 0,106382979 | 0,090909091 | 0,052631579 | 0,083307883 | 0,251061244 |
| Coton BIO | 1/5 | 3 | 1 | 0,14893617 | 0,272727273 | 0,157894737 | 0,19318606 | 0,58781092 |
| Total | 1 1/3 | 11 | 6 1/3 | | | | lmax | 3,111463701 |
| Priority vector | 0,723506057 | 0,083307883 | 0,19318606 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

CRITERION 5 : Functional

SUBCRITERION 1 : fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1 | 0,142857143 | 0,130434783 | 0,2 | 0,157763975 | 0,475610766 |
| Poly Coton | 5 | 1 | 3 | 0,714285714 | 0,652173913 | 0,6 | 0,655486542 | 2,004554865 |
| Coton BIO | 1 | 1/3 | 1 | 0,142857143 | 0,217391304 | 0,2 | 0,186749482 | 0,563008972 |
| Total | 7 | 1 1/2 | 5 | | | | lmax | 3,043174603 |
| Priority vector | 0,157763975 | 0,655486542 | 0,186749482 | | | | CI | 0,021587302 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,037219485 |

SUBCRITERION 2 : availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/2 | 0,125 | 0,090909091 | 0,2 | 0,138636364 | 0,421363636 |
| Poly Coton | 5 | 1 | 1 | 0,625 | 0,454545455 | 0,4 | 0,493181818 | 1,554545455 |
| Coton BIO | 2 | 1 | 1 | 0,25 | 0,454545455 | 0,4 | 0,368181818 | 1,138636364 |
| Total | 8 | 2 1/5 | 2 1/2 | | | | lmax | 3,114545455 |
| Priority vector | 0,138636364 | 0,493181818 | 0,368181818 | | | | CI | 0,057272727 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

II.SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 1 | 0,5 | **0,046889751** |
| Purchasing cost | 1 | 1 | 0,5 | **0,046889751** |
| **Total** | **2** | **2** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 5 | 0,833333333 | **0,333130587** |
| Provider performance | 1/5 | 1 | 0,166666667 | **0,066626117** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 5 | 0,833333333 | **0,176199422** |
| User resistance | 1/5 | 1 | 0,166666667 | **0,035239884** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,090130391** |
| Innovation | 1 | 1 | 0,5 | **0,090130391** |
| **Total** | **2** | **2** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 3 | 0,75 | **0,086072779** |
| availability | 1/3 | 1 | 0,25 | **0,028690926** |
| **Total** | **1 1/3** | **4** | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/5 | 1 | 1 | 0,07692308 | 0,08451 | 0,0384615 | 0,1579 | 0,11111 |
| Environmental | 5 | 1 | 2 | 3 | 3 | 0,38461538 | 0,42254 | 0,3846154 | 0,4737 | 0,33333 |
| Social | 5 | 1/2 | 1 | 1 | 1 | 0,38461538 | 0,21127 | 0,1923077 | 0,1579 | 0,11111 |
| Relational | 1 | 1/3 | 1 | 1 | 3 | 0,07692308 | 0,14085 | 0,1923077 | 0,1579 | 0,33333 |
| Functional | 1 | 1/3 | 1 | 1/3 | 1 | 0,07692308 | 0,14085 | 0,1923077 | 0,0526 | 0,11111 |
| **Total** | **13** | **2 3/8** | **5 1/5** | **6 1/3** | **9** | | | | | |
| **priority vector** | **0,093779501** | **0,399756705** | **0,211439306** | **0,180260782** | **0,114763706** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,219744828** | 0,539457391 | 0,333333333 | 0,723506057 | 0,15 | **0,4547156** |
| Poly Coton | **0,296915645** | 0,226725205 | 0,333333333 | 0,083307883 | 0,61 | **0,27454583** |
| Coton BIO | **0,483339527** | 0,233817404 | 0,333333333 | 0,19318606 | 0,23 | **0,27073858** |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,093779501** | **0,399756705** | **0,211439306** | **0,180260782** | **0,114763706** | |

| | LCC | PC | Economic |
|---|---|---|---|
| **Tencel** | 0,106156324 | 0,333333333 | 0,219744828 |
| **Poly Coton** | 0,260497956 | 0,333333333 | 0,296915645 |
| **Coton BIO** | 0,63334572 | 0,333333333 | 0,483339527 |
| **Priority** | **0,5** | **0,5** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| **Tencel** | 0,745581448 | 0,333333333 | 0,539457391 |
| **Poly Coton** | 0,120117078 | 0,333333333 | 0,226725205 |
| **Coton BIO** | 0,134301475 | 0,333333333 | 0,233817404 |
| **Priority** | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| **Tencel** | 0,333333333 | 0,333333333 | 0,333333333 |
| **Poly Coton** | 0,333333333 | 0,333333333 | 0,333333333 |
| **Coton BIO** | 0,333333333 | 0,333333333 | 0,333333333 |
| **Priority** | **0,833333333** | **0,166666667** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Tencel** | 0,723506057 | 0,723506057 | 0,723506057 |
| **Poly Coton** | 0,083307883 | 0,083307883 | 0,083307883 |
| **Coton BIO** | 0,19318606 | 0,19318606 | 0,19318606 |
| **Priority** | **0,5** | **0,5** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| **Tencel** | 0,157763975 | 0,14 | 0,152982072 |
| **Poly Coton** | 0,655486542 | 0,49 | 0,614910361 |
| **Coton BIO** | 0,186749482 | 0,37 | 0,232107566 |
| **Priority** | **0,75** | **0,25** | |

# Actor A6

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 : Economic**

**SUBCRITERION 1 : LCC**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | 0,723506057 | 2,272591537 |
| Poly Coton | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | 0,19318606 | 0,58781092 |
| Coton BIO | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | 0,083307883 | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | lmax | 3,111463701 |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**SUBCRITERION 2 : Purchasing cost**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1/5 | 0,076923077 | 0,096774194 | 0,047619048 | 0,073772106 | 0,222252607 |
| Poly Coton | 7 | 1 | 3 | 0,538461538 | 0,677419355 | 0,714285714 | 0,643388869 | 2,008310686 |
| Coton BIO | 5 | 1/3 | 1 | 0,384615385 | 0,225806452 | 0,238095238 | 0,282839025 | 0,866162511 |
| Total | 13 | 1 1/2 | 4 1/5 | | | | lmax | 3,096725804 |
| Priority vector | 0,073772106 | 0,643388869 | 0,282839025 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

**CRITERION 2 : Environmental**

**SUBCRITERION 1 : Fiber quality**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 7 | 0,777777778 | 0,777777778 | 0,777777778 | 0,777777778 | 2,333333333 |
| Poly Coton | 1/7 | 1 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Coton BIO | 1/7 | 1 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Total | 1 2/7 | 9 | 9 | | | | lmax | 3 |
| Priority vector | 0,777777778 | 0,111111111 | 0,111111111 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 : Provider performance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 3 : Social**

**SUBCRITERION 1 : Provider performance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 : User resistance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/7 | 0,076923077 | 0,090909091 | 0,066666667 | 0,078166278 | 0,234729715 |
| Poly Coton | 5 | 1 | 1 | 0,384615385 | 0,454545455 | 0,466666667 | 0,435275835 | 1,312665113 |
| Coton BIO | 7 | 1 | 1 | 0,538461538 | 0,454545455 | 0,466666667 | 0,486557887 | 1,468997669 |
| Total | 13 | 2 1/5 | 2 1/7 | | | | lmax | 3,016392496 |
| Priority vector | 0,078166278 | 0,435275835 | 0,486557887 | | | | CI | 0,008196248 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,014131462 |

**CRITERION 4 : Relational**

**SUBCRITERION 1 : Brand image**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | 0,723506057 | 2,272591537 |
| Poly Coton | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | 0,19318606 | 0,58781092 |
| Coton BIO | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | 0,083307883 | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | lmax | 3,111463701 |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**SUBCRITERION 2 : Innovation**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | 0,723506057 | 2,272591537 |
| Poly Coton | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | 0,19318606 | 0,58781092 |
| Coton BIO | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | 0,083307883 | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | lmax | 3,111463701 |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**CRITERION 5 : Functional**

**SUBCRITERION 1 : fiber quality**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 7 | 0,777777778 | 0,777777778 | 0,777777778 | 0,777777778 | 2,333333333 |
| Poly Coton | 1/7 | 1 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Coton BIO | 1/7 | 1 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Total | 1 2/7 | 9 | 9 | | | | lmax | 3 |
| Priority vector | 0,777777778 | 0,111111111 | 0,111111111 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 : availability**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

II.SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 7 | 0,875 | **0,078389875** |
| Purchasing cost | 1/7 | 1 | 0,125 | **0,011198554** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 5 | 0,833333333 | **0,223960752** |
| Provider performance | 1/5 | 1 | 0,166666667 | **0,04479215** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 5 | 0,833333333 | **0,40495882** |
| User resistance | 1/5 | 1 | 0,166666667 | **0,080991764** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,029745728** |
| Innovation | 1 | 1 | 0,5 | **0,029745728** |
| **Total** | **2** | **2** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 1/3 | 0,25 | **0,024054157** |
| availability | 3 | 1 | 0,75 | **0,072162472** |
| **Total** | **4** | **1 1/3** | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/5 | 3 | 1/2 | 0,075 | 0,0423 | 0,1066 | 0,17647 | 0,04762 |
| Environmental | 5 | 1 | 1/3 | 5 | 3 | 0,375 | 0,2113 | 0,17766 | 0,29412 | 0,28571 |
| Social | 5 | 3 | 1 | 7 | 5 | 0,375 | 0,6338 | 0,53299 | 0,41176 | 0,47619 |
| Relational | 1/3 | 1/5 | 1/7 | 1 | 1 | 0,025 | 0,0423 | 0,07614 | 0,05882 | 0,09524 |
| Functional | 2 | 1/3 | 1/5 | 1 | 1 | 0,15 | 0,0704 | 0,1066 | 0,05882 | 0,09524 |
| **Total** | **13 1/3** | **4 3/4** | **1 7/8** | **17** | **10 1/2** | | | | | |
| **priority vector** | **0,089588428** | **0,268752903** | **0,485950585** | **0,059491456** | **0,096216629** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,642289313** | 0,555555556 | 0,290805491 | 0,723506057 | 0,44 | **0,4339713** |
| Poly Coton | **0,249461411** | 0,222222222 | 0,35032375 | 0,19318606 | 0,28 | **0,2905315** |
| Coton BIO | **0,108249276** | 0,222222222 | 0,358870759 | 0,083307883 | 0,28 | **0,2754972** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,089588428** | **0,268752903** | **0,485950585** | **0,059491456** | **0,096216629** | |

| | LCC | PC | Economic |
|---|---|---|---|
| Tencel | 0,723506057 | 0,073772106 | 0,642289313 |
| Poly Coton | 0,19318606 | 0,643388869 | 0,249461411 |
| Coton BIO | 0,083307883 | 0,282839025 | 0,108249276 |
| Priority | **0,875** | **0,125** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| Tencel | 0,777777778 | 0,333333333 | 0,555555556 |
| Poly Coton | 0,111111111 | 0,333333333 | 0,222222222 |
| Coton BIO | 0,111111111 | 0,333333333 | 0,222222222 |
| Priority | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| Tencel | 0,333333333 | 0,078166278 | 0,290805491 |
| Poly Coton | 0,333333333 | 0,435275835 | 0,35032375 |
| Coton BIO | 0,333333333 | 0,486557887 | 0,358870759 |
| Priority | **0,833333333** | **0,166666667** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Tencel | 0,723506057 | 0,723506057 | 0,723506057 |
| Poly Coton | 0,19318606 | 0,19318606 | 0,19318606 |
| Coton BIO | 0,083307883 | 0,083307883 | 0,083307883 |
| Priority | **0,5** | **0,5** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| Tencel | 0,777777778 | 0,33 | 0,444444444 |
| Poly Coton | 0,111111111 | 0,33 | 0,277777778 |
| Coton BIO | 0,111111111 | 0,33 | 0,277777778 |
| Priority | **0,25** | **0,75** | |

# Actor A7

I. ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 1 : LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 3 | 0,677419355 | 0,538461538 | 0,714285714 | 0,643388869 | 2,008310686 |
| Poly Coton | 1/7 | 1 | 1/5 | 0,096774194 | 0,076923077 | 0,047619048 | 0,073772106 | 0,222252607 |
| Coton BIO | 1/3 | 5 | 1 | 0,225806452 | 0,384615385 | 0,238095238 | 0,282839025 | 0,866162511 |
| Total | 1 1/2 | 13 | 4 1/5 | | | | lmax | 3,096725804 |
| Priority vector | 0,643388869 | 0,073772106 | 0,282839025 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

SUBCRITERION 2 : Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 3 | 0,157894737 | 0,14893617 | 0,272727273 | 0,19318606 | 0,58781092 |
| Poly Coton | 5 | 1 | 7 | 0,789473684 | 0,744680851 | 0,636363636 | 0,723506057 | 2,272591537 |
| Coton BIO | 1/3 | 1/7 | 1 | 0,052631579 | 0,106382979 | 0,090909091 | 0,083307883 | 0,251061244 |
| Total | 6 1/3 | 1 1/3 | 11 | | | | lmax | 3,111463701 |
| Priority vector | 0,19318606 | 0,723506057 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

CRITERION 2 : Environmental

SUBCRITERION 1 : Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 9 | 6 | 0,782608696 | 0,692307692 | 0,818181818 | 0,764366069 | 2,387503801 |
| Poly Coton | 1/9 | 1 | 1/3 | 0,086956522 | 0,076923077 | 0,045454545 | 0,069778048 | 0,209992906 |
| Coton BIO | 1/6 | 3 | 1 | 0,130434783 | 0,230769231 | 0,136363636 | 0,165855883 | 0,502584372 |
| Total | 1 2/7 | 13 | 7 1/3 | | | | lmax | 3,100081078 |
| Priority vector | 0,764366069 | 0,069778048 | 0,165855883 | | | | CI | 0,050040539 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,086276792 |

SUBCRITERION 2 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 9 | 6 | 0,782608696 | 0,692307692 | 0,818181818 | 0,764366069 | 2,387503801 |
| Poly Coton | 1/9 | 1 | 1/3 | 0,086956522 | 0,076923077 | 0,045454545 | 0,069778048 | 0,209992906 |
| Coton BIO | 1/6 | 3 | 1 | 0,130434783 | 0,230769231 | 0,136363636 | 0,165855883 | 0,502584372 |
| Total | 1 2/7 | 13 | 7 1/3 | | | | lmax | 3,100081078 |
| Priority vector | 0,764366069 | 0,069778048 | 0,165855883 | | | | CI | 0,050040539 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,086276792 |

CRITERION 3 : Social

SUBCRITERION 1 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 7 | 0,466666667 | 0,428571429 | 0,636363636 | 0,510533911 | 1,600865801 |
| Poly Coton | 1 | 1 | 3 | 0,466666667 | 0,428571429 | 0,272727273 | 0,389321789 | 1,2002886 |
| Coton BIO | 1/7 | 1/3 | 1 | 0,066666667 | 0,142857143 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/7 | 2 1/3 | 11 | | | | lmax | 3,104006047 |
| Priority vector | 0,510533911 | 0,389321789 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

SUBCRITERION 2 : User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1/3 | 0,2 | 0,25 | 0,181818182 | 0,210606061 | 0,634343434 |
| Poly Coton | 1 | 1 | 1/2 | 0,2 | 0,25 | 0,272727273 | 0,240909091 | 0,725757576 |
| Coton BIO | 3 | 2 | 1 | 0,6 | 0,5 | 0,545454545 | 0,548484848 | 1,662121212 |
| Total | 5 | 4 | 1 5/6 | | | | lmax | 3,022222222 |
| Priority vector | 0,210606061 | 0,240909091 | 0,548484848 | | | | CI | 0,011111111 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019157088 |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 9 | 1 | 0,473684211 | 0,529411765 | 0,466666667 | 0,489920881 | 1,4749914 |
| Poly Coton | 1/9 | 1 | 1/7 | 0,052631579 | 0,058823529 | 0,066666667 | 0,059373925 | 0,178196035 |
| Coton BIO | 1 | 7 | 1 | 0,473684211 | 0,411764706 | 0,466666667 | 0,450705194 | 1,35624355 |
| Total | 2 1/9 | 17 | 2 1/7 | | | | lmax | 3,009430985 |
| Priority vector | 0,489920881 | 0,059373925 | 0,450705194 | | | | CI | 0,004715492 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,008130159 |

SUBCRITERION 2 : Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 1 | 0,466666667 | 0,466666667 | 0,466666667 | 0,466666667 | 1,4 |
| Poly Coton | 1/7 | 1 | 1/7 | 0,066666667 | 0,066666667 | 0,066666667 | 0,066666667 | 0,2 |
| Coton BIO | 1 | 7 | 1 | 0,466666667 | 0,466666667 | 0,466666667 | 0,466666667 | 1,4 |
| Total | 2 1/7 | 15 | 2 1/7 | | | | lmax | 3 |
| Priority vector | 0,466666667 | 0,066666667 | 0,466666667 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 5 : Functional

SUBCRITERION 1 : fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Poly Coton | 7 | 1 | 7 | 0,777777778 | 0,777777778 | 0,777777778 | 0,777777778 | 2,333333333 |
| Coton BIO | 1 | 1/7 | 1 | 0,111111111 | 0,111111111 | 0,111111111 | 0,111111111 | 0,333333333 |
| Total | 9 | 1 2/7 | 9 | | | | lmax | 3 |
| Priority vector | 0,111111111 | 0,777777778 | 0,111111111 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

## II. SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 7 | 0,875 | **0,065742954** |
| Purchasing cost | 1/7 | 1 | 0,125 | **0,009391851** |
| Total | **1 1/7** | **8** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 1/3 | 0,25 | **0,110904051** |
| Provider performance | 3 | 1 | 0,75 | **0,332712152** |
| Total | **4** | **1 1/3** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 1/5 | 0,166666667 | **0,040889203** |
| User resistance | 5 | 1 | 0,833333333 | **0,204446016** |
| Total | **6** | **1 1/5** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 7 | 0,875 | **0,169467424** |
| Innovation | 1/7 | 1 | 0,125 | **0,024209632** |
| Total | **1 1/7** | **8** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 7 | 0,875 | **0,036957127** |
| availability | 1/7 | 1 | 0,125 | **0,00527959** |
| Total | **1 1/7** | **8** | | |

## III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/5 | 1/5 | 3 | 0,06122449 | 0,09952607 | 0,0408163 | 0,03125 | 0,14286 |
| Environmental | 5 | 1 | 3 | 3 | 7 | 0,30612245 | 0,49763033 | 0,6122449 | 0,46875 | 0,33333 |
| Social | 5 | 1/3 | 1 | 2 | 5 | 0,30612245 | 0,16587678 | 0,2040816 | 0,3125 | 0,2381 |
| Relational | 5 | 1/3 | 1/2 | 1 | 5 | 0,30612245 | 0,16587678 | 0,1020408 | 0,15625 | 0,2381 |
| Functional | 1/3 | 1/7 | 1/5 | 1/5 | 1 | 0,02040816 | 0,07109005 | 0,0408163 | 0,03125 | 0,04762 |
| Total | **16 1/3** | **2** | **5** | **6 2/5** | **21** | | | | | |
| priority vector | **0,075134805** | **0,443616202** | **0,245335219** | **0,193677056** | **0,042236717** | | | | | |

## IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,587113518** | 0,764366069 | 0,260594036 | 0,487014104 | 0,31 | **0,55435985** |
| Poly Coton | **0,15498885** | 0,069778048 | 0,265644541 | 0,060285518 | 0,39 | **0,135873** |
| Coton BIO | **0,257897632** | 0,165855883 | 0,473761424 | 0,452700378 | 0,31 | **0,30976715** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,075134805** | **0,443616202** | **0,245335219** | **0,193677056** | **0,042236717** | |

| | LCC | PC | Economic |
|---|---|---|---|
| Tencel | 0,643388869 | 0,19318606 | 0,587113518 |
| Poly Coton | 0,073772106 | 0,723506057 | 0,15498885 |
| Coton BIO | 0,282839025 | 0,083307883 | 0,257897632 |
| Priority | **0,875** | **0,125** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| Tencel | 0,764366069 | 0,764366069 | 0,764366069 |
| Poly Coton | 0,069778048 | 0,069778048 | 0,069778048 |
| Coton BIO | 0,165855883 | 0,165855883 | 0,165855883 |
| Priority | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| Tencel | 0,510533911 | 0,210606061 | 0,260594036 |
| Poly Coton | 0,389321789 | 0,240909091 | 0,265644541 |
| Coton BIO | 0,1001443 | 0,548484848 | 0,473761424 |
| Priority | **0,166666667** | **0,833333333** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Tencel | 0,489920881 | 0,466666667 | 0,487014104 |
| Poly Coton | 0,059373925 | 0,066666667 | 0,060285518 |
| Coton BIO | 0,450705194 | 0,466666667 | 0,452700378 |
| Priority | **0,875** | **0,125** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| Tencel | 0,333333333 | 0,11 | 0,305555556 |
| Poly Coton | 0,333333333 | 0,78 | 0,388888889 |
| Coton BIO | 0,333333333 | 0,11 | 0,305555556 |
| Priority | **0,875** | **0,125** | |

# Actor A8

I. ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 1 : LCC

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/3 | 0,111111111 | 0,130434783 | 0,076923077 | 0,106156324 | 0,31965812 |
| Poly Coton | 5 | 1 | 3 | 0,555555556 | 0,652173913 | 0,692307692 | 0,63334572 | 1,945621206 |
| Coton BIO | 3 | 1/3 | 1 | 0,333333333 | 0,217391304 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 9 | 1 1/2 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,106156324 | 0,63334572 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

SUBCRITERION 2 : Purchasing cost

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/7 | 1/3 | 0,090909091 | 0,096774194 | 0,076923077 | 0,08820212 | 0,26476391 |
| Poly Coton | 7 | 1 | 3 | 0,636363636 | 0,677419355 | 0,692307692 | 0,668696895 | 2,015414693 |
| Coton BIO | 3 | 1/3 | 1 | 0,272727273 | 0,225806452 | 0,230769231 | 0,243100985 | 0,730606311 |
| Total | 11 | 1 1/2 | 4 1/3 | | | | lmax | 3,010784914 |
| Priority vector | 0,08820212 | 0,668696895 | 0,243100985 | | | | CI | 0,005392457 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,00929734 |

CRITERION 2 : Environmental

SUBCRITERION 1 : Fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 0,692307692 | 0,63334572 | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | 0,106156324 | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

SUBCRITERION 2 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 1 | 0,428571429 | 0,272727273 | 0,466666667 | 0,389321789 | 1,2002886 |
| Poly Coton | 1/3 | 1 | 1/7 | 0,142857143 | 0,090909091 | 0,066666667 | 0,1001443 | 0,302851646 |
| Coton BIO | 1 | 7 | 1 | 0,428571429 | 0,636363636 | 0,466666667 | 0,510533911 | 1,600865801 |
| Total | 2 1/3 | 11 | 2 1/7 | | | | lmax | 3,104006047 |
| Priority vector | 0,389321789 | 0,1001443 | 0,510533911 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

CRITERION 3 : Social

SUBCRITERION 1 : Provider performance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 1 | 0,454545455 | 0,384615385 | 0,466666667 | 0,435275835 | 1,312665113 |
| Poly Coton | 1/5 | 1 | 1/7 | 0,090909091 | 0,076923077 | 0,066666667 | 0,078166278 | 0,234729715 |
| Coton BIO | 1 | 7 | 1 | 0,454545455 | 0,538461538 | 0,466666667 | 0,486557887 | 1,468997669 |
| Total | 2 1/5 | 13 | 2 1/7 | | | | lmax | 3,016392496 |
| Priority vector | 0,435275835 | 0,078166278 | 0,486557887 | | | | CI | 0,008196248 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,014131462 |

SUBCRITERION 2 : User resistance

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1/3 | 0,2 | 0,142857143 | 0,217391304 | 0,186749482 | 0,563008972 |
| Poly Coton | 1 | 1 | 1/5 | 0,2 | 0,142857143 | 0,130434783 | 0,157763975 | 0,475610766 |
| Coton BIO | 3 | 5 | 1 | 0,6 | 0,714285714 | 0,652173913 | 0,655486542 | 2,004554865 |
| Total | 5 | 7 | 1 1/2 | | | | lmax | 3,043174603 |
| Priority vector | 0,186749482 | 0,157763975 | 0,655486542 | | | | CI | 0,021587302 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,037219485 |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 1/5 | 0,157894737 | 0,230769231 | 0,152542373 | 0,180402113 | 0,544335415 |
| Poly Coton | 1/3 | 1 | 1/9 | 0,052631579 | 0,076923077 | 0,084745763 | 0,071433473 | 0,21469689 |
| Coton BIO | 5 | 9 | 1 | 0,789473684 | 0,692307692 | 0,762711864 | 0,748164414 | 2,293076237 |
| Total | 6 1/3 | 13 | 1 1/3 | | | | lmax | 3,052108542 |
| Priority vector | 0,180402113 | 0,071433473 | 0,748164414 | | | | CI | 0,026054271 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,044921157 |

SUBCRITERION 2 : Innovation

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 7 | 3 | 0,677419355 | 0,538461538 | 0,714285714 | 0,643388869 | 2,008310686 |
| Poly Coton | 1/7 | 1 | 1/5 | 0,096774194 | 0,076923077 | 0,047619048 | 0,073772106 | 0,222252607 |
| Coton BIO | 1/3 | 5 | 1 | 0,225806452 | 0,384615385 | 0,238095238 | 0,282839025 | 0,866162511 |
| Total | 1 1/2 | 13 | 4 1/5 | | | | lmax | 3,096725804 |
| Priority vector | 0,643388869 | 0,073772106 | 0,282839025 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

CRITERION 5 : Functional

SUBCRITERION 1 : fiber quality

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/2 | 1 | 0,25 | 0,272727273 | 0,2 | 0,240909091 | 0,725757576 |
| Poly Coton | 2 | 1 | 3 | 0,5 | 0,545454545 | 0,6 | 0,548484848 | 1,662121212 |
| Coton BIO | 1 | 1/3 | 1 | 0,25 | 0,181818182 | 0,2 | 0,210606061 | 0,634343434 |
| Total | 4 | 1 5/6 | 5 | | | | lmax | 3,022222222 |
| Priority vector | 0,240909091 | 0,548484848 | 0,210606061 | | | | CI | 0,011111111 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019157088 |

SUBCRITERION 2 : availability

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/5 | 1/3 | 0,111111111 | 0,130434783 | 0,076923077 | 0,106156324 | 0,31965812 |
| Poly Coton | 5 | 1 | 3 | 0,555555556 | 0,652173913 | 0,692307692 | 0,63334572 | 1,945621206 |
| Coton BIO | 3 | 1/3 | 1 | 0,333333333 | 0,217391304 | 0,230769231 | 0,260497956 | 0,790082167 |
| Total | 9 | 1 1/2 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,106156324 | 0,63334572 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |

## II. SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 7 | 0,875 | **0,063661639** |
| Purchasing cost | 1/7 | 1 | 0,125 | **0,00909452** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fiber quality | Provider performance | Priority vector | Global priority |
| Fiber quality | 1 | 1 | 0,5 | **0,168428356** |
| Provider performance | 1 | 1 | 0,5 | **0,168428356** |
| **Total** | **2** | **2** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 7 | 0,875 | **0,194096028** |
| User resistance | 1/7 | 1 | 0,125 | **0,027728004** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 5 | 0,833333333 | **0,181890397** |
| Innovation | 1/5 | 1 | 0,166666667 | **0,036378079** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | fiber quality | availability | Priority vector | Global priority |
| fiber quality | 1 | 3 | 0,75 | **0,112720965** |
| availability | 1/3 | 1 | 0,25 | **0,037573655** |
| **Total** | **1 1/3** | **4** | | |

## III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/3 | 1/3 | 1/3 | 1/3 | 0,07692308 | 0,11111 | 0,059 | 0,076923 | 0,04 |
| Environmental | 3 | 1 | 3 | 1 | 3 | 0,23076923 | 0,33333 | 0,529 | 0,230769 | 0,36 |
| Social | 3 | 1/3 | 1 | 1 | 3 | 0,23076923 | 0,11111 | 0,176 | 0,230769 | 0,36 |
| Relational | 3 | 1 | 1 | 1 | 1 | 0,23076923 | 0,33333 | 0,176 | 0,230769 | 0,12 |
| Functional | 3 | 1/3 | 1/3 | 1 | 1 | 0,23076923 | 0,11111 | 0,059 | 0,230769 | 0,12 |
| **Total** | **13** | **3** | **5 2/3** | **4 1/3** | **8 1/3** | | | | | |
| **priority vector** | **0,072756159** | **0,336856712** | **0,221824032** | **0,218268477** | **0,15029462** | | | | | |

## IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,103912048** | 0,511333755 | 0,404210041 | 0,257566573 | 0,21 | **0,3568328** |
| Poly Coton | **0,637764617** | 0,103150312 | 0,08811599 | 0,071823245 | 0,57 | **0,20199403** |
| Coton BIO | **0,258323335** | 0,385515933 | 0,507673969 | 0,670610182 | 0,22 | **0,44117317** |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,072756159** | **0,336856712** | **0,221824032** | **0,218268477** | **0,15029462** | |

| | LCC | PC | Economic |
|---|---|---|---|
| Tencel | 0,106156324 | 0,08820212 | 0,103912048 |
| Poly Coton | 0,63334572 | 0,668696895 | 0,637764617 |
| Coton BIO | 0,260497956 | 0,243100985 | 0,258323335 |
| Priority | **0,875** | **0,125** | |

| | Fiber quality | Provider performance | Environmental |
|---|---|---|---|
| Tencel | 0,63334572 | 0,389321789 | 0,511333755 |
| Poly Coton | 0,106156324 | 0,1001443 | 0,103150312 |
| Coton BIO | 0,260497956 | 0,510533911 | 0,385515933 |
| Priority | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| Tencel | 0,435275835 | 0,186749482 | 0,404210041 |
| Poly Coton | 0,078166278 | 0,157763975 | 0,08811599 |
| Coton BIO | 0,486557887 | 0,655486542 | 0,507673969 |
| Priority | **0,875** | **0,125** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Tencel | 0,180402113 | 0,643388869 | 0,257566573 |
| Poly Coton | 0,071433473 | 0,073772106 | 0,071823245 |
| Coton BIO | 0,748164414 | 0,282839025 | 0,670610182 |
| Priority | **0,833333333** | **0,166666667** | |

| | fiber quality | availability | Functional |
|---|---|---|---|
| Tencel | 0,240909091 | 0,11 | 0,207220899 |
| Poly Coton | 0,548484848 | 0,63 | 0,569700066 |
| Coton BIO | 0,210606061 | 0,26 | 0,223079034 |
| Priority | **0,75** | **0,25** | |

# Actor A9

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 : Economic**

**SUBCRITERION 1 : LCC**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 2/3 | 0,63334572 | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,07692308 | 0,106156324 | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,23076923 | 0,260497956 | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

**SUBCRITERION 2 : Purchasing cost**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 0,69230769 | 0,63334572 | 1,945621206 |
| Poly Coton | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,07692308 | 0,106156324 | 0,31965812 |
| Coton BIO | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,23076923 | 0,260497956 | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | 3,055361493 |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | 0,027680747 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

**CRITERION 2 : Environmental**

**SUBCRITERION 1 : Fibre quality**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 5 | 2 | 0,588235294 | 0,454545455 | 0,625 | 0,555926916 | 1,715129234 |
| Poly Coton | 1/5 | 1 | 1/5 | 0,117647059 | 0,090909091 | 0,0625 | 0,09035205 | 0,27228164 |
| Coton BIO | 1/2 | 5 | 1 | 0,294117647 | 0,454545455 | 0,3125 | 0,353721034 | 1,083444742 |
| Total | 1 2/3 | 11 | 3 1/5 | | | | lmax | 3,070855615 |
| Priority vector | 0,555926916 | 0,09035205 | 0,353721034 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

**SUBCRITERION 2 : Provider performance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 3 : Social**

**SUBCRITERION 1 : Provider performance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 : User resistance**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 4 : Relational**

**SUBCRITERION 1 : Brand image**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 1 | 0,428571429 | 0,333333333 | 0,45454545 | 0,405483405 | 1,22991823 |
| Poly Coton | 1/3 | 1 | 1/5 | 0,142857143 | 0,111111111 | 0,09090909 | 0,114959115 | 0,346031746 |
| Coton BIO | 1 | 5 | 1 | 0,428571429 | 0,555555556 | 0,45454545 | 0,47955748 | 1,45983646 |
| Total | 2 1/3 | 9 | 2 1/5 | | | | lmax | 3,035786436 |
| Priority vector | 0,405483405 | 0,114959115 | 0,47955748 | | | | CI | 0,017893218 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,030850376 |

**SUBCRITERION 2 : Innovation**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,42857143 | 0,428571429 | 1,285714286 |
| Poly Coton | 1/3 | 1 | 1/3 | 0,142857143 | 0,142857143 | 0,14285714 | 0,142857143 | 0,428571429 |
| Coton BIO | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,42857143 | 0,428571429 | 1,285714286 |
| Total | 2 1/3 | 7 | 2 1/3 | | | | lmax | 3 |
| Priority vector | 0,428571429 | 0,142857143 | 0,428571429 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**CRITERION 5 : Functional**

**SUBCRITERION 1 : Fibre quality**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Poly Coton | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Coton BIO | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,33333333 | 0,333333333 | 1 |
| Total | 3 | 3 | 3 | | | | lmax | 3 |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

**SUBCRITERION 2 : availability**

| | Tencel | Poly Coton | Coton BIO | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Tencel | 1 | 1/3 | 5 | 0,238095238 | 0,225806452 | 0,38461538 | 0,282839025 | 0,866162511 |
| Poly Coton | 3 | 1 | 7 | 0,714285714 | 0,677419355 | 0,53846154 | 0,643388869 | 2,008310686 |
| Coton BIO | 1/5 | 1/7 | 1 | 0,047619048 | 0,096774194 | 0,07692308 | 0,073772106 | 0,222252607 |
| Total | 4 1/5 | 1 1/2 | 13 | | | | lmax | 3,096725804 |
| Priority vector | 0,282839025 | 0,643388869 | 0,073772106 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

## II. SUB-CRITERIA COMPARISON

| CRITERION 1 : | Economic | | | |
|---|---|---|---|---|
| | LCC | Purchasing cost | Priority vector | Global priority |
| LCC | 1 | 3 | 0,75 | **0,131062322** |
| Purchasing cost | 1/3 | 1 | 0,25 | **0,043687441** |
| Total | **1 1/3** | **4** | | |

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Fibre quality | Provider performance | Priority vector | Global priority |
| Fibre quality | 1 | 5 | 0,833333333 | **0,263177138** |
| Provider performance | 1/5 | 1 | 0,166666667 | **0,052635428** |
| Total | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | |
|---|---|---|---|---|
| | Social performance | User resistance | Priority vector | Global priority |
| Social performance | 1 | 1/5 | 0,166666667 | **0,052635428** |
| User resistance | 5 | 1 | 0,833333333 | **0,263177138** |
| Total | **6** | **1 1/5** | | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,059324391** |
| Innovation | 1 | 1 | 0,5 | **0,059324391** |
| Total | **2** | **2** | | |

| CRITERION 5 : | Functional | | | |
|---|---|---|---|---|
| | Fibre quality | availability | Priority vector | Global priority |
| Fibre quality | 1 | 1/7 | 0,125 | **0,009372041** |
| availability | 7 | 1 | 0,875 | **0,065604284** |
| Total | **8** | **1 1/7** | | |

## III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/3 | 1/3 | 3 | 3 | 0,13 | 0,11 | 0,11 | 0,29 | 0,23 |
| Environmental | 3 | 1 | 1 | 3 | 3 | 0,39 | 0,33 | 0,33 | 0,29 | 0,23 |
| Social | 3 | 1 | 1 | 3 | 3 | 0,39 | 0,33 | 0,33 | 0,29 | 0,23 |
| Relational | 1/3 | 1/3 | 1/3 | 1 | 3 | 0,04 | 0,11 | 0,11 | 0,10 | 0,23 |
| Functional | 1/3 | 1/3 | 1/3 | 1/3 | 1 | 0,04 | 0,11 | 0,11 | 0,03 | 0,08 |
| Total | **7 2/3** | **3** | **3** | **10 1/3** | **13** | | | | | |
| priority vector | **0,174749763** | **0,315812565** | **0,315812565** | **0,118648781** | **0,074976325** | | | | | |

## IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Tencel | **0,63334572** | 0,444630125 | 0,333333333 | 0,417027417 | 0,29 | **0,4275269** |
| Poly Coton | **0,106156324** | 0,211842692 | 0,333333333 | 0,128908129 | 0,60 | **0,2513521** |
| Coton BIO | **0,260497956** | 0,343527184 | 0,333333333 | 0,454064454 | 0,11 | **0,321121** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,174749763** | **0,315812565** | **0,315812565** | **0,118648781** | **0,074976325** | |

| | LCC | PC | Economic |
|---|---|---|---|
| Tencel | 0,63334572 | 0,63334572 | 0,63334572 |
| Poly Coton | 0,106156324 | 0,106156324 | 0,106156324 |
| Coton BIO | 0,260497956 | 0,260497956 | 0,260497956 |
| Priority | **0,75** | **0,25** | |

| | Fibre quality | Provider performance | Environmental |
|---|---|---|---|
| Tencel | 0,555926916 | 0,333333333 | 0,444630125 |
| Poly Coton | 0,09035205 | 0,333333333 | 0,211842692 |
| Coton BIO | 0,353721034 | 0,333333333 | 0,343527184 |
| Priority | **0,5** | **0,5** | |

| | Social performance | User resistance | Social |
|---|---|---|---|
| Tencel | 0,333333333 | 0,333333333 | 0,333333333 |
| Poly Coton | 0,333333333 | 0,333333333 | 0,333333333 |
| Coton BIO | 0,333333333 | 0,333333333 | 0,333333333 |
| Priority | **0,166666667** | **0,833333333** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Tencel | 0,405483405 | 0,428571429 | 0,417027417 |
| Poly Coton | 0,114959115 | 0,142857143 | 0,128908129 |
| Coton BIO | 0,47955748 | 0,428571429 | 0,454064454 |
| Priority | **0,5** | **0,5** | |

| | Fibre quality | availability | Functional |
|---|---|---|---|
| Tencel | 0,333333333 | 0,28 | 0,289150813 |
| Poly Coton | 0,333333333 | 0,64 | 0,604631927 |
| Coton BIO | 0,333333333 | 0,07 | 0,106217259 |
| Priority | **0,125** | **0,875** | |

# Annex D-2: Evaluation matrices Middle of life

# Actor A1

**I. ALTERNATIVES COMPARISON**

| CRITERION 1 : | Economic | | |
|---|---|---|---|
| SUBCRITERION 1 : | Purchasing cost | | |
| | LC | LL | Priority vector |
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| CRITERION 2 : | Environmental | | |
|---|---|---|---|
| SUBCRITERION 1 : | Carbon footprint | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Chemical use | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 3 : | Social | | |
|---|---|---|---|
| SUBCRITERION 1 : | Local job | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | User resistance | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | SAP purchasing | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 4 : | Relational | | |
|---|---|---|---|
| SUBCRITERION 1 : | Brand image | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Innovation | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| CRITERION 5 : | Functional | | |
|---|---|---|---|
| SUBCRITERION 1 : | Lifespan | | |
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 2 : | Confort | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | Traceability | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 3 | 0,75 |
| LL | 1/3 | 1 | 0,25 |
| Total | 1 1/3 | 4 | |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1 | 0,5 | **0,243417326** |
| Chemical use | 1 | 1 | 0,5 | **0,243417326** |
| **Total** | **2** | **2** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | **0,108070093** | 1,36363636 |
| User resistance | 1/5 | 1 | 1/5 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | **0,021614019** | 0,27272727 |
| SAP purchasing | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | **0,108070093** | 1,36363636 |
| **Total** | **2 1/5** | **11** | **2 1/5** | | | | | **lmax** | **3** |
| **Priority vector** | **4/9** | **0** | **4/9** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1/3 | 0,25 | **0,029428094** |
| Innovation | 3 | 1 | 0,75 | **0,088284281** |
| **Total** | **4** | **1 1/3** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1/3 | 3 | 0,230769231 | 0,217391304 | 0,333333333 | **0,260497956** | **0,010416374** | 0,79008217 |
| Confort | 3 | 1 | 5 | 0,692307692 | 0,652173913 | 0,555555556 | **0,63334572** | **0,025325211** | 1,94562121 |
| Traceability | 1/3 | 1/5 | 1 | 0,076923077 | 0,130434783 | 0,111111111 | **0,106156324** | **0,004244809** | 0,31965812 |
| **Total** | **4 1/3** | **1 1/2** | **9** | | | | | **lmax** | **3,05536149** |
| **Priority vector** | **1/4** | **5/8** | **1/9** | | | | | **CI** | **0,02768075** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,04772543 |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1 | 5 | 0,098039216 | 0,106598985 | 0,068493151 | 0,09803922 | 0,2173913 |
| Environmental | 5 | 1 | 3 | 5 | 7 | 0,490196078 | 0,532994924 | 0,616438356 | 0,49019608 | 0,3043478 |
| Social | 3 | 1/3 | 1 | 3 | 5 | 0,294117647 | 0,177664975 | 0,205479452 | 0,29411765 | 0,2173913 |
| Relational | 1 | 1/5 | 1/3 | 1 | 5 | 0,098039216 | 0,106598985 | 0,068493151 | 0,09803922 | 0,2173913 |
| Functional | 1/5 | 1/7 | 1/5 | 1/5 | 1 | 0,019607843 | 0,076142132 | 0,04109589 | 0,01960784 | 0,0434783 |
| **Total** | **10 1/5** | **1 7/8** | **4 7/8** | **10 1/5** | **23** | | | | | |
| **priority vector** | **0,117712374** | **0,486834653** | **0,237754205** | **0,117712374** | **0,039986394** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,833333333** | 0,208333333 | 0,147727273 | 0,666666667 | 0,53 | **0,334169627** |
| LL | **0,166666667** | 0,791666667 | 0,852272727 | 0,333333333 | 0,47 | **0,665830373** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,117712374** | **0,486834653** | **0,237754205** | **0,117712374** | **0,039986394** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,166666667 | 0,25 | 0,208333333 |
| LL | 0,833333333 | 0,75 | 0,791666667 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,166666667 | 0,166666667 | 0,147727273 |
| LL | 0,875 | 0,833333333 | 0,833333333 | 0,852272727 |
| Priority | **0,454545455** | **0,090909091** | **0,454545455** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,833333333 | 0,666666667 |
| LL | 0,833333333 | 0,166666667 | 0,333333333 |
| Priority | **0,25** | **0,75** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,5 | 0,50 | 0,75 | 0,526539081 |
| LL | 0,5 | 0,50 | 0,25 | 0,473460919 |
| Priority | **0,260497956** | **0,63334572** | **0,106156324** | |

## I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbonfootprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| SUBCRITERION 2 : | Chemicaluse |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1 | 0,5 | **0,10318934** |
| Chemical use | 1 | 1 | 0,5 | **0,10318934** |
| Total | **2** | **2** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | Imax |
| Local job | 1 | 1/3 | 1 | 0,2 | 0,052631579 | 0,454545455 | **0,235725678** | **0,073039866** | 0,811376927 |
| User resistance | 3 | 1 | 1/5 | 0,6 | 0,157894737 | 0,090909091 | **0,282934609** | **0,087667607** | 1,086379585 |
| SAP purchasing | 1 | 5 | 1 | 0,2 | 0,789473684 | 0,454545455 | **0,481339713** | **0,149143651** | 2,131738437 |
| Total | **5** | **6 1/3** | **2 1/5** | | | | | **Imax** | **4,029494949** |
| Priority vector | **1/4** | **2/7** | **1/2** | | | | | **CI** | **0,514747475** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,887495646 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,104976118** |
| Innovation | 1 | 1 | 0,5 | **0,104976118** |
| Total | **2** | **2** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | Imax |
| Lifespan | 1 | 1/3 | 1/3 | 0,142857143 | 0,1 | 0,181818182 | **0,141558442** | **0,032182397** | 0,427705628 |
| Confort | 3 | 1 | 1/2 | 0,428571429 | 0,3 | 0,272727273 | **0,333766234** | **0,075879597** | 1,020779221 |
| Traceability | 3 | 2 | 1 | 0,428571429 | 0,6 | 0,545454545 | **0,524675325** | **0,119281546** | 1,616883117 |
| Total | **7** | **3 1/3** | **1 5/6** | | | | | **Imax** | **3,065367965** |
| Priority vector | **1/7** | **1/3** | **1/2** | | | | | **CI** | **0,032683983** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,056351694 |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/7 | 1/7 | 1/3 | 1/5 | 0,043478261 | 0,023255814 | 0,04109589 | 0,076923077 | 0,047619 |
| Environmental | 7 | 1 | 1/3 | 1 | 1 | 0,304347826 | 0,162790698 | 0,095890411 | 0,230769231 | 0,2380952 |
| Social | 7 | 3 | 1 | 1 | 1 | 0,304347826 | 0,488372093 | 0,287671233 | 0,230769231 | 0,2380952 |
| Relational | 3 | 1 | 1 | 1 | 1 | 0,130434783 | 0,162790698 | 0,287671233 | 0,230769231 | 0,2380952 |
| Functional | 5 | 1 | 1 | 1 | 1 | 0,217391304 | 0,162790698 | 0,287671233 | 0,230769231 | 0,2380952 |
| Total | **23** | **6 1/7** | **3 1/2** | **4 1/3** | **4 1/5** | | | | | |
| priority vector | **0,046474418** | **0,206378681** | **0,309851124** | **0,209952236** | **0,227343541** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,166666667** | 0,25 | 0,206778309 | 0,208333333 | 0,17 | **0,205041538** |
| LL | **0,833333333** | 0,75 | 0,793221691 | 0,791666667 | 0,83 | 0,794958462 |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,046474418** | **0,206378681** | **0,309851124** | **0,209952236** | **0,227343541** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,25 | 0,25 | 0,25 |
| LL | 0,75 | 0,75 | 0,75 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,166666667 | 0,166666667 | 0,25 | 0,206778309 |
| LL | 0,833333333 | 0,833333333 | 0,75 | 0,793221691 |
| Priority | **0,235725678** | **0,282934609** | **0,481339713** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,25 | 0,166666667 | 0,208333333 |
| LL | 0,75 | 0,833333333 | 0,791666667 |
| Priority | **0,5** | **0,5** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,166666667 | 0,17 | 0,17 | 0,166666667 |
| LL | 0,833333333 | 0,83 | 0,83 | 0,833333333 |
| Priority | **0,141558442** | **0,333766234** | **0,524675325** | |

# Actor A3

I.ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic | | |
|---|---|---|---|
| SUBCRITERION 1 : | Purchasing cost | | |
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 2 : | Environmental | | |
|---|---|---|---|
| SUBCRITERION 1 : | Carbon footprint | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | Chemical use | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 3 : | Social | | |
|---|---|---|---|
| SUBCRITERION 1 : | Local job | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | User resistance | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | SAP purchasing | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 4 : | Relational | | |
|---|---|---|---|
| SUBCRITERION 1 : | Brand image | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Innovation | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 5 : | Functional | | |
|---|---|---|---|
| SUBCRITERION 1 : | Lifespan | | |
| | LC | LL | Priority vector |
| LC | 1 | 7 | 0,875 |
| LL | 1/7 | 1 | 0,125 |
| Total | 1 1/7 | 8 | |

| SUBCRITERION 2 : | Confort | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 7 | 0,875 |
| LL | 1/7 | 1 | 0,125 |
| Total | 1 1/7 | 8 | |

| SUBCRITERION 3 : | Traceability | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 7 | 0,875 |
| LL | 1/7 | 1 | 0,125 |
| Total | 1 1/7 | 8 | |

II. SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1 | 0,5 | **0,206962857** |
| Chemical use | 1 | 1 | 0,5 | **0,206962857** |
| Total | **2** | **2** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 1/5 | 1/2 | 0,125 | 0,090909091 | 0,2 | **0,138636364** | **0,044209177** | 0,421363636 |
| User resistance | 5 | 1 | 1 | 0,625 | 0,454545455 | 0,4 | **0,493181818** | **0,157268713** | 1,554545455 |
| SAP purchasing | 2 | 1 | 1 | 0,25 | 0,454545455 | 0,4 | **0,368181818** | **0,117407979** | 1,138636364 |
| Total | **8** | **2 1/5** | **2 1/2** | | | | | **lmax** | **3,114545455** |
| Priority vector | **1/7** | **1/2** | **3/8** | | | | | **CI** | **0,057272727** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,098746082 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 7 | 0,875 | **0,067553279** |
| Innovation | 1/7 | 1 | 0,125 | **0,009650468** |
| Total | **1 1/7** | **8** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | **0,039320942** | 1,363636364 |
| Confort | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | **0,039320942** | 1,363636364 |
| Traceability | 1/5 | 1/5 | 1 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | **0,007864188** | 0,272727273 |
| Total | **2 1/5** | **2 1/5** | **11** | | | | | **lmax** | **3** |
| Priority vector | **4/9** | **4/9** | **0** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/7 | 1/5 | 3 | 1 | 0,069767442 | 0,056179775 | 0,069767442 | 0,230769231 | 0,090909091 |
| Environmental | 7 | 1 | 1 | 5 | 5 | 0,488372093 | 0,393258427 | 0,348837209 | 0,384615385 | 0,454545455 |
| Social | 5 | 1 | 1 | 3 | 3 | 0,348837209 | 0,393258427 | 0,348837209 | 0,230769231 | 0,272727273 |
| Relational | 1/3 | 1/5 | 1/3 | 1 | 1 | 0,023255814 | 0,078651685 | 0,11627907 | 0,076923077 | 0,090909091 |
| Functional | 1 | 1/5 | 1/3 | 1 | 1 | 0,069767442 | 0,078651685 | 0,11627907 | 0,076923077 | 0,090909091 |
| Total | **14 1/3** | **2 1/2** | **2 7/8** | **13** | **11** | | | | | |
| priority vector | **0,103478596** | **0,413925714** | **0,31888587** | **0,077203747** | **0,086506073** | | | | | |

IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,5** | 0,3125 | 0,448011364 | 0,208333333 | 0,88 | **0,415732505** |
| LL | **0,5** | 0,6875 | 0,551988636 | 0,791666667 | 0,13 | **0,584267495** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,103478596** | **0,413925714** | **0,31888587** | **0,077203747** | **0,086506073** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,125 | 0,5 | 0,3125 |
| LL | 0,875 | 0,5 | 0,6875 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,5 | 0,5 | 0,448011364 |
| LL | 0,875 | 0,5 | 0,5 | 0,551988636 |
| Priority | **0,138636364** | **0,493181818** | **0,368181818** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,5 | 0,208333333 |
| LL | 0,833333333 | 0,5 | 0,791666667 |
| Priority | **0,875** | **0,125** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,875 | 0,88 | 0,88 | 0,875 |
| LL | 0,125 | 0,13 | 0,13 | 0,125 |
| Priority | **0,454545455** | **0,454545455** | **0,090909091** | |

# Actor A4

I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Chemical use |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 5 | 0,833333333 | **0,131450241** |
| Chemical use | 1/5 | 1 | 0,166666667 | **0,026290048** |
| Total | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,428571429 | 0,428571429 | **0,052720348** | 1,285714286 |
| User resistance | 1/3 | 1 | 1/3 | 0,142857143 | 0,142857143 | 0,142857143 | 0,142857143 | **0,017573449** | 0,428571429 |
| SAP purchasing | 1 | 3 | 1 | 0,428571429 | 0,428571429 | 0,428571429 | 0,428571429 | **0,052720348** | 1,285714286 |
| Total | **2 1/3** | **7** | **2 1/3** | | | | | **lmax** | 3 |
| Priority vector | **3/7** | **1/7** | **3/7** | | | | | **CI** | 0 |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 5 | 0,833333333 | **0,033158996** |
| Innovation | 1/5 | 1 | 0,166666667 | **0,006631799** |
| Total | **1 1/5** | **6** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1/5 | 1 | 0,142857143 | 0,14893617 | 0,111111111 | **0,134301475** | **0,056491235** | 0,403534842 |
| Confort | 5 | 1 | 7 | 0,714285714 | 0,744680851 | 0,777777778 | **0,745581448** | **0,313613953** | 2,257908364 |
| Traceability | 1 | 1/7 | 1 | 0,142857143 | 0,106382979 | 0,111111111 | **0,120117078** | **0,050524851** | 0,360930188 |
| Total | **7** | **1 1/3** | **9** | | | | | **lmax** | **3,022373394** |
| Priority vector | **1/7** | **3/4** | **1/8** | | | | | **CI** | **0,011186697** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,019287408 |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 3 | 3 | 5 | 1/3 | 0,205479452 | 0,38961039 | 0,326086957 | 0,217391304 | 0,1555556 |
| Environmental | 1/3 | 1 | 2 | 5 | 1/3 | 0,068493151 | 0,12987013 | 0,217391304 | 0,217391304 | 0,1555556 |
| Social | 1/3 | 1/2 | 1 | 5 | 1/3 | 0,068493151 | 0,064935065 | 0,108695652 | 0,217391304 | 0,1555556 |
| Relational | 1/5 | 1/5 | 1/5 | 1 | 1/7 | 0,04109589 | 0,025974026 | 0,02173913 | 0,043478261 | 0,0666667 |
| Functional | 3 | 3 | 3 | 7 | 1 | 0,616438356 | 0,38961039 | 0,326086957 | 0,304347826 | 0,4666667 |
| Total | **4 6/7** | **7 5/7** | **9 1/5** | **23** | **2 1/7** | | | | | |
| priority vector | **0,258824732** | **0,157740289** | **0,123014146** | **0,039790795** | **0,420630039** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,25** | 0,208333333 | 0,357142857 | 0,166666667 | 0,13 | **0,200712921** |
| LL | **0,75** | 0,791666667 | 0,642857143 | 0,833333333 | 0,88 | **0,799287079** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,258824732** | **0,157740289** | **0,123014146** | **0,039790795** | **0,420630039** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,166666667 | 0,25 | 0,208333333 |
| LL | 0,833333333 | 0,75 | 0,791666667 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,166666667 | 0,5 | 0,5 | 0,357142857 |
| LL | 0,833333333 | 0,5 | 0,5 | 0,642857143 |
| Priority | **0,428571429** | **0,142857143** | **0,428571429** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,166666667 | 0,166666667 |
| LL | 0,833333333 | 0,833333333 | 0,833333333 |
| Priority | **0,833333333** | **0,166666667** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,125 | 0,13 | 0,13 | 0,125 |
| LL | 0,875 | 0,88 | 0,88 | 0,875 |
| Priority | **0,134301475** | **0,745581448** | **0,120117078** | |

# Actor A5

**I. ALTERNATIVES COMPARISON**

| CRITERION 1 : | Economic | | |
|---|---|---|---|
| SUBCRITERION 1 : | Purchasing cost | | |
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 2 : | Environmental | | |
|---|---|---|---|
| SUBCRITERION 1 : | Carbon footprint | | |
| | LC | LL | Priority vector |
| LC | 1 | 3 | 0,75 |
| LL | 1/3 | 1 | 0,25 |
| Total | 1 1/3 | 4 | |

| SUBCRITERION 2 : | Chemical use | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 3 : | Social | | |
|---|---|---|---|
| SUBCRITERION 1 : | Local job | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| SUBCRITERION 2 : | User resistance | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | SAP purchasing | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 4 : | Relational | | |
|---|---|---|---|
| SUBCRITERION 1 : | Brand image | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Innovation | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| CRITERION 5 : | Functional | | |
|---|---|---|---|
| SUBCRITERION 1 : | Lifespan | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| SUBCRITERION 2 : | Confort | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | 4 | 1 1/3 | |

| SUBCRITERION 3 : | Traceability | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

## II SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,042262086** |
| Chemical use | 5 | 1 | 0,833333333 | **0,211310429** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 1 | 5 | 0,454545455 | 0,4 | 0,625 | 0,493181818 | **0,120573883** | 1,554545455 |
| User resistance | 1 | 1 | 2 | 0,454545455 | 0,4 | 0,25 | 0,368181818 | **0,090013682** | 1,138636364 |
| SAP purchasing | 1/5 | 1/2 | 1 | 0,090909091 | 0,2 | 0,125 | 0,138636364 | **0,033894041** | 0,421363636 |
| Total | **2 1/5** | **2 1/2** | **8** | | | | | **lmax** | **3,114545455** |
| Priority vector | **1/2** | **3/8** | **1/7** | | | | | **CI** | **0,057272727** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,098746082 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,113149894** |
| Innovation | 1 | 1 | 0,5 | **0,113149894** |
| Total | **2** | **2** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | **0,0564812** | 1 |
| Confort | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | **0,0564812** | 1 |
| Traceability | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | **0,0564812** | 1 |
| Total | **3** | **3** | **3** | | | | | **lmax** | **3** |
| Priority vector | **1/3** | **1/3** | **1/3** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

## III CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/3 | 1 | 1/3 | 1/3 | 0,090909091 | 0,086956522 | 0,230769231 | 0,076923077 | 0,0454545 |
| Environmental | 3 | 1 | 1 | 1 | 2 | 0,272727273 | 0,260869565 | 0,230769231 | 0,230769231 | 0,2727273 |
| Social | 1 | 1 | 1 | 1 | 3 | 0,090909091 | 0,260869565 | 0,230769231 | 0,230769231 | 0,4090909 |
| Relational | 3 | 1 | 1 | 1 | 1 | 0,272727273 | 0,260869565 | 0,230769231 | 0,230769231 | 0,1363636 |
| Functional | 3 | 1/2 | 1/3 | 1 | 1 | 0,272727273 | 0,130434783 | 0,076923077 | 0,230769231 | 0,1363636 |
| Total | **11** | **3 5/6** | **4 1/3** | **4 1/3** | **7 1/3** | | | | | |
| priority vector | **0,106202493** | **0,253572514** | **0,244481605** | **0,226299787** | **0,1694436** | | | | | |

## IV ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,5** | 0,625 | 0,376704545 | 0,208333333 | 0,33 | **0,407308389** |
| LL | **0,5** | 0,375 | 0,623295455 | 0,791666667 | 0,67 | **0,592691611** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,106202493** | **0,253572514** | **0,244481605** | **0,226299787** | **0,1694436** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,75 | 0,5 | 0,625 |
| LL | 0,25 | 0,5 | 0,375 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,25 | 0,5 | 0,5 | 0,376704545 |
| LL | 0,75 | 0,5 | 0,5 | 0,623295455 |
| Priority | **0,493181818** | **0,368181818** | **0,138636364** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,25 | 0,208333333 |
| LL | 0,833333333 | 0,75 | 0,791666667 |
| Priority | **0,5** | **0,5** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,25 | 0,25 | 0,50 | 0,333333333 |
| LL | 0,75 | 0,75 | 0,50 | 0,666666667 |
| Priority | **0,333333333** | **0,333333333** | **0,333333333** | |

# Actor A6

**I. ALTERNATIVES COMPARISON**

| CRITERION 1 : | Economic | | |
|---|---|---|---|
| SUBCRITERION 1 : | Purchasing cost | | |
| | LC | LL | Priority vector |
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| CRITERION 2 : | Environmental | | |
|---|---|---|---|
| SUBCRITERION 1 : | Carbon footprint | | |
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 2 : | Chemical use | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 3 : | Social | | |
|---|---|---|---|
| SUBCRITERION 1 : | Local job | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | User resistance | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 3 : | SAP purchasing | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| CRITERION 4 : | Relational | | |
|---|---|---|---|
| SUBCRITERION 1 : | Brand image | | |
| | LC | LL | Priority vector |
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Innovation | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 3 | 0,75 |
| LL | 1/3 | 1 | 0,25 |
| Total | 1 1/3 | 4 | |

| CRITERION 5 : | Functional | | |
|---|---|---|---|
| SUBCRITERION 1 : | Lifespan | | |
| | LC | LL | Priority vector |
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| SUBCRITERION 2 : | Confort | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | Traceability | | |
|---|---|---|---|
| | LC | LL | Priority vector |
| LC | 1 | 7 | 0,875 |
| LL | 1/7 | 1 | 0,125 |
| Total | 1 1/7 | 8 | |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 5 | 0,833333333 | **0,409002162** |
| Chemical use | 1/5 | 1 | 0,166666667 | **0,081800432** |
| Total | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 0,454545455 | 0,454545455 | **0,128858555** | 1,363636364 |
| User resistance | 1/5 | 1 | 1/5 | 0,090909091 | 0,090909091 | 0,090909091 | 0,090909091 | **0,025771711** | 0,272727273 |
| SAP purchasing | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 0,454545455 | 0,454545455 | **0,128858555** | 1,363636364 |
| Total | **2 1/5** | **11** | **2 1/5** | | | | | **lmax** | **3** |
| Priority vector | **4/9** | **0** | **4/9** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1/7 | 0,125 | **0,006705769** |
| Innovation | 7 | 1 | 0,875 | **0,046940386** |
| Total | **8** | **1 1/7** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 3 | 5 | 0,652173913 | 0,6 | 0,714285714 | **0,655486542** | **0,035164333** | 2,004554865 |
| Confort | 1/3 | 1 | 1 | 0,217391304 | 0,2 | 0,142857143 | **0,186749482** | **0,010018392** | 0,563008972 |
| Traceability | 1/5 | 1 | 1 | 0,130434783 | 0,2 | 0,142857143 | **0,157763975** | **0,008463431** | 0,475610766 |
| Total | **1 1/2** | **5** | **7** | | | | | **lmax** | **3,043174603** |
| Priority vector | **2/3** | **1/5** | **1/6** | | | | | **CI** | **0,021587302** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,037219485 |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/5 | 3 | 3 | 0,085714286 | 0,109947644 | 0,043478261 | 0,176470588 | 0,1764706 |
| Environmental | 5 | 1 | 3 | 7 | 7 | 0,428571429 | 0,54973822 | 0,652173913 | 0,411764706 | 0,4117647 |
| Social | 5 | 1/3 | 1 | 5 | 5 | 0,428571429 | 0,183246073 | 0,217391304 | 0,294117647 | 0,2941176 |
| Relational | 1/3 | 1/7 | 1/5 | 1 | 1 | 0,028571429 | 0,078534031 | 0,043478261 | 0,058823529 | 0,0588235 |
| Functional | 1/3 | 1/7 | 1/5 | 1 | 1 | 0,028571429 | 0,078534031 | 0,043478261 | 0,058823529 | 0,0588235 |
| Total | **11 2/3** | **1 5/6** | **4 3/5** | **17** | **17** | | | | | |
| priority vector | **0,118416273** | **0,490802595** | **0,28348882** | **0,053646156** | **0,053646156** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,833333333** | 0,5 | 0,125 | 0,677083333 | 0,78 | **0,457558855** |
| LL | **0,166666667** | 0,5 | 0,875 | 0,322916667 | 0,22 | **0,542441145** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,118416273** | **0,490802595** | **0,28348882** | **0,053646156** | **0,053646156** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,5 | 0,5 | 0,5 |
| LL | 0,5 | 0,5 | 0,5 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,125 | 0,125 | 0,125 |
| LL | 0,875 | 0,875 | 0,875 | 0,875 |
| Priority | **0,454545455** | **0,090909091** | **0,454545455** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,75 | 0,677083333 |
| LL | 0,833333333 | 0,25 | 0,322916667 |
| Priority | **0,125** | **0,875** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,833333333 | 0,50 | 0,88 | 0,777657005 |
| LL | 0,166666667 | 0,50 | 0,13 | 0,222342995 |
| Priority | **0,655486542** | **0,186749482** | **0,157763975** | |

# Actor A7

I. ALTERNATIVES COMPARISON

**CRITERION 1 : Economic**
**SUBCRITERION 1 : Purchasing cost**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

**CRITERION 2 : Environmental**
**SUBCRITERION 1 : Carbon footprint**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

**SUBCRITERION 2 : Chemical use**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

**CRITERION 3 : Social**
**SUBCRITERION 1 : Local job**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

**SUBCRITERION 2 : User resistance**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 3 | 0,75 |
| LL | 1/3 | 1 | 0,25 |
| Total | 1 1/3 | 4 | |

**SUBCRITERION 3 : SAP purchasing**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

**CRITERION 4 : Relational**
**SUBCRITERION 1 : Brand image**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

**SUBCRITERION 2 : Innovation**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

**CRITERION 5 : Functional**
**SUBCRITERION 1 : Lifespan**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

**SUBCRITERION 2 : Confort**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

**SUBCRITERION 3 : Traceability**

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 3 | 0,75 |
| LL | 1/3 | 1 | 0,25 |
| Total | 1 1/3 | 4 | |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : Environmental | Carbon footprint | Chemical use | Priority vector | Global priority |
|---|---|---|---|---|
| Carbon footprint | 1 | 7 | 0,875 | **0,466278348** |
| Chemical use | 1/7 | 1 | 0,125 | **0,066611193** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 3 : Social | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
|---|---|---|---|---|---|---|---|---|---|
| Local job | 1 | 6 | 1/3 | 0,24 | 0,375 | 0,230769231 | **0,281923077** | **0,050625857** | 0,860192308 |
| User resistance | 1/6 | 1 | 1/9 | 0,04 | 0,0625 | 0,076923077 | **0,059807692** | **0,010739865** | 0,179935897 |
| SAP purchasing | 3 | 9 | 1 | 0,72 | 0,5625 | 0,692307692 | **0,658269231** | **0,118207578** | 2,042307692 |
| **Total** | **4 1/6** | **16** | **1 4/9** | | | | | **lmax** | **3,082435897** |
| **Priority vector** | **2/7** | **0** | **2/3** | | | | | **CI** | **0,041217949** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,071065429 |

| CRITERION 4 : Relational | Brand image | Innovation | Priority vector | Global priority |
|---|---|---|---|---|
| Brand image | 1 | 7 | 0,875 | **0,12325567** |
| Innovation | 1/7 | 1 | 0,125 | **0,017607953** |
| **Total** | **1 1/7** | **8** | | |

| CRITERION 5 : Functional | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
|---|---|---|---|---|---|---|---|---|---|
| Lifespan | 1 | 1/3 | 1 | 0,2 | 0,181818182 | 0,25 | **0,210606061** | **0,008962688** | 0,634343434 |
| Confort | 3 | 1 | 2 | 0,6 | 0,545454545 | 0,5 | **0,548484848** | **0,023341677** | 1,662121212 |
| Traceability | 1 | 1/2 | 1 | 0,2 | 0,272727273 | 0,25 | **0,240909091** | **0,010252283** | 0,725757576 |
| **Total** | **5** | **1 5/6** | **4** | | | | | **lmax** | **3,022222222** |
| **Priority vector** | **1/5** | **5/9** | **1/4** | | | | | **CI** | **0,011111111** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,019157088 |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Economic** | 1 | 1/5 | 1/3 | 1 | 3 | 0,096774194 | 0,114754098 | 0,044247788 | 0,12195122 | 0,1428571 |
| **Environmental** | 5 | 1 | 5 | 5 | 7 | 0,483870968 | 0,573770492 | 0,663716814 | 0,609756098 | 0,3333333 |
| **Social** | 3 | 1/5 | 1 | 1 | 5 | 0,290322581 | 0,114754098 | 0,132743363 | 0,12195122 | 0,2380952 |
| **Relational** | 1 | 1/5 | 1 | 1 | 5 | 0,096774194 | 0,114754098 | 0,132743363 | 0,12195122 | 0,2380952 |
| **Functional** | 1/3 | 1/7 | 1/5 | 1/5 | 1 | 0,032258065 | 0,081967213 | 0,026548673 | 0,024390244 | 0,047619 |
| **Total** | **10 1/3** | **1 3/4** | **7 1/2** | **8 1/5** | **21** | | | | | |
| **priority vector** | **0,104116888** | **0,532889541** | **0,1795733** | **0,140863622** | **0,042556648** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| **LC** | **0,125** | 0,3125 | 0,162379808 | 0,171875 | 0,56 | **0,256754001** |
| **LL** | **0,875** | 0,6875 | 0,837620192 | 0,828125 | 0,44 | 0,743245999 |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,104116888** | **0,532889541** | **0,1795733** | **0,140863622** | **0,042556648** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| **LC** | 0,125 | 0,5 | 0,3125 |
| **LL** | 0,875 | 0,5 | 0,6875 |
| **Priority** | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| **LC** | 0,125 | 0,75 | 0,125 | 0,162379808 |
| **LL** | 0,875 | 0,25 | 0,875 | 0,837620192 |
| **Priority** | **0,281923077** | **0,059807692** | **0,658269231** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **LC** | 0,125 | 0,5 | 0,171875 |
| **LL** | 0,875 | 0,5 | 0,828125 |
| **Priority** | **0,875** | **0,125** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| **LC** | 0,5 | 0,50 | 0,75 | 0,560227273 |
| **LL** | 0,5 | 0,50 | 0,25 | 0,439772727 |
| **Priority** | **0,210606061** | **0,548484848** | **0,240909091** | |

# Actor A8

I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | **4** | **1 1/3** | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

| SUBCRITERION 2 : | Chemical use |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | **10** | **1 1/9** | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | **10** | **1 1/9** | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

## II. SUB-CRITERIA COMPARISON

**CRITERION 2 :** Environmental

| | Carbon footprint | Chemical use | Priority vector | Global priority |
|---|---|---|---|---|
| Carbon footprint | 1 | 1/7 | 0,125 | **0,024340659** |
| Chemical use | 7 | 1 | 0,875 | **0,170384615** |
| **Total** | **8** | **1 1/7** | | |

**CRITERION 3 :** Social

| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | Imax |
|---|---|---|---|---|---|---|---|---|---|
| Local job | 1 | 1 | 1/2 | 0,25 | 0,2 | 0,272727273 | 0,240909091 | **0,060677323** | 0,725757576 |
| User resistance | 1 | 1 | 1/3 | 0,25 | 0,2 | 0,181818182 | 0,210606061 | **0,053044955** | 0,634343434 |
| SAP purchasing | 2 | 3 | 1 | 0,5 | 0,6 | 0,545454545 | 0,548484848 | **0,138145854** | 1,662121212 |
| **Total** | **4** | **5** | **1 5/6** | | | | | **Imax** | **3,022222222** |
| **Priority vector** | **1/4** | **1/5** | **5/9** | | | | | **CI** | **0,011111111** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,019157088 |

**CRITERION 4 :** Relational

| | Brand image | Innovation | Priority vector | Global priority |
|---|---|---|---|---|
| Brand image | 1 | 1/5 | 0,166666667 | **0,032454212** |
| Innovation | 5 | 1 | 0,833333333 | **0,162271062** |
| **Total** | **6** | **1 1/5** | | |

**CRITERION 5 :** Functional

| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | Imax |
|---|---|---|---|---|---|---|---|---|---|
| Lifespan | 1 | 1 | 5 | 0,454545455 | 0,4 | 0,625 | **0,493181818** | **0,096034965** | 1,554545455 |
| Confort | 1 | 1 | 2 | 0,454545455 | 0,4 | 0,25 | **0,368181818** | **0,071694306** | 1,138636364 |
| Traceability | 1/5 | 1/2 | 1 | 0,090909091 | 0,2 | 0,125 | **0,138636364** | **0,026996004** | 0,421363636 |
| **Total** | **2 1/5** | **2 1/2** | **8** | | | | | **Imax** | **3,114545455** |
| **Priority vector** | **1/2** | **3/8** | **1/7** | | | | | **CI** | **0,057272727** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,098746082 |

## III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1 | 1/3 | 1 | 1 | 0,142857143 | 0,2 | 0,076923077 | 0,2 | 0,2 |
| Environmental | 1 | 1 | 1 | 1 | 1 | 0,142857143 | 0,2 | 0,230769231 | 0,2 | 0,2 |
| Social | 3 | 1 | 1 | 1 | 1 | 0,428571429 | 0,2 | 0,230769231 | 0,2 | 0,2 |
| Relational | 1 | 1 | 1 | 1 | 1 | 0,142857143 | 0,2 | 0,230769231 | 0,2 | 0,2 |
| Functional | 1 | 1 | 1 | 1 | 1 | 0,142857143 | 0,2 | 0,230769231 | 0,2 | 0,2 |
| **Total** | **7** | **5** | **4 1/3** | **5** | **5** | | | | | |
| **priority vector** | **0,163956044** | **0,194725275** | **0,251868132** | **0,194725275** | **0,194725275** | | | | | |

## IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,25** | 0,3125 | 0,203977273 | 0,1 | 0,50 | **0,270051199** |
| LL | **0,75** | 0,6875 | 0,796022727 | 0,9 | 0,50 | **0,729948801** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,163956044** | **0,194725275** | **0,251868132** | **0,194725275** | **0,194725275** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,125 | 0,5 | 0,3125 |
| LL | 0,875 | 0,5 | 0,6875 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,5 | 0,125 | 0,203977273 |
| LL | 0,875 | 0,5 | 0,875 | 0,796022727 |
| Priority | **0,240909091** | **0,210606061** | **0,548484848** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,1 | 0,1 | 0,1 |
| LL | 0,9 | 0,9 | 0,9 |
| Priority | **0,166666667** | **0,833333333** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,5 | 0,50 | 0,50 | 0,5 |
| LL | 0,5 | 0,50 | 0,50 | 0,5 |
| Priority | **0,493181818** | **0,368181818** | **0,138636364** | |

# Actor A9

I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | 10 | 1 1/9 | |

| SUBCRITERION 2 : | Chemical use |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | 10 | 1 1/9 | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | 10 | 1 1/9 | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | 10 | 1 1/9 | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 9 | 0,9 | **0,337978056** |
| Chemical use | 1/9 | 1 | 0,1 | **0,037553117** |
| **Total** | **1 1/9** | **10** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 1 | 1/7 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | **0,010819885** | 0,33333333 |
| User resistance | 1 | 1 | 1/7 | 0,111111111 | 0,111111111 | 0,111111111 | **0,111111111** | **0,010819885** | 0,33333333 |
| SAP purchasing | 7 | 7 | 1 | 0,777777778 | 0,777777778 | 0,777777778 | **0,777777778** | **0,075739193** | 2,33333333 |
| **Total** | **9** | **9** | **1 2/7** | | | | | **lmax** | **3** |
| **Priority vector** | **1/9** | **1/9** | **7/9** | | | | | **CI** | **0%** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0% |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1/7 | 0,125 | **0,014758577** |
| Innovation | 7 | 1 | 0,875 | **0,10331004** |
| **Total** | **8** | **1 1/7** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1/3 | 1 | 0,2 | 0,2 | 0,2 | **0,2** | **0,05505573** | 0,6 |
| Confort | 3 | 1 | 3 | 0,6 | 0,6 | 0,6 | **0,6** | **0,165167189** | 1,8 |
| Traceability | 1 | 1/3 | 1 | 0,2 | 0,2 | 0,2 | **0,2** | **0,05505573** | 0,6 |
| **Total** | **5** | **1 2/3** | **5** | | | | | **lmax** | **3** |
| **Priority vector** | **1/5** | **3/5** | **1/5** | | | | | **CI** | **0%** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0% |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1 | 1 | 1 | 0,111111111 | 0,068965517 | 0,090909091 | 0,125 | 0,2727273 |
| Environmental | 5 | 1 | 5 | 2 | 1 | 0,555555556 | 0,344827586 | 0,454545455 | 0,25 | 0,2727273 |
| Social | 1 | 1/5 | 1 | 1 | 1/3 | 0,111111111 | 0,068965517 | 0,090909091 | 0,125 | 0,0909091 |
| Relational | 1 | 1/2 | 1 | 1 | 1/3 | 0,111111111 | 0,172413793 | 0,090909091 | 0,125 | 0,0909091 |
| Functional | 1 | 1 | 3 | 3 | 1 | 0,111111111 | 0,344827586 | 0,272727273 | 0,375 | 0,2727273 |
| **Total** | **9** | **2 8/9** | **11** | **8** | **3 2/3** | | | | | |
| **priority vector** | **0,133742598** | **0,375531174** | **0,097378962** | **0,118068617** | **0,275278649** | | | | | |

IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,166666667** | 0,1125 | 0,105555556 | 0,1 | 0,13 | **0,121033273** |
| LL | **0,833333333** | 0,8875 | 0,894444444 | 0,9 | 0,88 | 0,878966727 |
| **Total** | 1 | 1 | 1 | 1 | 1 | **1** |
| **Priority vector** | **0,133742598** | **0,375531174** | **0,097378962** | **0,118068617** | **0,275278649** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,1 | 0,125 | 0,1125 |
| LL | 0,9 | 0,875 | 0,8875 |
| **Priority** | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,125 | 0,1 | 0,105555556 |
| LL | 0,875 | 0,875 | 0,9 | 0,894444444 |
| **Priority** | **0,111111111** | **0,111111111** | **0,777777778** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,1 | 0,1 | 0,1 |
| LL | 0,9 | 0,9 | 0,9 |
| **Priority** | **0,125** | **0,875** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,125 | 0,13 | 0,13 | 0,125 |
| LL | 0,875 | 0,88 | 0,88 | 0,875 |
| **Priority** | **0,2** | **0,6** | **0,2** | |

# Actor A10

**I. ALTERNATIVES COMPARISON**

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Chemical use |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | 8 | 1 1/7 | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/9 | 0,1 |
| LL | 9 | 1 | 0,9 |
| Total | 10 | 1 1/9 | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

## II. SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1 | 0,5 | **0,148581607** |
| Chemical use | 1 | 1 | 0,5 | **0,148581607** |
| Total | **2** | **2** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 5 | 1 | 0,454545455 | 0,45454545 | 0,45454545 | 0,454545455 | **0,121088174** | 1,363636364 |
| User resistance | 1/5 | 1 | 1/5 | 0,090909091 | 0,09090909 | 0,09090909 | 0,090909091 | **0,024217635** | 0,272727273 |
| SAP purchasing | 1 | 5 | 1 | 0,454545455 | 0,45454545 | 0,45454545 | 0,454545455 | **0,121088174** | 1,363636364 |
| Total | **2 1/5** | **11** | **2 1/5** | | | | | lmax | 3 |
| Priority vector | **4/9** | **0** | **4/9** | | | | | CI | 0 |
| | | | | | | | | RC | 0,58 |
| | | | | | | | | CR | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 3 | 0,75 | **0,066598496** |
| Innovation | 1/3 | 1 | 0,25 | **0,022199499** |
| Total | **1 1/3** | **4** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1 | 3 | 0,428571429 | 0,4 | 0,5 | **0,442857143** | **0,117974478** | 1,33968254 |
| Confort | 1 | 1 | 2 | 0,428571429 | 0,4 | 0,33333333 | **0,387301587** | **0,103174813** | 1,16984127 |
| Traceability | 1/3 | 1/2 | 1 | 0,142857143 | 0,2 | 0,16666667 | **0,16984127** | **0,045244692** | 0,511111111 |
| Total | **2 1/3** | **2 1/2** | **6** | | | | | lmax | **3,020634921** |
| Priority vector | **4/9** | **2/5** | **1/6** | | | | | CI | **0,01031746** |
| | | | | | | | | RC | 0,58 |
| | | | | | | | | CR | 0,017788725 |

## III. CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1 | 1/3 | 0,07692308 | 0,056603774 | 0,090909091 | 0,090909091 | 0,0909091 |
| Environmental | 5 | 1 | 1 | 3 | 1 | 0,38461538 | 0,283018868 | 0,272727273 | 0,272727273 | 0,2727273 |
| Social | 3 | 1 | 1 | 3 | 1 | 0,23076923 | 0,283018868 | 0,272727273 | 0,272727273 | 0,2727273 |
| Relational | 1 | 1/3 | 1/3 | 1 | 1/3 | 0,07692308 | 0,094339623 | 0,090909091 | 0,090909091 | 0,0909091 |
| Functional | 3 | 1 | 1 | 3 | 1 | 0,23076923 | 0,283018868 | 0,272727273 | 0,272727273 | 0,2727273 |
| Total | **13** | **3 1/2** | **3 2/3** | **11** | **3 2/3** | | | | | |
| priority vector | **0,081250825** | **0,297163214** | **0,266393983** | **0,088797994** | **0,26639398** | | | | | |

## IV. ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,5** | 0,333333333 | 0,299242424 | 0,2 | 0,50 | **0,37035279** |
| LL | **0,5** | 0,666666667 | 0,700757576 | 0,8 | 0,50 | 0,54166667 |
| Total | 1 | 1 | 1 | 1 | 1 | **0,91201946** |
| Priority vector | **0,081250825** | **0,297163214** | **0,266393983** | **0,088797994** | **0,26639398** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,166666667 | 0,5 | 0,333333333 |
| LL | 0,833333333 | 0,5 | 0,666666667 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,166666667 | 0,5 | 0,299242424 |
| LL | 0,875 | 0,833333333 | 0,5 | 0,700757576 |
| Priority | **0,454545455** | **0,090909091** | **0,454545455** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,1 | 0,5 | 0,2 |
| LL | 0,9 | 0,5 | 0,8 |
| Priority | **0,75** | **0,25** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,5 | 0,50 | 0,50 | 0,5 |
| LL | 0,5 | 0,50 | 0,50 | 0,5 |
| Priority | **0,442857143** | **0,387301587** | **0,16984127** | |

# Actor A11

I. ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 1 : Purchasing cost

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | **4** | **1 1/3** | |

CRITERION 2 : Environmental

SUBCRITERION 1 : Carbon footprint

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

SUBCRITERION 2 : Chemical use

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

CRITERION 3 : Social

SUBCRITERION 1 : Local job

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

SUBCRITERION 2 : User resistance

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | **4** | **1 1/3** | |

SUBCRITERION 3 : SAP purchasing

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/7 | 0,125 |
| LL | 7 | 1 | 0,875 |
| Total | **8** | **1 1/7** | |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | **6** | **1 1/5** | |

SUBCRITERION 2 : Innovation

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/3 | 0,25 |
| LL | 3 | 1 | 0,75 |
| Total | **4** | **1 1/3** | |

CRITERION 5 : Functional

SUBCRITERION 1 : Lifespan

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

SUBCRITERION 2 : Confort

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

SUBCRITERION 3 : Traceability

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | **2** | **2** | |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 5 | 0,833333333 | **0,184620606** |
| Chemical use | 1/5 | 1 | 0,166666667 | **0,036924121** |
| **Total** | **1 1/5** | **6** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 5 | 5 | 0,714285714 | 0,769230769 | 0,625 | **0,702838828** | **0,346837806** | 2,188644689 |
| User resistance | 1/5 | 1 | 2 | 0,142857143 | 0,153846154 | 0,25 | **0,182234432** | **0,089929281** | 0,552655678 |
| SAP purchasing | 1/5 | 1/2 | 1 | 0,142857143 | 0,076923077 | 0,125 | **0,11492674** | **0,056714195** | 0,346611722 |
| **Total** | **1 2/5** | **6 1/2** | **8** | | | | | **lmax** | **3,087912088** |
| **Priority vector** | **5/7** | **1/5** | **1/9** | | | | | **CI** | **0,043956044** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,075786283 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 3 | 0,75 | **0,039471317** |
| Innovation | 1/3 | 1 | 0,25 | **0,013157106** |
| **Total** | **1 1/3** | **4** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1/7 | 1/5 | 0,076923077 | 0,096774194 | 0,04761905 | **0,073772106** | **0,006865233** | 0,222252607 |
| Confort | 7 | 1 | 3 | 0,538461538 | 0,677419355 | 0,71428571 | **0,643388869** | **0,059873778** | 2,008310686 |
| Traceability | 5 | 1/3 | 1 | 0,384615385 | 0,225806452 | 0,23809524 | **0,282839025** | **0,026321004** | 0,866162511 |
| **Total** | **13** | **1 1/2** | **4 1/5** | | | | | **lmax** | **3,096725804** |
| **Priority vector** | **0** | **2/3** | **2/7** | | | | | **CI** | **0,048362902** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,083384313 |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/3 | 1/5 | 3 | 3 | 0,10344828 | 0,066666667 | 0,106598985 | 0,176470588 | 0,2432432 |
| Environmental | 3 | 1 | 1/3 | 3 | 3 | 0,31034483 | 0,2 | 0,177664975 | 0,176470588 | 0,2432432 |
| Social | 5 | 3 | 1 | 7 | 5 | 0,51724138 | 0,6 | 0,532994924 | 0,411764706 | 0,4054054 |
| Relational | 1/3 | 1/3 | 1/7 | 1 | 1/3 | 0,03448276 | 0,066666667 | 0,076142132 | 0,058823529 | 0,027027 |
| Functional | 1/3 | 1/3 | 1/5 | 3 | 1 | 0,03448276 | 0,066666667 | 0,106598985 | 0,176470588 | 0,0810811 |
| **Total** | **9 2/3** | **5** | **1 7/8** | **17** | **12 1/3** | | | | | |
| **priority vector** | **0,139285552** | **0,221544727** | **0,493481283** | **0,052628423** | **0,093060016** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,25** | 0,3125 | 0,147779304 | 0,1875 | 0,50 | **0,23337827** |
| LL | **0,75** | 0,6875 | 0,852220696 | 0,8125 | 0,50 | 0,734375 |
| Total | 1 | 1 | 1 | 1 | 1 | **0,96775327** |
| Priority vector | **0,139285552** | **0,221544727** | **0,493481283** | **0,052628423** | **0,093060016** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,125 | 0,5 | 0,3125 |
| LL | 0,875 | 0,5 | 0,6875 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,125 | 0,25 | 0,125 | 0,147779304 |
| LL | 0,875 | 0,75 | 0,875 | 0,852220696 |
| Priority | **0,702838828** | **0,182234432** | **0,11492674** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,166666667 | 0,25 | 0,1875 |
| LL | 0,833333333 | 0,75 | 0,8125 |
| Priority | **0,75** | **0,25** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,5 | 0,50 | 0,50 | 0,5 |
| LL | 0,5 | 0,50 | 0,50 | 0,5 |
| Priority | **0,073772106** | **0,643388869** | **0,282839025** | |

# Actor A12

I.ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 1 : | Purchasing cost |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Chemical use |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | SAP purchasing |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 5 | 0,833333333 |
| LL | 1/5 | 1 | 0,166666667 |
| Total | 1 1/5 | 6 | |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | Lifespan |

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 2 : | Confort |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1/5 | 0,166666667 |
| LL | 5 | 1 | 0,833333333 |
| Total | 6 | 1 1/5 | |

| SUBCRITERION 3 : | Traceability |
|---|---|

| | LC | LL | Priority vector |
|---|---|---|---|
| LC | 1 | 1 | 0,5 |
| LL | 1 | 1 | 0,5 |
| Total | 2 | 2 | |

### II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Chemical use | Priority vector | Global priority |
| Carbon footprint | 1 | 1 | 0,5 | **0,031802233** |
| Chemical use | 1 | 1 | 0,5 | **0,031802233** |
| **Total** | **2** | **2** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,184774056** | 1 |
| User resistance | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,184774056** | 1 |
| SAP purchasing | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,184774056** | 1 |
| **Total** | **3** | **3** | **3** | | | | | **lmax** | **3** |
| **Priority vector** | **1/3** | **1/3** | **1/3** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,031802233** |
| Innovation | 1 | 1 | 0,5 | **0,031802233** |
| **Total** | **2** | **2** | | |

| CRITERION 5 : | Functional | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Lifespan | Confort | Traceability | Normalized | | | Priority vector | Global priority | lmax |
| Lifespan | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,021201489** | 1 |
| Confort | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,021201489** | 1 |
| Traceability | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,333333333 | **0,333333333** | **0,021201489** | 1 |
| **Total** | **3** | **3** | **3** | | | | | **lmax** | **3** |
| **Priority vector** | **1/3** | **1/3** | **1/3** | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

### III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 5 | 1/5 | 5 | 5 | 0,151515152 | 0,333333333 | 0,122807018 | 0,3333333 | 0,333333 |
| Environmental | 1/5 | 1 | 1/7 | 1 | 1 | 0,03030303 | 0,066666667 | 0,087719298 | 0,0666667 | 0,066667 |
| Social | 5 | 7 | 1 | 7 | 7 | 0,757575758 | 0,466666667 | 0,614035088 | 0,4666667 | 0,466667 |
| Relational | 1/5 | 1 | 1/7 | 1 | 1 | 0,03030303 | 0,066666667 | 0,087719298 | 0,0666667 | 0,066667 |
| Functional | 1/5 | 1 | 1/7 | 1 | 1 | 0,03030303 | 0,066666667 | 0,087719298 | 0,0666667 | 0,066667 |
| **Total** | **6 3/5** | **15** | **1 5/8** | **15** | **15** | | | | | |
| **priority vector** | **0,254864434** | **0,063604466** | **0,554322169** | **0,063604466** | **0,06360447** | | | | | |

### IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| LC | **0,5** | 0,166666667 | 0,611111111 | 0,5 | 0,28 | **0,526255538** |
| LL | **0,5** | 0,833333333 | 0,388888889 | 0,5 | 0,72 | **0,473744462** |
| Total | 1 | 1 | 1 | 1 | 1 | **1** |
| Priority vector | **0,254864434** | **0,063604466** | **0,554322169** | **0,063604466** | **0,06360447** | |

| | Carbon footprint | Chemical use | Environmental |
|---|---|---|---|
| LC | 0,166666667 | 0,166666667 | 0,166666667 |
| LL | 0,833333333 | 0,833333333 | 0,833333333 |
| Priority | **0,5** | **0,5** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| LC | 0,833333333 | 0,166666667 | 0,833333333 | 0,611111111 |
| LL | 0,166666667 | 0,833333333 | 0,166666667 | 0,388888889 |
| Priority | **0,333333333** | **0,333333333** | **0,333333333** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| LC | 0,5 | 0,5 | 0,5 |
| LL | 0,5 | 0,5 | 0,5 |
| Priority | **0,5** | **0,5** | |

| | Lifespan | Confort | Traceability | Functional |
|---|---|---|---|---|
| LC | 0,166666667 | 0,17 | 0,50 | 0,277777778 |
| LL | 0,833333333 | 0,83 | 0,50 | 0,722222222 |
| Priority | **0,333333333** | **0,333333333** | **0,333333333** | |

# Annex D-3: Evaluation matrices End of life

# Actor A1

I.ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 2 : | Purchasing cost |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 1/5 | 0,157894737 | 0,272727273 | 0,14893617 | **0,19318606** | 0,58781092 |
| New clothing | 1/3 | 1 | 1/7 | 0,052631579 | 0,090909091 | 0,106382979 | **0,083307883** | 0,251061244 |
| Energy | 5 | 7 | 1 | 0,789473684 | 0,636363636 | 0,744680851 | **0,723506057** | 2,272591537 |
| Total | 6 1/3 | 11 | 1 1/3 | | | | Imax | **3,111463701** |
| Priority vector | **0,19318606** | **0,083307883** | **0,723506057** | | | | Imax | **0,055731851** |
| | | | | | | | CI | 0,58 |
| | | | | | | | RC | 0,096089398 |
| | | | | | | | CR | |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 3 | 0,652173913 | 0,714285714 | 0,6 | **0,655486542** | 2,004554865 |
| New clothing | 1/5 | 1 | 1 | 0,130434783 | 0,142857143 | 0,2 | **0,157763975** | 0,475610766 |
| Energy | 1/3 | 1 | 1 | 0,217391304 | 0,142857143 | 0,2 | **0,186749482** | 0,563008972 |
| Total | 1 1/2 | 7 | 5 | | | | Imax | **3,043174603** |
| Priority vector | **0,655486542** | **0,157763975** | **0,186749482** | | | | CI | **0,021587302** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,037219485 |

| SUBCRITERION 2 : | Recycling |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | **0,723506057** | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | **0,19318606** | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| New clothing | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Energy | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | 1 2/5 | 7 | 7 | | | | Imax | **3** |
| Priority vector | 0,714285714 | 0,142857143 | 0,142857143 | | | | CI | **0,00** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,00 |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| New clothing | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Energy | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | 3 | 3 | 3 | | | | Imax | **3** |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

| SUBCRITERION 2 : | SAP purchasing |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | **0,723506057** | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | **0,19318606** | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 7 | 5 | 0,744680851 | 0,777777778 | 0,714285714 | **0,745581448** | 2,257908364 |
| New clothing | 1/7 | 1 | 1 | 0,106382979 | 0,111111111 | 0,142857143 | **0,120117078** | 0,360930188 |
| Energy | 1/5 | 1 | 1 | 0,14893617 | 0,111111111 | 0,142857143 | **0,134301475** | 0,403534842 |
| Total | 1 1/3 | 9 | 7 | | | | Imax | **3,022373394** |
| Priority vector | 0,745581448 | 0,120117078 | 0,134301475 | | | | CI | **0,011186697** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019287408 |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | **0,723506057** | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 0,157894737 | 0,272727273 | **0,19318606** | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | fiber quality |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 7 | 0,677419355 | 0,714285714 | 0,538461538 | **0,643388869** | 2,008310686 |
| New clothing | 1/3 | 1 | 5 | 0,225806452 | 0,238095238 | 0,384615385 | **0,282839025** | 0,866162511 |
| Energy | 1/7 | 1/5 | 1 | 0,096774194 | 0,047619048 | 0,076923077 | **0,073772106** | 0,222252607 |
| Total | 1 1/2 | 4 1/5 | 13 | | | | Imax | **3,096725804** |
| Priority vector | 0,643388869 | 0,282839025 | 0,073772106 | | | | CI | **0,048362902** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,076538386** |
| Recycling | 5 | 1 | 0,833333333 | **0,382691929** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax | |
| Local job | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 2/3 | **0,63334572** | **0,125480418** | 1,94562 | |
| User resistance | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | **0,106156324** | **0,02103202** | 0,31966 | |
| SAP purchasing | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | **0,260497956** | **0,051610663** | 0,79008 | |
| Total | 1 1/2 | 9 | 4 1/3 | | | | | **lmax** | **3,05536** | |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | | **CI** | **0,02768** | |
| | | | | | | | | **RC** | 0,58 | |
| | | | | | | | | **CR** | 0,04773 | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1/3 | 0,25 | **0,049530775** |
| Innovation | 3 | 1 | 0,75 | **0,148592326** |
| Total | 4 | 1 1/3 | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1/3 | 5 | 0,081967213 | 0 | 0,060240964 | 0,06024 | 0,217391 |
| Environmental | 5 | 1 | 3 | 3 | 7 | 0,409836066 | 0,497630332 | 0,542168675 | 0,54217 | 0,304348 |
| Social | 3 | 1/3 | 1 | 1 | 5 | 0,245901639 | 0,165876777 | 0,180722892 | 0,18072 | 0,217391 |
| Relational | 3 | 1/3 | 1 | 1 | 5 | 0,245901639 | 0,165876777 | 0,180722892 | 0,18072 | 0,217391 |
| Functional | 1/5 | 1/7 | 1/5 | 1/5 | 1 | 0,016393443 | 0,071090047 | 0,036144578 | 0,03614 | 0,043478 |
| | **12 1/5** | **2** | **5 1/2** | **5 1/2** | **23** | | | | | |
| priority vector | **0,103873302** | **0,459230315** | **0,198123101** | **0,198123101** | **0,040650182** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Other product | **0,19318606** | 0,712169471 | 0,676247091 | 0,729024905 | 0,64 | **0,651687404** |
| New clothing | **0,083307883** | 0,187282379 | 0,176187975 | 0,174918814 | 0,28 | **0,175719034** |
| Energy | **0,723506057** | 0,100548149 | 0,147564934 | 0,096056281 | 0,07 | **0,172593562** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **1** |
| Priority vector | **0,103873302** | **0,459230315** | **0,198123101** | **0,198123101** | **0,040650182** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Other product | 0,655486542 | 0,723506057 | 0,712169471 |
| New clothing | 0,157763975 | 0,19318606 | 0,187282379 |
| Energy | 0,186749482 | 0,083307883 | 0,100548149 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Other product | 0,714285714 | 0,333333333 | 0,723506057 | 0,676247091 |
| New clothing | 0,142857143 | 0,333333333 | 0,19318606 | 0,176187975 |
| Energy | 0,142857143 | 0,333333333 | 0,083307883 | 0,147564934 |
| Priority | **0,63334572** | **0,106156324** | **0,260497956** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Other product | 0,745581448 | 0,723506057 | 0,729024905 |
| New clothing | 0,120117078 | 0,19318606 | 0,174918814 |
| Energy | 0,134301475 | 0,083307883 | 0,096056281 |
| Priority | **0,25** | **0,75** | |

# Actor A2

**I. ALTERNATIVES COMPARISON**

**CRITERION 1 : Economic**
**SUBCRITERION 2 : Purchasing cost**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | **0,368181818** | **0,493181818** | **0,138636364** | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**CRITERION 2 : Environmental**
**SUBCRITERION 1 : Carbon footprint**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | **0,368181818** | **0,493181818** | **0,138636364** | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**SUBCRITERION 2 : Recycling**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**CRITERION 3 : Social**
**SUBCRITERION 1 : Local job**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**SUBCRITERION 2 : User resistance**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 4/9 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**SUBCRITERION 2 : SAP purchasing**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**CRITERION 4 : Relational**
**SUBCRITERION 1 : Brand image**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**SUBCRITERION 2 : Innovation**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

**CRITERION 5 : Functional**
**SUBCRITERION 1 : Revaluation capability**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 2 | 0,4 | 0,454545455 | 0,25 | **0,368181818** | 1,138636364 |
| New clothing | 1 | 1 | 5 | 0,4 | 0,454545455 | 0,625 | **0,493181818** | 1,554545455 |
| Energy | 1/2 | 1/5 | 1 | 0,2 | 0,090909091 | 0,125 | **0,138636364** | 0,421363636 |
| Total | 2 1/2 | 2 1/5 | 8 | | | | lmax | **3,114545455** |
| Priority vector | 0,368181818 | 0,493181818 | 0,138636364 | | | | CI | **0,057272727** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,098746082 |

II. **SUB-CRITERIA COMPARISON**

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | **Carbon footprint** | **Recycling** | **Priority vector** | **Global priority** |
| **Carbon footprint** | 1 | 1/5 | 0,166666667 | **0,088647643** |
| **Recycling** | 5 | 1 | 0,833333333 | **0,443238217** |
| **Total** | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Local job** | **User resistance** | **SAP purchasing** | **Normalized** | | | **Priority vector** | **Global priority** | **lmax** |
| **Local job** | 1 | 5 | 3 | 0,652173913 | 0,714285714 | 3/5 | **0,655486542** | **0,085152017** | 2,0045549 |
| **User resistance** | 1/5 | 1 | 1 | 0,130434783 | 0,142857143 | 0,2 | **0,157763975** | **0,020494579** | 0,4756108 |
| **SAP purchasing** | 1/3 | 1 | 1 | 0,217391304 | 0,142857143 | 0,2 | **0,186749482** | **0,024259987** | 0,563009 |
| **Total** | 1 1/2 | 7 | 5 | | | | | **lmax** | **3,0431746** |
| **Priority vector** | 2/3 | 1/6 | 1/5 | | | | | **CI** | **0,0215873** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,0372195 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | **Brand image** | **Innovation** | **Priority vector** | **Global priority** |
| **Brand image** | 1 | 1 | 0,5 | **0,064953292** |
| **Innovation** | 1 | 1 | 0,5 | **0,064953292** |
| **Total** | 2 | 2 | | |

III. **CRITERIA COMPARISON**

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1/3 | 1/5 | 0,05882353 | 0,111111111 | 0,04 | 0,04 | 0,02439 |
| Environmental | 5 | 1 | 5 | 5 | 5 | 0,29411765 | 0,555555556 | 0,6 | 0,6 | 0,609756 |
| Social | 3 | 1/5 | 1 | 1 | 1 | 0,17647059 | 0,111111111 | 0,12 | 0,12 | 0,121951 |
| Relational | 3 | 1/5 | 1 | 1 | 1 | 0,17647059 | 0,111111111 | 0,12 | 0,12 | 0,121951 |
| Functional | 5 | 1/5 | 1 | 1 | 1 | 0,29411765 | 0,111111111 | 0,12 | 0,12 | 0,121951 |
| | **17** | **1 4/5** | **8 1/3** | **8 1/3** | **8 1/5** | | | | | |
| **priority vector** | **0,054864977** | **0,53188586** | **0,129906584** | **0,129906584** | **0,153435996** | | | | | |

IV. **ALTERNATIVES PRIORITIZATION**

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| **Other product** | **0,368181818** | 0,368181818 | 0,368181818 | 0,368181818 | 0,37 | **0,36818182** |
| **New clothing** | **0,493181818** | 0,493181818 | 0,493181818 | 0,493181818 | 0,49 | **0,49318182** |
| **Energy** | **0,138636364** | 0,138636364 | 0,138636364 | 0,138636364 | 0,14 | **0,13863636** |
| **Total** | 1 | 1 | 1 | 1 | 1,00 | **1** |
| **Priority vector** | **0,054864977** | **0,53188586** | **0,129906584** | **0,129906584** | **0,153435996** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| **Other product** | 0,368181818 | 0,368181818 | 0,368181818 |
| **New clothing** | 0,493181818 | 0,493181818 | 0,493181818 |
| **Energy** | 0,138636364 | 0,138636364 | 0,138636364 |
| **Priority** | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| **Other product** | 0,368181818 | 0,368181818 | 0,368181818 | 0,368181818 |
| **New clothing** | 0,493181818 | 0,493181818 | 0,493181818 | 0,493181818 |
| **Energy** | 0,138636364 | 0,138636364 | 0,138636364 | 0,138636364 |
| **Priority** | **0,655486542** | **0,157763975** | **0,186749482** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Other product** | 0,368181818 | 0,368181818 | 0,368181818 |
| **New clothing** | 0,493181818 | 0,493181818 | 0,493181818 |
| **Energy** | 0,138636364 | 0,138636364 | 0,138636364 |
| **Priority** | **0,5** | **0,5** | |

# Actor A3

I.ALTERNATIVES COMPARISON

CRITERION 1 : Economic
SUBCRITERION 2 : Purchasing cost

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 3 | 3/5 | 0,5 | 0,666666667 | **0,588888889** | 1,822222222 |
| New clothing | 1/3 | 1 | 1/2 | 0,2 | 0,166666667 | 0,111111111 | **0,159259259** | 0,481481481 |
| Energy | 1/3 | 2 | 1 | 0,2 | 0,333333333 | 0,222222222 | **0,251851852** | 0,766666667 |
| Total | 1 2/3 | 6 | 4 1/2 | | | | lmax | **3,07037037** |
| Priority vector | **0,588888889** | **0,159259259** | **0,251851852** | | | | CI | **0,035185185** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,060664112 |

CRITERION 2 : Environmental
SUBCRITERION 1 : Carbon footprint

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 5 | 0,714285714 | 0,625 | 0,769230769 | **0,702838828** | 2,188644689 |
| New clothing | 1/5 | 1 | 1/2 | 0,142857143 | 0,125 | 0,076923077 | **0,11492674** | 0,346611722 |
| Energy | 1/5 | 2 | 1 | 0,142857143 | 0,25 | 0,153846154 | **0,182234432** | 0,552655678 |
| Total | 1 2/5 | 8 | 6 1/2 | | | | lmax | **3,087912088** |
| Priority vector | **0,702838828** | **0,11492674** | **0,182234432** | | | | CI | **0,043956044** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,075786283 |

SUBCRITERION 2 : Recycling

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 7 | 2 | 0,608695652 | 0,46666666 | 0,63636363 | **0,570575318** | 1,761220905 |
| New clothing | 1/7 | 1 | 1/7 | 0,086956522 | 0,06666666 | 0,04545454 | **0,066359245** | 0,199736495 |
| Energy | 1/2 | 7 | 1 | 0,304347826 | 0,46666666 | 0,31818181 | **0,363065437** | 1,112867809 |
| Total | 1 2/3 | 15 | 3 1/7 | | | | lmax | **3,073825209** |
| Priority vector | 0,570575318 | 0,066359245 | 0,363065437 | | | | CI | **0,036912604** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,063642421 |

CRITERION 3 : Social
SUBCRITERION 1 : Local job

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 1 | 0,428571429 | 0,333333333 | 0,454545455 | **0,405483405** | 1,22991823 |
| New clothing | 1/3 | 1 | 1/5 | 0,142857143 | 0,111111111 | 0,090909091 | **0,114959115** | 0,346031746 |
| Energy | 1 | 5 | 1 | 0,428571429 | 0,555555556 | 0,454545455 | **0,47955748** | 1,45983646 |
| Total | 2 1/3 | 9 | 2 1/5 | | | | lmax | **3,035786436** |
| Priority vector | 0,405483405 | 0,114959115 | 0,47955748 | | | | CI | **0,017893218** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,030850376 |

SUBCRITERION 2 : User resistance

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| New clothing | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Energy | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | 1 2/5 | 7 | 7 | | | | lmax | **3** |
| Priority vector | 0,714285714 | 0,142857143 | 0,142857143 | | | | CI | **-4,44089E-16** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | -7,65671E-16 |

SUBCRITERION 2 : SAP purchasing

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 5 | 0,714285714 | 0,714285714 | 0,714285714 | **0,714285714** | 2,142857143 |
| New clothing | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Energy | 1/5 | 1 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | 1 2/5 | 7 | 7 | | | | lmax | **3** |
| Priority vector | 0,714285714 | 0,142857143 | 0,142857143 | | | | CI | **-4,44089E-16** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | -7,65671E-16 |

CRITERION 4 : Relational
SUBCRITERION 1 : Brand image

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| New clothing | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Energy | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | 3 | 3 | 3 | | | | lmax | **3** |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : Innovation

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 2 | 5/9 | 0,6 | 0,5 | **0,548484848** | 1,662121212 |
| New clothing | 1/3 | 1 | 1 | 0,181818182 | 0,2 | 0,25 | **0,210606061** | 0,634343434 |
| Energy | 1/2 | 1 | 1 | 0,272727273 | 0,2 | 0,25 | **0,240909091** | 0,725757576 |
| Total | 1 5/6 | 5 | 4 | | | | lmax | **3,022222222** |
| Priority vector | 0,548484848 | 0,210606061 | 0,240909091 | | | | CI | **0,011111111** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019157088 |

CRITERION 5 : Functional
SUBCRITERION 1 : fiber quality

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 3 | 0,652173913 | 0,555555556 | 0,692307692 | **0,63334572** | 1,945621206 |
| New clothing | 1/5 | 1 | 1/3 | 0,130434783 | 0,111111111 | 0,076923077 | **0,106156324** | 0,31965812 |
| Energy | 1/3 | 3 | 1 | 0,217391304 | 0,333333333 | 0,230769231 | **0,260497956** | 0,790082167 |
| Total | 1 1/2 | 9 | 4 1/3 | | | | lmax | **3,055361493** |
| Priority vector | 0,63334572 | 0,106156324 | 0,260497956 | | | | CI | **0,027680747** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,047725425 |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,034839127** |
| Recycling | 5 | 1 | 0,833333333 | **0,174195637** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | Userresistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 3 | 1 | 0,428571429 | 0,33333333 | 4/9 | **0,405483405** | **0,049317449** | 1,22991823 |
| Userresistance | 1/3 | 1 | 1/5 | 0,142857143 | 0,11111111 | 0,09090909 | **0,114959115** | **0,013982053** | 0,34603175 |
| SAP purchasing | 1 | 5 | 1 | 0,428571429 | 0,55555555 | 0,45454545 | **0,47955748** | **0,058326805** | 1,45983646 |
| Total | 2 1/3 | 9 | 2 1/5 | | | | | **lmax** | **3,03578644** |
| Priority vector | 2/5 | 1/9 | 1/2 | | | | | **CI** | **0,01789322** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,03085038 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 5 | 0,833333333 | **0,03840419** |
| Innovation | 1/5 | 1 | 0,166666667 | **0,007680838** |
| Total | 1 1/5 | 6 | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1 | 3 | 5 | 1/3 | 0,18072289 | 0,180722892 | 0,294117647 | 0,23809524 | 0,151515 |
| Environmental | 1 | 1 | 3 | 5 | 0,33333333 | 0,18072289 | 0,180722892 | 0,294117647 | 0,23809524 | 0,151515 |
| Social | 1/3 | 1/3 | 1 | 5 | 1/3 | 0,06024096 | 0,060240964 | 0,098039216 | 0,23809524 | 0,151515 |
| Relational | 1/5 | 1/5 | 1/5 | 1 | 1/5 | 0,03614457 | 0,036144578 | 0,019607843 | 0,04761905 | 0,090909 |
| Functional | 3 | 3 | 3 | 5 | 1 | 0,54216867 | 0,542168675 | 0,294117647 | 0,23809524 | 0,454545 |
| | **5 1/2** | **5 1/2** | **10 1/5** | **21** | **2 1/5** | | | | | |
| priority vector | **0,209034764** | **0,209034764** | **0,121626307** | **0,046085028** | **0,41421913** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| **Otherproduct** | **0,588888889** | 0,592619237 | 0,589071502 | 0,369191919 | 0,63 | **0,59798100** |
| **Newclothing** | **0,159259259** | 0,074453827 | 0,131544955 | 0,312878788 | 0,11 | **0,12324449** |
| **Energy** | **0,251851852** | 0,332926936 | 0,279383542 | 0,317929293 | 0,26 | **0,27877450** |
| **Total** | 1 | 1 | 1 | 1 | 1,00 | **1** |
| **Priority vector** | **0,209034764** | **0,209034764** | **0,121626307** | **0,046085028** | **0,41421913** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| **Otherproduct** | 0,702838828 | 0,570575318 | 0,592619237 |
| **Newclothing** | 0,11492674 | 0,066359245 | 0,074453827 |
| **Energy** | 0,182234432 | 0,363065437 | 0,332926936 |
| **Priority** | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| **Otherproduct** | 0,405483405 | 0,714285714 | 0,714285714 | 0,589071502 |
| **Newclothing** | 0,114959115 | 0,142857143 | 0,142857143 | 0,131544955 |
| **Energy** | 0,47955748 | 0,142857143 | 0,142857143 | 0,279383542 |
| **Priority** | **0,405483405** | **0,114959115** | **0,47955748** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| **Otherproduct** | 0,333333333 | 0,548484848 | 0,369191919 |
| **Newclothing** | 0,333333333 | 0,210606061 | 0,312878788 |
| **Energy** | 0,333333333 | 0,240909091 | 0,317929293 |
| **Priority** | **0,833333333** | **0,166666667** | |

# Actor A4

I. ALTERNATIVES COMPARISON

**CRITERION 1 :** Economic

**SUBCRITERION 2 :** Purchasing cost

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/7 | 1/5 | 0,076923077 | 0,0967741935 | 0,047619048 | **0,073772106** | 0,222252607 |
| New clothing | 7 | 1 | 3 | 0,538461538 | 0,6774193555 | 0,714285714 | **0,643388869** | 2,008310686 |
| Energy | 5 | 1/3 | 1 | 0,384615385 | 0,225806452 | 0,238095238 | **0,282839025** | 0,866162511 |
| Total | 13 | 1 1/2 | 4 1/5 | | | | Imax | **3,096725804** |
| Priority vector | **0,073772106** | **0,643388869** | **0,282839025** | | | | CI | **0,048362902** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

**CRITERION 2 :** Environmental

**SUBCRITERION 1 :** Carbon footprint

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/5 | 3 | 0,157894737 | 0,14893617 | 0,272727273 | **0,19318606** | 0,58781092 |
| New clothing | 5 | 1 | 7 | 0,789473684 | 0,744680851 | 0,636363636 | **0,723506057** | 2,272591537 |
| Energy | 1/3 | 1/7 | 1 | 0,052631579 | 0,106382979 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 6 1/3 | 1 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | **0,19318606** | **0,723506057** | **0,083307883** | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**SUBCRITERION 2 :** Recycling

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/5 | 3 | 0,157894737 | 0,14893617 | 0,272727273 | **0,19318606** | 0,58781092 |
| New clothing | 5 | 1 | 7 | 0,789473684 | 0,744680851 | 0,636363636 | **0,723506057** | 2,272591537 |
| Energy | 1/3 | 1/7 | 1 | 0,052631579 | 0,106382979 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 6 1/3 | 1 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | 0,19318606 | 0,723506057 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**CRITERION 3 :** Social

**SUBCRITERION 1 :** Local job

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,454545455 | 0,428571429 | 0,555555556 | **0,47955748** | 1,45983646 |
| New clothing | 1 | 1 | 3 | 0,454545455 | 0,428571429 | 0,333333333 | **0,405483405** | 1,22991823 |
| Energy | 1/5 | 1/3 | 1 | 0,090909091 | 0,142857143 | 0,111111111 | **0,114959115** | 0,346031746 |
| Total | 2 1/5 | 2 1/3 | 9 | | | | Imax | **3,035786436** |
| Priority vector | 0,47955748 | 0,405483405 | 0,114959115 | | | | CI | **0,017893218** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,030850376 |

**SUBCRITERION 2 :** User resistance

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 3 | 3/5 | 0,6 | 0,6 | **0,6** | 1,8 |
| New clothing | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | **0,2** | 0,6 |
| Energy | 1/3 | 1 | 1 | 0,2 | 0,2 | 0,2 | **0,2** | 0,6 |
| Total | 1 2/3 | 5 | 5 | | | | Imax | **3** |
| Priority vector | 0,6 | 0,2 | 0,2 | | | | CI | **0%** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0% |

**SUBCRITERION 2 :** SAP purchasing

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/7 | 2 | 0,117647059 | 0,111111111 | 0,2 | **0,14291939** | 0,432461874 |
| New clothing | 7 | 1 | 7 | 0,823529412 | 0,777777778 | 0,7 | **0,767102397** | 2,397385621 |
| Energy | 1/2 | 1/7 | 1 | 0,058823529 | 0,111111111 | 0,1 | **0,089978214** | 0,271023965 |
| Total | 8 1/2 | 1 2/7 | 10 | | | | Imax | **3,10087146** |
| Priority vector | 0,14291939 | 0,767102397 | 0,089978214 | | | | CI | **0,05043573** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,086958155 |

**CRITERION 4 :** Relational

**SUBCRITERION 1 :** Brand image

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/5 | 3 | 0,157894737 | 0,14893617 | 0,272727273 | **0,19318606** | 0,58781092 |
| New clothing | 5 | 1 | 7 | 0,789473684 | 0,744680851 | 0,636363636 | **0,723506057** | 2,272591537 |
| Energy | 1/3 | 1/7 | 1 | 0,052631579 | 0,106382979 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 6 1/3 | 1 1/3 | 11 | | | | Imax | **3,111463701** |
| Priority vector | 0,19318606 | 0,723506057 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

**SUBCRITERION 2 :** Innovation

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/7 | 2 | 0,117647059 | 0,111111111 | 0,2 | **0,14291939** | 0,432461874 |
| New clothing | 7 | 1 | 7 | 0,823529412 | 0,777777778 | 0,7 | **0,767102397** | 2,397385621 |
| Energy | 1/2 | 1/7 | 1 | 0,058823529 | 0,111111111 | 0,1 | **0,089978214** | 0,271023965 |
| Total | 8 1/2 | 1 2/7 | 10 | | | | Imax | **3,10087146** |
| Priority vector | 0,14291939 | 0,767102397 | 0,089978214 | | | | CI | **0,05043573** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,086958155 |

**CRITERION 5 :** Functional

**SUBCRITERION 1 :** recycling capability

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/3 | 5 | 0,238095238 | 0,225806452 | 0,384615385 | **0,282839025** | 0,866162511 |
| New clothing | 3 | 1 | 7 | 0,714285714 | 0,677419355 | 0,538461538 | **0,643388869** | 2,008310686 |
| Energy | 1/5 | 1/7 | 1 | 0,047619048 | 0,096774194 | 0,076923077 | **0,073772106** | 0,222252607 |
| Total | 4 1/5 | 1 1/2 | 13 | | | | Imax | **3,096725804** |
| Priority vector | 0,282839025 | 0,643388869 | 0,073772106 | | | | CI | **0,048362902** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,06873973** |
| Recycling | 5 | 1 | 0,833333333 | **0,34369865** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Local job | Userresistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax | |
| Local job | 1 | 7 | 5 | 0,744680851 | 0,636363636 | 4/5 | **0,723506057** | **0,272092355** | 2,272591537 | |
| Userresistance | 1/7 | 1 | 1/3 | 0,106382979 | 0,090909091 | 0,052631579 | **0,083307883** | **0,031329991** | 0,2510612444 | |
| SAP purchasing | 1/5 | 3 | 1 | 0,14893617 | 0,272727273 | 0,157894737 | **0,19318606** | **0,072652398** | 0,58781092 | |
| Total | 1 1/3 | 11 | 6 1/3 | | | | | lmax | 3,11146370 1 | |
| Priority vector | 5/7 | 0 | 1/5 | | | | | CI | **0,055731851** | |
| | | | | | | | | RC | 0,58 | |
| | | | | | | | | CR | 0,096089398 | |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1/5 | 0,166666667 | **0,010685762** |
| Innovation | 5 | 1 | 0,833333333 | **0,053428811** |
| Total | 6 | 1 1/5 | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 1/3 | 1 | 1 | 0,090909091 | 0,08045977 | 0,127272727 | 0,058823529 | 0,058823529 |
| Environmental | 5 | 1 | 1 | 7 | 7 | 0,454545455 | 0,402298851 | 0,381818182 | 0,411764706 | 0,411764706 |
| Social | 3 | 1 | 1 | 7 | 7 | 0,272727273 | 0,402298851 | 0,381818182 | 0,411764706 | 0,411764706 |
| Relational | 1 | 1/7 | 1/7 | 1 | 1 | 0,090909091 | 0,057471264 | 0,054545455 | 0,058823529 | 0,058823529 |
| Functional | 1 | 1/7 | 1/7 | 1 | 1 | 0,090909091 | 0,057471264 | 0,054545455 | 0,058823529 | 0,058823529 |
| | **11** | **2 1/2** | **2 5/8** | **17** | **17** | | | | | |
| priority vector | **0,083257729** | **0,41243838** | **0,376074743** | **0,064114574** | **0,064114574** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Otherproduct | **0,073772106** | 0,19318606 | 0,424557505 | 0,151297168 | 0,28 | **0,273319259** |
| Newclothing | **0,643388869** | 0,723506057 | 0,458224766 | 0,75983634 | 0,64 | **0,61426271** |
| Energy | **0,282839025** | 0,083307883 | 0,117217729 | 0,088866492 | 0,07 | **0,112418039** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **1** |
| Priority vector | **0,083257729** | **0,41243838** | **0,376074743** | **0,064114574** | **0,064114574** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Otherproduct | 0,19318606 | 0,19318606 | 0,19318606 |
| Newclothing | 0,723506057 | 0,723506057 | 0,723506057 |
| Energy | 0,083307883 | 0,083307883 | 0,083307883 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Otherproduct | 0,47955748 | 0,6 | 0,14291939 | 0,424557505 |
| Newclothing | 0,405483405 | 0,2 | 0,767102397 | 0,458224766 |
| Energy | 0,114959115 | 0,2 | 0,089978214 | 0,117217729 |
| Priority | **0,723506057** | **0,083307883** | **0,19318606** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Otherproduct | 0,19318606 | 0,14291939 | 0,151297168 |
| Newclothing | 0,723506057 | 0,767102397 | 0,75983634 |
| Energy | 0,083307883 | 0,089978214 | 0,088866492 |
| Priority | **0,166666667** | **0,833333333** | |

# Actor A5

I. ALTERNATIVES COMPARISON

**CRITERION 1 : Economic**
**SUBCRITERION 2 : Purchasing cost**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**CRITERION 2 : Environmental**
**SUBCRITERION 1 : Carbon footprint**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**SUBCRITERION 2 : Recycling**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**CRITERION 3 : Social**
**SUBCRITERION 1 : Local job**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**SUBCRITERION 2 : User resistance**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**SUBCRITERION 2 : SAP purchasing**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**CRITERION 4 : Relational**
**SUBCRITERION 1 : Brand image**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**SUBCRITERION 2 : Innovation**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

**CRITERION 5 : Functional**
**SUBCRITERION 1 : fiber quality**

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,466666667 | 0,272727273 | 0,389321789 | 1,2002886 |
| New clothing | 1 | 1 | 7 | 0,428571429 | 0,466666667 | 0,636363636 | 0,510533911 | 1,600865801 |
| Energy | 1/3 | 1/7 | 1 | 0,142857143 | 0,066666667 | 0,090909091 | 0,1001443 | 0,302851646 |
| Total | 2 1/3 | 2 1/7 | 11 | | | | Imax | 3,104006047 |
| Priority vector | 0,389321789 | 0,510533911 | 0,1001443 | | | | CI | 0,052003023 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,089660385 |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,033333333** |
| Recycling | 5 | 1 | 0,833333333 | **0,166666667** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | Normalized | | | Priority vector | Global priority | lmax |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | | | | | | |
| Local job | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 1/3 | **0,333333333** | **0,066666667** | 1 |
| User resistance | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,33333333 | **0,333333333** | **0,066666667** | 1 |
| SAP purchasing | 1 | 1 | 1 | 0,333333333 | 0,33333333 | 0,33333333 | **0,333333333** | **0,066666667** | 1 |
| Total | 3 | 3 | 3 | | | | | **lmax** | **3** |
| Priority vector | 1/3 | 1/3 | 1/3 | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,1** |
| Innovation | 1 | 1 | 0,5 | **0,1** |
| Total | 2 | 2 | | |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1 | 1 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 |
| Environmental | 1 | 1 | 1 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 |
| Social | 1 | 1 | 1 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 |
| Relational | 1 | 1 | 1 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 |
| Functional | 1 | 1 | 1 | 1 | 1 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 |
| | **5** | **5** | **5** | **5** | **5** | | | | | |
| priority vector | **0,2** | **0,2** | **0,2** | **0,2** | **0,2** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Other product | **0,389321789** | 0,389321789 | 0,389321789 | 0,389321789 | 0,39 | **0,38932178** |
| New clothing | **0,510533911** | 0,510533911 | 0,510533911 | 0,510533911 | 0,51 | **0,51053391** |
| Energy | **0,1001443** | 0,1001443 | 0,1001443 | 0,1001443 | 0,10 | **0,1001443** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **1** |
| Priority vector | **0,2** | **0,2** | **0,2** | **0,2** | **0,2** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Other product | 0,389321789 | 0,389321789 | 0,389321789 |
| New clothing | 0,510533911 | 0,510533911 | 0,510533911 |
| Energy | 0,1001443 | 0,1001443 | 0,1001443 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Other product | 0,389321789 | 0,389321789 | 0,389321789 | 0,389321789 |
| New clothing | 0,510533911 | 0,510533911 | 0,510533911 | 0,510533911 |
| Energy | 0,1001443 | 0,1001443 | 0,1001443 | 0,1001443 |
| Priority | **0,333333333** | **0,333333333** | **0,333333333** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Other product | 0,389321789 | 0,389321789 | 0,389321789 |
| New clothing | 0,510533911 | 0,510533911 | 0,510533911 |
| Energy | 0,1001443 | 0,1001443 | 0,1001443 |
| Priority | **0,5** | **0,5** | |

# Actor A6

I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 2 : | Purchasing cost |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 2 | 1/7 | 0,117647059 | 0,2 | 0,111111111 | **0,14291939** | 0,432461874 |
| New clothing | 1/2 | 1 | 1/7 | 0,058823529 | 0,1 | 0,111111111 | **0,089978214** | 0,271023965 |
| Energy | 7 | 7 | 1 | 0,823529412 | 0,7 | 0,777777778 | **0,767102397** | 2,397385621 |
| Total | 8 1/2 | 10 | 1 2/7 | | | | lmax | **3,10087146** |
| Priority vector | **0,14291939** | **0,089978214** | **0,767102397** | | | | CI | **0,05043573** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,086958155 |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 2 | 5 | 0,588235294 | 0,625 | 0,454545455 | **0,555926916** | 1,715129234 |
| New clothing | 1/2 | 1 | 5 | 0,294117647 | 0,3125 | 0,454545455 | **0,353721034** | 1,083444742 |
| Energy | 1/5 | 1/5 | 1 | 0,117647059 | 0,0625 | 0,090909091 | **0,09035205** | 0,27228164 |
| Total | 1 2/3 | 3 1/5 | 11 | | | | lmax | **3,070855615** |
| Priority vector | **0,555926916** | **0,353721034** | **0,09035205** | | | | CI | **0,035427807** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

| SUBCRITERION 2 : | Recycling |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 2 | 1 | 0,4 | 0,5 | 0,33333333 | **0,411111111** | 1,261111111 |
| New clothing | 1/2 | 1 | 1 | 0,2 | 0,25 | 0,33333333 | **0,261111111** | 0,794444444 |
| Energy | 1 | 1 | 1 | 0,4 | 0,25 | 0,33333333 | **0,327777778** | 1 |
| Total | 2 1/2 | 4 | 3 | | | | lmax | **3,055555556** |
| Priority vector | 0,411111111 | 0,261111111 | 0,327777778 | | | | CI | **0,027777778** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,04789272 |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| New clothing | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| Energy | 1/5 | 1/5 | 1 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | 0,272727273 |
| Total | 2 1/5 | 2 1/5 | 11 | | | | lmax | **3** |
| Priority vector | 0,454545455 | 0,454545455 | 0,090909091 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,744680851 | 0,789473684 | 0,636363636 | **0,723506057** | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 1/6 | 0,272727273 | **0,19318606** | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,106382979 | 0,052631579 | 0,090909091 | **0,083307883** | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | lmax | **3,111463701** |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | **0,055731851** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

| SUBCRITERION 2 : | SAP purchasing |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,428571429 | 0,428571429 | **0,428571429** | 1,285714286 |
| New clothing | 1 | 1 | 3 | 0,428571429 | 0,428571429 | 0,428571429 | **0,428571429** | 1,285714286 |
| Energy | 1/3 | 1/3 | 1 | 0,142857143 | 0,142857143 | 0,142857143 | **0,142857143** | 0,428571429 |
| Total | 2 1/3 | 2 1/3 | 7 | | | | lmax | **3** |
| Priority vector | 0,428571429 | 0,428571429 | 0,142857143 | | | | CI | **0%** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0% |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 2 | 9 | 0,620689655 | 0,642857143 | 0,473684211 | **0,579077003** | 1,787982888 |
| New clothing | 1/2 | 1 | 9 | 0,310344828 | 0,321428571 | 0,473684211 | **0,36848587** | 1,129958517 |
| Energy | 1/9 | 1/9 | 1 | 0,068965517 | 0,035714286 | 0,052631579 | **0,052437127** | 0,157721891 |
| Total | 1 3/5 | 3 1/9 | 19 | | | | lmax | **3,075663296** |
| Priority vector | 0,579077003 | 0,36848587 | 0,052437127 | | | | CI | **0,037831648** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,065226979 |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 2 | 7 | 0,608695652 | 0,636363636 | 0,466666667 | **0,570575318** | 1,761220905 |
| New clothing | 1/2 | 1 | 7 | 0,304347826 | 0,318181818 | 0,466666667 | **0,363065437** | 1,112867809 |
| Energy | 1/7 | 1/7 | 1 | 0,086956522 | 0,045454545 | 0,066666667 | **0,066359245** | 0,199736495 |
| Total | 1 2/3 | 3 1/7 | 15 | | | | lmax | **3,073825209** |
| Priority vector | 0,570575318 | 0,363065437 | 0,066359245 | | | | CI | **0,036912604** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,063642421 |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | fiber quality |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| New clothing | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| Energy | 1/5 | 1/5 | 1 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | 0,272727273 |
| Total | 2 1/5 | 2 1/5 | 11 | | | | lmax | **3** |
| Priority vector | 0,454545455 | 0,454545455 | 0,090909091 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,080943956** |
| Recycling | 5 | 1 | 0,833333333 | **0,404719779** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | lmax |
| Local job | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 4/9 | **0,454545455** | **0,031828121** | 1,363636364 |
| User resistance | 1/5 | 1 | 1/5 | 0,090909091 | 0,090909091 | 0,09090909 | **0,090909091** | **0,006365624** | 0,272727273 |
| SAP purchasing | 1 | 5 | 1 | 0,454545455 | 0,454545455 | 0,45454545 | **0,454545455** | **0,031828121** | 1,363636364 |
| Total | 2 1/5 | 11 | 2 1/5 | | | | | **lmax** | **3** |
| Priority vector | 4/9 | 0 | 4/9 | | | | | **CI** | **0** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,033241022** |
| Innovation | 1 | 1 | 0,5 | **0,033241022** |
| Total | 2 | 2 | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1/5 | 3 | 5 | 1 | 0,13274336 | 0,103448276 | 0,230769231 | 0,333333333 | 0,176470588 |
| Environmental | 5 | 1 | 5 | 5 | 3 | 0,66371681 | 0,517241379 | 0,384615385 | 0,333333333 | 0,529411765 |
| Social | 1/3 | 1/5 | 1 | 1 | 1/3 | 0,04424778 | 0,103448276 | 0,076923077 | 0,066666667 | 0,058823529 |
| Relational | 1/5 | 1/5 | 1 | 1 | 1/3 | 0,02654867 | 0,103448276 | 0,076923077 | 0,066666667 | 0,058823529 |
| Functional | 1 | 1/3 | 3 | 3 | 1 | 0,13274336 | 0,172413793 | 0,230769231 | 0,2 | 0,176470588 |
| | **7 1/2** | **2** | **13** | **15** | **5 2/3** | | | | | |
| priority vector | **0,195352958** | **0,485663735** | **0,070021867** | **0,066482044** | **0,182479395** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Other product | **0,14291939** | 0,435247079 | 0,467190043 | 0,574826161 | 0,45 | **0,39317776** |
| New clothing | **0,089978214** | 0,276546098 | 0,418979134 | 0,365775653 | 0,45 | **0,28848631** |
| Energy | **0,767102397** | 0,288206823 | 0,113830823 | 0,059398186 | 0,09 | **0,31833592** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **0,68166408** |
| Priority vector | **0,195352958** | **0,485663735** | **0,070021867** | **0,066482044** | **0,182479395** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Other product | 0,555926916 | 0,411111111 | 0,435247079 |
| New clothing | 0,353721034 | 0,261111111 | 0,276546098 |
| Energy | 0,09035205 | 0,327777778 | 0,288206823 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Other product | 0,454545455 | 0,723506057 | 0,428571429 | 0,467190043 |
| New clothing | 0,454545455 | 0,19318606 | 0,428571429 | 0,418979134 |
| Energy | 0,090909091 | 0,083307883 | 0,142857143 | 0,113830823 |
| Priority | **0,454545455** | **0,090909091** | **0,454545455** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Other product | 0,579077003 | 0,570575318 | 0,574826161 |
| New clothing | 0,36848587 | 0,363065437 | 0,365775653 |
| Energy | 0,052437127 | 0,066359245 | 0,059398186 |
| Priority | **0,5** | **0,5** | |

# Actor A7

I ALTERNATIVES COMPARISON

CRITERION 1 : Economic

SUBCRITERION 2 : Purchasing cost

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| New clothing | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| Energy | 1/5 | 1/5 | 1 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | 0,272727273 |
| Total | 2 1/5 | 2 1/5 | 11 | | | | lmax | **3** |
| Priority vector | **0,454545455** | **0,454545455** | **0,090909091** | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 2 : Environmental

SUBCRITERION 1 : Carbon footprint

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| New clothing | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| Energy | 1/7 | 1/7 | 1 | 0,066666667 | 0,066666667 | 0,066666667 | **0,066666667** | 0,2 |
| Total | 2 1/7 | 2 1/7 | 15 | | | | lmax | **3** |
| Priority vector | **0,466666667** | **0,466666667** | **0,066666667** | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : Recycling

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| New clothing | 1 | 1 | 5 | 0,454545455 | 0,454545455 | 0,454545455 | **0,454545455** | 1,363636364 |
| Energy | 1/5 | 1/5 | 1 | 0,090909091 | 0,090909091 | 0,090909091 | **0,090909091** | 0,272727273 |
| Total | 2 1/5 | 2 1/5 | 11 | | | | lmax | **3** |
| Priority vector | 0,454545455 | 0,454545455 | 0,090909091 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 3 : Social

SUBCRITERION 1 : Local job

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| New clothing | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Energy | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | 3 | 3 | 3 | | | | lmax | **3** |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : User resistance

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| New clothing | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Energy | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | 3 | 3 | 3 | | | | lmax | **3** |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

SUBCRITERION 2 : SAP purchasing

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| New clothing | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Energy | 1 | 1 | 1 | 0,333333333 | 0,333333333 | 0,333333333 | **0,333333333** | 1 |
| Total | 3 | 3 | 3 | | | | lmax | **3** |
| Priority vector | 0,333333333 | 0,333333333 | 0,333333333 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 4 : Relational

SUBCRITERION 1 : Brand image

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 3 | 0,428571429 | 0,4 | 0,5 | **0,442857143** | 1,33968254 |
| New clothing | 1 | 1 | 2 | 0,428571429 | 0,4 | 0,333333333 | **0,387301587** | 1,16984127 |
| Energy | 1/3 | 1/2 | 1 | 0,142857143 | 0,2 | 0,166666667 | **0,16984127** | 0,511111111 |
| Total | 2 1/3 | 2 1/2 | 6 | | | | lmax | **3,020634921** |
| Priority vector | 0,442857143 | 0,387301587 | 0,16984127 | | | | CI | **0,01031746** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,017788725 |

SUBCRITERION 2 : Innovation

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| New clothing | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| Energy | 1/7 | 1/7 | 1 | 0,066666667 | 0,066666667 | 0,066666667 | **0,066666667** | 0,2 |
| Total | 2 1/7 | 2 1/7 | 15 | | | | lmax | **3** |
| Priority vector | 0,466666667 | 0,466666667 | 0,066666667 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

CRITERION 5 : Functional

SUBCRITERION 1 : fiber quality

| | Other product | New clothing | Energy | Normalized | | | Priority vector | lmax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| New clothing | 1 | 1 | 7 | 0,466666667 | 0,466666667 | 0,466666667 | **0,466666667** | 1,4 |
| Energy | 1/7 | 1/7 | 1 | 0,066666667 | 0,066666667 | 0,066666667 | **0,066666667** | 0,2 |
| Total | 2 1/7 | 2 1/7 | 15 | | | | lmax | **3** |
| Priority vector | 0,466666667 | 0,466666667 | 0,066666667 | | | | CI | **0** |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

## II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,027538368** |
| Recycling | 5 | 1 | 0,833333333 | **0,137691841** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | Normalized | | | Priority vector | Global priority | Imax |
| Local job | 1 | 1/5 | 2 | 0,153846154 | 0,14285714 | 1/4 | **0,182234432** | **0,098873062** | 0,552655678 |
| User resistance | 5 | 1 | 5 | 0,769230769 | 0,71428571 | 0,625 | **0,702838828** | **0,381332036** | 2,188644689 |
| SAP purchasing | 1/2 | 1/5 | 1 | 0,076923077 | 0,14285714 | 0,125 | **0,11492674** | **0,06235462** | 0,346611722 |
| Total | 6 1/2 | 1 2/5 | 8 | | | | | **Imax** | **3,087912088** |
| Priority vector | 1/5 | 5/7 | 1/9 | | | | | **CI** | **0,043956044** |
| | | | | | | | | **RC** | 0,58 |
| | | | | | | | | **CR** | 0,075786283 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 5 | 0,833333333 | **0,044579281** |
| Innovation | 1/5 | 1 | 0,166666667 | **0,008915856** |
| Total | 1 1/5 | 6 | | |

## III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 1 | 1/5 | 5 | 5 | 0,13513513 | 0,132743363 | 0,118644068 | 0,294117647 | 0,26315789 |
| Environmental | 1 | 1 | 1/5 | 3 | 5 | 0,13513513 | 0,132743363 | 0,118644068 | 0,176470588 | 0,26315789 |
| Social | 5 | 5 | 1 | 7 | 7 | 0,67567567 | 0,663716814 | 0,593220339 | 0,411764706 | 0,36842105 |
| Relational | 1/5 | 1/3 | 1/7 | 1 | 1 | 0,02702702 | 0,044247788 | 0,084745763 | 0,058823529 | 0,05263158 |
| Functional | 1/5 | 1/5 | 1/7 | 1 | 1 | 0,02702702 | 0,026548673 | 0,084745763 | 0,058823529 | 0,05263158 |
| | **7 2/5** | **7 1/2** | **1 2/3** | **17** | **19** | | | | | |
| priority vector | **0,188759622** | **0,16523021** | **0,542559717** | **0,053495137** | **0,04995531** | | | | | |

## IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Other product | **0,454545455** | 0,456565657 | 0,333333333 | 0,446825397 | 0,47 | **0,38930697** |
| New clothing | **0,454545455** | 0,456565657 | 0,333333333 | 0,400529101 | 0,47 | **0,38683034** |
| Energy | **0,090909091** | 0,086868687 | 0,333333333 | 0,152645503 | 0,07 | **0,22386268** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **1** |
| Priority vector | **0,188759622** | **0,16523021** | **0,542559717** | **0,053495137** | **0,04995531** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Other product | 0,466666667 | 0,454545455 | 0,456565657 |
| New clothing | 0,466666667 | 0,454545455 | 0,456565657 |
| Energy | 0,066666667 | 0,090909091 | 0,086868687 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Other product | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 |
| New clothing | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 |
| Energy | 0,333333333 | 0,333333333 | 0,333333333 | 0,333333333 |
| Priority | **0,182234432** | **0,702838828** | **0,11492674** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Other product | 0,442857143 | 0,466666667 | 0,446825397 |
| New clothing | 0,387301587 | 0,466666667 | 0,400529101 |
| Energy | 0,16984127 | 0,066666667 | 0,152645503 |
| Priority | **0,833333333** | **0,166666667** | |

# Actor A8

I. ALTERNATIVES COMPARISON

| CRITERION 1 : | Economic |
|---|---|
| SUBCRITERION 2 : | Purchasing cost |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/5 | 1/5 | 0,09090909 1 | 0,11764705 9 | 0,0625 | 0,09035205 | 0,27228164 |
| New clothing | 5 | 1 | 2 | 0,45454545 5 | 0,58823529 4 | 0,625 | 0,555926916 | 1,715129234 |
| Energy | 5 | 1/2 | 1 | 0,45454545 5 | 0,29411764 7 | 0,3125 | 0,353721034 | 1,083444742 |
| Total | 11 | 1 2/3 | 3 1/5 | | | | Imax | 3,070855615 |
| Priority vector | 0,09035205 | 0,555926916 | 0,353721034 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

| CRITERION 2 : | Environmental |
|---|---|
| SUBCRITERION 1 : | Carbon footprint |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/2 | 5 | 0,3125 | 0,29411764 7 | 0,45454545 5 | 0,353721034 | 1,083444742 |
| New clothing | 2 | 1 | 5 | 0,625 | 0,58823529 4 | 0,45454545 5 | 0,555926916 | 1,715129234 |
| Energy | 1/5 | 1/5 | 1 | 0,0625 | 0,11764705 9 | 0,09090909 1 | 0,09035205 | 0,27228164 |
| Total | 3 1/5 | 1 2/3 | 11 | | | | Imax | 3,070855615 |
| Priority vector | 0,353721034 | 0,555926916 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

| SUBCRITERION 2 : | Recycling |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/2 | 5 | 0,3125 | 0,294117647 | 0,454545455 | 0,353721034 | 1,083444742 |
| New clothing | 2 | 1 | 5 | 0,625 | 0,588235294 | 0,454545455 | 0,555926916 | 1,715129234 |
| Energy | 1/5 | 1/5 | 1 | 0,0625 | 0,117647059 | 0,090909091 | 0,09035205 | 0,27228164 |
| Total | 3 1/5 | 1 2/3 | 11 | | | | Imax | 3,070855615 |
| Priority vector | 0,353721034 | 0,555926916 | 0,09035205 | | | | CI | 0,035427807 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,061082427 |

| CRITERION 3 : | Social |
|---|---|
| SUBCRITERION 1 : | Local job |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 3 | 3 | 0,6 | 0,66666666 7 | 0,5 | 0,588888889 | 1,822222222 |
| New clothing | 1/3 | 1 | 2 | 0,2 | 0,22222222 2 | 0,33333333 3 | 0,251851852 | 0,766666667 |
| Energy | 1/3 | 1/2 | 1 | 0,2 | 0,11111111 1 | 0,16666666 7 | 0,159259259 | 0,481481481 |
| Total | 1 2/3 | 4 1/2 | 6 | | | | Imax | 3,07037037 |
| Priority vector | 0,58888888 9 | 0,25185185 2 | 0,15925925 9 | | | | CI | 0,035185185 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,060664112 |

| SUBCRITERION 2 : | User resistance |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/3 | 1 | 0,2 | 0,18181818 2 | 0,25 | 0,210606061 | 0,634343434 |
| New clothing | 3 | 1 | 2 | 0,6 | 0,54545454 5 | 0,5 | 0,548484848 | 1,662121212 |
| Energy | 1 | 1/2 | 1 | 0,2 | 0,27272727 3 | 0,25 | 0,240909091 | 0,725757576 |
| Total | 5 | 1 5/6 | 4 | | | | Imax | 3,022222222 |
| Priority vector | 0,210606061 | 0,548484848 | 0,240909091 | | | | CI | 0,011111111 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,019157088 |

| SUBCRITERION 2 : | SAP purchasing |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1 | 5 | 0,45454545 5 | 0,45454545 5 | 0,45454545 5 | 0,454545455 | 1,363636364 |
| New clothing | 1 | 1 | 5 | 0,45454545 5 | 0,45454545 5 | 0,45454545 5 | 0,454545455 | 1,363636364 |
| Energy | 1/5 | 1/5 | 1 | 0 | 0 | 0 | 0,090909091 | 0,272727273 |
| Total | 2 1/5 | 2 1/5 | 11 | | | | Imax | 3 |
| Priority vector | 0,454545455 | 0,454545455 | 0,090909091 | | | | CI | 0 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0 |

| CRITERION 4 : | Relational |
|---|---|
| SUBCRITERION 1 : | Brand image |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,74468085 1 | 0,78947368 4 | 0,63636363 6 | 0,723506057 | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 0,15789473 7 | 0,27272727 3 | 0,19318606 | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,10638297 9 | 0,05263157 9 | 0,09090909 1 | 0,083307883 | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | Imax | 3,111463701 |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

| SUBCRITERION 2 : | Innovation |
|---|---|

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 5 | 7 | 0,74468085 1 | 0,78947368 4 | 0,63636363 6 | 0,723506057 | 2,272591537 |
| New clothing | 1/5 | 1 | 3 | 0,14893617 | 0,15789473 7 | 0,27272727 3 | 0,19318606 | 0,58781092 |
| Energy | 1/7 | 1/3 | 1 | 0,10638297 9 | 0,05263157 9 | 0,09090909 1 | 0,083307883 | 0,251061244 |
| Total | 1 1/3 | 6 1/3 | 11 | | | | Imax | 3,111463701 |
| Priority vector | 0,723506057 | 0,19318606 | 0,083307883 | | | | CI | 0,055731851 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,096089398 |

| CRITERION 5 : | Functional |
|---|---|
| SUBCRITERION 1 : | fiber quality |

| | Other product | New clothing | Energy | Normalized | | | Priority vector | Imax |
|---|---|---|---|---|---|---|---|---|
| Other product | 1 | 1/3 | 5 | 0,23809523 8 | 0,22580645 2 | 0,38461538 5 | 0,282839025 | 0,866162511 |
| New clothing | 3 | 1 | 7 | 0,71428571 4 | 0,67741935 5 | 0,53846153 8 | 0,643388869 | 2,008310686 |
| Energy | 1/5 | 1/7 | 1 | 0,04761904 8 | 0,09677419 4 | 0,07692307 7 | 0,073772106 | 0,222252607 |
| Total | 4 1/5 | 1 1/2 | 13 | | | | Imax | 3,096725804 |
| Priority vector | 0,282839025 | 0,643388869 | 0,073772106 | | | | CI | 0,048362902 |
| | | | | | | | RC | 0,58 |
| | | | | | | | CR | 0,083384313 |

II.SUB-CRITERIA COMPARISON

| CRITERION 2 : | Environmental | | | |
|---|---|---|---|---|
| | Carbon footprint | Recycling | Priority vector | Global priority |
| Carbon footprint | 1 | 1/5 | 0,166666667 | **0,025889356** |
| Recycling | 5 | 1 | 0,833333333 | **0,129446779** |
| Total | **6** | **1 1/5** | | |

| CRITERION 3 : | Social | | | Normalized | | | Priority vector | Global priority | lmax |
|---|---|---|---|---|---|---|---|---|---|
| | Local job | User resistance | SAP purchasing | | | | | | |
| Local job | 1 | 3 | 1 | 0,428571429 | 0,333333333 | 4/9 | **0,405483405** | **0,162840773** | 1,2299182 |
| User resistance | 1/3 | 1 | 1/5 | 0,142857143 | 0,111111111 | 0,090909091 | **0,114959115** | **0,046167194** | 0,3460317 |
| SAP purchasing | 1 | 5 | 1 | 0,428571429 | 0,555555556 | 0,454545455 | **0,47955748** | **0,192588672** | 1,4598365 |
| Total | 2 1/3 | 9 | 2 1/5 | | | | | lmax | **3,0357864** |
| Priority vector | 2/5 | 1/9 | 1/2 | | | | | CI | **0,0178932** |
| | | | | | | | | RC | 0,58 |
| | | | | | | | | CR | 0,0308504 |

| CRITERION 4 : | Relational | | | |
|---|---|---|---|---|
| | Brand image | Innovation | Priority vector | Global priority |
| Brand image | 1 | 1 | 0,5 | **0,048918067** |
| Innovation | 1 | 1 | 0,5 | **0,048918067** |
| Total | 2 | 2 | | |

III.CRITERIA COMPARISON

| | Economic | Environmental | Social | Relational | Functional | Normalized | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Economic | 1 | 3 | 1/3 | 3 | 1 | 0,176470588 | 0,375 | 0,142857143 | 0,3 | 0,125 |
| Environmental | 1/3 | 1 | 1/3 | 2 | 2 | 0,058823529 | 0,125 | 0,142857143 | 0,2 | 0,25 |
| Social | 3 | 3 | 1 | 3 | 3 | 0,529411765 | 0,375 | 0,428571429 | 0,3 | 0,375 |
| Relational | 1/3 | 1/2 | 1/3 | 1 | 1 | 0,058823529 | 0,0625 | 0,142857143 | 0,1 | 0,125 |
| Functional | 1 | 1/2 | 1/3 | 1 | 1 | 0,176470588 | 0,0625 | 0,142857143 | 0,1 | 0,125 |
| | **5 2/3** | **8** | **2 1/3** | **10** | **8** | | | | | |
| priority vector | **0,223865546** | **0,155336134** | **0,401596639** | **0,097836134** | **0,121365546** | | | | | |

IV.ALTERNATIVES PRIORITIZATION

| | Economic | Environmental | Social | Relational | Functional | Ranking |
|---|---|---|---|---|---|---|
| Other product | **0,09035205** | 0,353721034 | 0,480976431 | 0,723506057 | 0,28 | **0,373442836** |
| New clothing | **0,555926916** | 0,555926916 | 0,383155752 | 0,19318606 | 0,64 | **0,461668302** |
| Energy | **0,353721034** | 0,09035205 | 0,135867817 | 0,083307883 | 0,07 | **0,164888862** |
| Total | 1 | 1 | 1 | 1 | 1,00 | **1** |
| Priority vector | **0,223865546** | **0,155336134** | **0,401596639** | **0,097836134** | **0,121365546** | |

| | Carbon footprint | Recycling | Environmental |
|---|---|---|---|
| Other product | 0,353721034 | 0,353721034 | 0,353721034 |
| New clothing | 0,555926916 | 0,555926916 | 0,555926916 |
| Energy | 0,09035205 | 0,09035205 | 0,09035205 |
| Priority | **0,166666667** | **0,833333333** | |

| | Local job | User resistance | SAP purchasing | Social |
|---|---|---|---|---|
| Other product | 0,588888889 | 0,210606061 | 0,454545455 | 0,480976431 |
| New clothing | 0,251851852 | 0,548484848 | 0,454545455 | 0,383155752 |
| Energy | 0,159259259 | 0,240909091 | 0,090909091 | 0,135867817 |
| Priority | **0,405483405** | **0,114959115** | **0,47955748** | |

| | Brand image | Innovation | Relational |
|---|---|---|---|
| Other product | 0,723506057 | 0,723506057 | 0,723506057 |
| New clothing | 0,19318606 | 0,19318606 | 0,19318606 |
| Energy | 0,083307883 | 0,083307883 | 0,083307883 |
| Priority | **0,5** | **0,5** | |

# Annex E-1: Similarity matrices
# Beginning of life

| Economic | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,951080264 | 0,98017708 | 0,979453883 | 0,996245695 | 0,992054622 | 0,977600999 | 0,975222353 | 0,922784043 |
| A2 | 0,951080264 | 1 | 0,970903184 | 0,930534147 | 0,954834569 | 0,959025642 | 0,973479265 | 0,975857911 | 0,873864307 |
| A3 | 0,98017708 | 0,970903184 | 1 | 0,959630963 | 0,983931385 | 0,988122458 | 0,997423919 | 0,995045273 | 0,902961123 |
| A4 | 0,979453883 | 0,930534147 | 0,959630963 | 1 | 0,975699578 | 0,971508505 | 0,957054882 | 0,954676236 | 0,94333016 |
| A5 | 0,996245695 | 0,954834569 | 0,983931385 | 0,975699578 | 1 | 0,995808927 | 0,981355304 | 0,978976658 | 0,919029738 |
| A6 | 0,992054622 | 0,959025642 | 0,988122458 | 0,971508505 | 0,995808927 | 1 | 0,985546377 | 0,983167731 | 0,914838665 |
| A7 | 0,977600999 | 0,973479265 | 0,997423919 | 0,957054882 | 0,981355304 | 0,985546377 | 1 | 0,997621354 | 0,900385042 |
| A8 | 0,975222353 | 0,975857911 | 0,995045273 | 0,954676236 | 0,978976658 | 0,983167731 | 0,997621354 | 1 | 0,898006396 |
| A9 | 0,922784043 | 0,873864307 | 0,902961123 | 0,94333016 | 0,919029738 | 0,914838665 | 0,900385042 | 0,898006396 | 1 |

| Environmental | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,707299754 | 0,976333144 | 0,863631138 | 0,952551596 | 0,821547793 | 0,996411093 | 0,889651603 | 0,868607456 |
| A2 | 0,707299754 | 1 | 0,73096661 | 0,843668616 | 0,754748158 | 0,885751961 | 0,710888661 | 0,817648151 | 0,838692298 |
| A3 | 0,976333144 | 0,73096661 | 1 | 0,887297995 | 0,976218452 | 0,84521465 | 0,97992205 | 0,913318459 | 0,892274312 |
| A4 | 0,863631138 | 0,843668616 | 0,887297995 | 1 | 0,911079542 | 0,957916655 | 0,867220045 | 0,973979535 | 0,995023682 |
| A5 | 0,952551596 | 0,754748158 | 0,976218452 | 0,911079542 | 1 | 0,868996198 | 0,956140502 | 0,937100007 | 0,91605586 |
| A6 | 0,821547793 | 0,885751961 | 0,84521465 | 0,957916655 | 0,868996198 | 1 | 0,958985754 | 0,827579731 | 0,947631916 |
| A7 | 0,996411093 | 0,710888661 | 0,97992205 | 0,867220045 | 0,956140502 | 0,958985754 | 1 | 0,89324051 | 0,872196363 |
| A8 | 0,889651603 | 0,817648151 | 0,913318459 | 0,973979535 | 0,937100007 | 0,827579731 | 0,89324051 | 1 | 0,978955853 |
| A9 | 0,868607456 | 0,838692298 | 0,892274312 | 0,995023682 | 0,91605586 | 0,947631916 | 0,872196363 | 0,978955853 | 1 |

| Social | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,933047782 | 0,871603718 | 0,911400065 | 0,934139569 | 0,791349152 | 0,968035482 | 0,944524295 | 0,961487172 |
| A2 | 0,933047782 | 1 | 0,938555936 | 0,978352283 | 0,998908213 | 0,724396934 | 0,9650123 | 0,988523487 | 0,894534954 |
| A3 | 0,871603718 | 0,938555936 | 1 | 0,960203653 | 0,937464149 | 0,66295287 | 0,903568235 | 0,927079423 | 0,83309089 |
| A4 | 0,911400065 | 0,978352283 | 0,960203653 | 1 | 0,977260496 | 0,702749217 | 0,943364582 | 0,96687577 | 0,872887237 |
| A5 | 0,934139569 | 0,998908213 | 0,937464149 | 0,977260496 | 1 | 0,725488722 | 0,966104087 | 0,989615274 | 0,895626741 |
| A6 | 0,791349152 | 0,724396934 | 0,66295287 | 0,702749217 | 0,725488722 | 1 | 0,759384635 | 0,735873448 | 0,829861981 |
| A7 | 0,968035482 | 0,9650123 | 0,903568235 | 0,943364582 | 0,966104087 | 0,759384635 | 1 | 0,976488813 | 0,929522654 |
| A8 | 0,944524295 | 0,988523487 | 0,927079423 | 0,96687577 | 0,989615274 | 0,735873448 | 0,976488813 | 1 | 0,906011467 |
| A9 | 0,961487172 | 0,894534954 | 0,83309089 | 0,872887237 | 0,895626741 | 0,829861981 | 0,929522654 | 0,906011467 | 1 |

| Relational | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,884351102 | 0,946285217 | 0,914633839 | 0,955224588 | 0,924006085 | 0,941808314 | 0,917216894 | 0,983163411 |
| A2 | 0,884351102 | 1 | 0,830636319 | 0,79898494 | 0,929126513 | 0,808357187 | 0,942542788 | 0,967134208 | 0,867514513 |
| A3 | 0,946285217 | 0,830636319 | 1 | 0,968348621 | 0,901509806 | 0,977720868 | 0,888093531 | 0,863502111 | 0,963121806 |
| A4 | 0,914633839 | 0,79898494 | 0,968348621 | 1 | 0,869858427 | 0,990627753 | 0,856442153 | 0,831850732 | 0,931470428 |
| A5 | 0,955224588 | 0,929126513 | 0,901509806 | 0,869858427 | 1 | 0,879230674 | 0,986583726 | 0,961992305 | 0,938388 |
| A6 | 0,924006085 | 0,808357187 | 0,977720868 | 0,990627753 | 0,879230674 | 1 | 0,865814399 | 0,841222979 | 0,940842674 |
| A7 | 0,941808314 | 0,942542788 | 0,888093531 | 0,856442153 | 0,986583726 | 0,865814399 | 1 | 0,97540858 | 0,924971725 |
| A8 | 0,917216894 | 0,967134208 | 0,863502111 | 0,831850732 | 0,961992305 | 0,841222979 | 0,97540858 | 1 | 0,900380305 |
| A9 | 0,983163411 | 0,867514513 | 0,963121806 | 0,931470428 | 0,938388 | 0,940842674 | 0,924971725 | 0,900380305 | 1 |

| Functional | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,707076699 | 0,774399159 | 0,710211159 | 0,927712271 | 0,946259348 | 0,99976074 | 0,892181357 | 0,967499653 |
| A2 | 0,707076699 | 1 | 0,93267754 | 0,99686554 | 0,779364427 | 0,76081735 | 0,706837438 | 0,814895342 | 0,739577046 |
| A3 | 0,774399159 | 0,93267754 | 1 | 0,935812 | 0,846686887 | 0,82813981 | 0,774159898 | 0,882217802 | 0,806899506 |
| A4 | 0,710211159 | 0,99686554 | 0,935812 | 1 | 0,782498887 | 0,76395181 | 0,709971898 | 0,818029802 | 0,742711506 |
| A5 | 0,927712271 | 0,779364427 | 0,846686887 | 0,782498887 | 1 | 0,981452923 | 0,927473011 | 0,964469086 | 0,960212619 |
| A6 | 0,946259348 | 0,76081735 | 0,82813981 | 0,76395181 | 0,981452923 | 1 | 0,946020088 | 0,945922009 | 0,978759696 |
| A7 | 0,99976074 | 0,706837438 | 0,774159898 | 0,709971898 | 0,927473011 | 0,946020088 | 1 | 0,891942097 | 0,967260392 |
| A8 | 0,892181357 | 0,814895342 | 0,882217802 | 0,818029802 | 0,964469086 | 0,945922009 | 0,891942097 | 1 | 0,924681704 |
| A9 | 0,967499653 | 0,739577046 | 0,806899506 | 0,742711506 | 0,960212619 | 0,978759696 | 0,967260392 | 0,924681704 | 1 |

# Annex E-2: Similarity matrices Middle of life

| Economic | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,928762044 | 0,985766222 | 0,858887643 | 0,988490119 | 0,999296101 | 0,986404514 | 0,95375633 | 0,983969776 | 0,96353845 | 0,978426822 | 0,86284794 |
| A2 | 0,928762044 | 1 | 0,942995822 | 0,787649686 | 0,940271925 | 0,928058145 | 0,94235753 | 0,882518374 | 0,91273182 | 0,965223593 | 0,907188866 | 0,791609984 |
| A3 | 0,985766222 | 0,942995822 | 1 | 0,844653865 | 0,997276103 | 0,985062323 | 0,999361708 | 0,939522552 | 0,969735998 | 0,977772229 | 0,964193044 | 0,848614162 |
| A4 | 0,858887643 | 0,787649686 | 0,844653865 | 1 | 0,847377762 | 0,859591542 | 0,845292157 | 0,905131312 | 0,874917867 | 0,822426093 | 0,88046082 | 0,996039702 |
| A5 | 0,988490119 | 0,940271925 | 0,997276103 | 0,847377762 | 1 | 0,98778622 | 0,997914395 | 0,942246449 | 0,972459895 | 0,975048331 | 0,966916941 | 0,851338059 |
| A6 | 0,999296101 | 0,928058145 | 0,985062323 | 0,859591542 | 0,98778622 | 1 | 0,985700615 | 0,954460229 | 0,984673675 | 0,962834551 | 0,979130722 | 0,86355184 |
| A7 | 0,986404514 | 0,94235753 | 0,999361708 | 0,845292157 | 0,997914395 | 0,985700615 | 1 | 0,940160844 | 0,97037429 | 0,977133936 | 0,964831337 | 0,849252455 |
| A8 | 0,95375633 | 0,882518374 | 0,939522552 | 0,905131312 | 0,942246449 | 0,954460229 | 0,940160844 | 1 | 0,969786554 | 0,917294781 | 0,975329508 | 0,90909161 |
| A9 | 0,983969776 | 0,91273182 | 0,969735998 | 0,874917867 | 0,972459895 | 0,984673675 | 0,97037429 | 0,969786554 | 1 | 0,947508226 | 0,994457047 | 0,878878165 |
| A10 | 0,96353845 | 0,965223593 | 0,977772229 | 0,822426093 | 0,975048331 | 0,962834551 | 0,977133936 | 0,917294781 | 0,947508226 | 1 | 0,941965273 | 0,826386391 |
| A11 | 0,978426822 | 0,907188866 | 0,964193044 | 0,88046082 | 0,966916941 | 0,979130722 | 0,964831337 | 0,975329508 | 0,994457047 | 0,941965273 | 1 | 0,884421118 |
| A12 | 0,86284794 | 0,791609984 | 0,848614162 | 0,996039702 | 0,851338059 | 0,86355184 | 0,849252455 | 0,90909161 | 0,878878165 | 0,826386391 | 0,884421118 | 1 |

| Environmental | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,719544028 | 0,927091061 | 0,670905636 | 0,766737862 | 0,996032058 | 0,953945112 | 0,707890622 | 0,888696521 | 0,810328562 | 0,734710074 | 0,576769813 |
| A2 | 0,719544028 | 1 | 0,792452967 | 0,951361608 | 0,952806166 | 0,715576086 | 0,67348914 | 0,988346594 | 0,830847507 | 0,909215467 | 0,984833954 | 0,857225785 |
| A3 | 0,927091061 | 0,792452967 | 1 | 0,743814575 | 0,839646801 | 0,923123119 | 0,881036173 | 0,780799561 | 0,96160546 | 0,8832375 | 0,807619013 | 0,649678752 |
| A4 | 0,670905636 | 0,951361608 | 0,743814575 | 1 | 0,904167775 | 0,666937694 | 0,624850748 | 0,963015014 | 0,782209115 | 0,860577075 | 0,936195562 | 0,905864177 |
| A5 | 0,766737862 | 0,952806166 | 0,839646801 | 0,904167775 | 1 | 0,76276992 | 0,720682974 | 0,94115276 | 0,878041341 | 0,9564093 | 0,967972212 | 0,810031951 |
| A6 | 0,996032058 | 0,715576086 | 0,923123119 | 0,666937694 | 0,76276992 | 1 | 0,957913054 | 0,70392268 | 0,884728579 | 0,806360619 | 0,730742132 | 0,572801871 |
| A7 | 0,953945112 | 0,67348914 | 0,881036173 | 0,624850748 | 0,720682974 | 0,957913054 | 1 | 0,661835734 | 0,842641633 | 0,764273673 | 0,688655186 | 0,530714925 |
| A8 | 0,707890622 | 0,988346594 | 0,780799561 | 0,963015014 | 0,94115276 | 0,70392268 | 0,661835734 | 1 | 0,819194101 | 0,897562061 | 0,973180548 | 0,868879191 |
| A9 | 0,888696521 | 0,830847507 | 0,96160546 | 0,782209115 | 0,878041341 | 0,884728579 | 0,842641633 | 0,819194101 | 1 | 0,92163204 | 0,846013553 | 0,688073292 |
| A10 | 0,810328562 | 0,909215467 | 0,8832375 | 0,860577075 | 0,9564093 | 0,806360619 | 0,764273673 | 0,897562061 | 0,92163204 | 1 | 0,924381513 | 0,766441252 |
| A11 | 0,734710074 | 0,984833954 | 0,807619013 | 0,936195562 | 0,967972212 | 0,730742132 | 0,688655186 | 0,973180548 | 0,846013553 | 0,924381513 | 1 | 0,842059739 |
| A12 | 0,576769813 | 0,857225785 | 0,649678752 | 0,905864177 | 0,810031951 | 0,572801871 | 0,530714925 | 0,868879191 | 0,688073292 | 0,766441252 | 0,842059739 | 1 |

| Social | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,927903081 | 0,918868335 | 0,885259941 | 0,9932726 | 0,954265385 | 0,941819095 | 0,985886073 | 0,859624757 | 0,971360222 | 0,744272922 | 0,683432036 |
| A2 | 0,927903081 | 1 | 0,990965254 | 0,813163021 | 0,934630481 | 0,973637696 | 0,869722176 | 0,942017008 | 0,787527838 | 0,956542859 | 0,816369841 | 0,755528955 |
| A3 | 0,918868335 | 0,990965254 | 1 | 0,804128276 | 0,925595736 | 0,96460295 | 0,86068743 | 0,932982262 | 0,778493092 | 0,947508114 | 0,825404587 | 0,764563701 |
| A4 | 0,885259941 | 0,813163021 | 0,804128276 | 1 | 0,87853254 | 0,839525325 | 0,943440846 | 0,871146014 | 0,974364816 | 0,856620162 | 0,629532863 | 0,568691976 |
| A5 | 0,9932726 | 0,934630481 | 0,925595736 | 0,87853254 | 1 | 0,960992785 | 0,935091695 | 0,992613473 | 0,852897357 | 0,978087622 | 0,751000322 | 0,690159436 |
| A6 | 0,954265385 | 0,973637696 | 0,96460295 | 0,839525325 | 0,960992785 | 1 | 0,89608448 | 0,968379312 | 0,813890142 | 0,982905163 | 0,790007537 | 0,729166651 |
| A7 | 0,941819095 | 0,869722176 | 0,86068743 | 0,943440846 | 0,935091695 | 0,89608448 | 1 | 0,927705168 | 0,917805662 | 0,913179317 | 0,686092017 | 0,625251131 |
| A8 | 0,985886073 | 0,942017008 | 0,932982262 | 0,871146014 | 0,992613473 | 0,968379312 | 0,927705168 | 1 | 0,84551083 | 0,985474148 | 0,758386849 | 0,697545963 |
| A9 | 0,859624757 | 0,787527838 | 0,778493092 | 0,974364816 | 0,852897357 | 0,813890142 | 0,917805662 | 0,84551083 | 1 | 0,830984979 | 0,603897679 | 0,543056793 |
| A10 | 0,971360222 | 0,956542859 | 0,947508114 | 0,856620162 | 0,978087622 | 0,982905163 | 0,913179317 | 0,985474148 | 0,830984979 | 1 | 0,7729127 | 0,712071814 |
| A11 | 0,744272922 | 0,816369841 | 0,825404587 | 0,629532863 | 0,751000322 | 0,790007537 | 0,686092017 | 0,758386849 | 0,603897679 | 0,7729127 | 1 | 0,939159114 |
| A12 | 0,683432036 | 0,755528955 | 0,764563701 | 0,568691976 | 0,690159436 | 0,729166651 | 0,625251131 | 0,697545963 | 0,543056793 | 0,712071814 | 0,939159114 | 1 |

| Relational | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,907760138 | 0,959491373 | 0,922078421 | 0,891412587 | 0,935933782 | 0,976848752 | 0,9229871 | 0,999643757 | 0,97108562 | 0,934916049 | 0,945892091 |
| A2 | 0,907760138 | 1 | 0,867251511 | 0,829838558 | 0,983652449 | 0,84369392 | 0,930911386 | 0,984773038 | 0,908116381 | 0,878845758 | 0,842676186 | 0,853652229 |
| A3 | 0,959491373 | 0,867251511 | 1 | 0,962587047 | 0,85090396 | 0,976442409 | 0,936340125 | 0,882478473 | 0,95913513 | 0,988405753 | 0,975424675 | 0,986400718 |
| A4 | 0,922078421 | 0,829838558 | 0,962587047 | 1 | 0,813491008 | 0,986144639 | 0,898927172 | 0,84506552 | 0,921722178 | 0,9509928 | 0,987162372 | 0,976186329 |
| A5 | 0,891412587 | 0,983652449 | 0,85090396 | 0,813491008 | 1 | 0,827346369 | 0,914563835 | 0,968425488 | 0,89176883 | 0,862498207 | 0,826328636 | 0,837304679 |
| A6 | 0,935933782 | 0,84369392 | 0,976442409 | 0,986144639 | 0,827346369 | 1 | 0,912782533 | 0,858920881 | 0,935577539 | 0,964848161 | 0,998982267 | 0,99004169 |
| A7 | 0,976848752 | 0,930911386 | 0,936340125 | 0,898927172 | 0,914563835 | 0,912782533 | 1 | 0,946138348 | 0,977204995 | 0,947934372 | 0,9117648 | 0,922740843 |
| A8 | 0,9229871 | 0,984773038 | 0,882478473 | 0,84506552 | 0,968425488 | 0,858920881 | 0,946138348 | 1 | 0,923343342 | 0,89407272 | 0,857903148 | 0,868879191 |
| A9 | 0,999643757 | 0,908116381 | 0,95913513 | 0,921722178 | 0,89176883 | 0,935577539 | 0,977204995 | 0,923343342 | 1 | 0,970729377 | 0,934559806 | 0,945535849 |
| A10 | 0,97108562 | 0,878845758 | 0,988405753 | 0,9509928 | 0,862498207 | 0,964848161 | 0,947934372 | 0,89407272 | 0,970729377 | 1 | 0,963830428 | 0,974806471 |
| A11 | 0,934916049 | 0,842676186 | 0,975424675 | 0,987162372 | 0,826328636 | 0,998982267 | 0,9117648 | 0,857903148 | 0,934559806 | 0,963830428 | 1 | 0,989023957 |
| A12 | 0,945892091 | 0,853652229 | 0,986400718 | 0,976186329 | 0,837304679 | 0,99004169 | 0,922740843 | 0,868879191 | 0,945535849 | 0,974806471 | 0,989023957 | 1 |

| Functional | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0,812642853 | 0,953480321 | 0,619356355 | 0,870542794 | 0,986340238 | 0,997429746 | 0,845261119 | 0,764707745 | 0,773592411 | 0,946926378 | 0,976381928 |
| A2 | 0,812642853 | 1 | 0,859162532 | 0,806713502 | 0,942100059 | 0,826302615 | 0,815213108 | 0,967381734 | 0,952064892 | 0,960949557 | 0,865716475 | 0,836260925 |
| A3 | 0,953480321 | 0,859162532 | 1 | 0,665876034 | 0,917062473 | 0,967140083 | 0,956050575 | 0,891780798 | 0,811227424 | 0,82011209 | 0,993446057 | 0,977098393 |
| A4 | 0,619356355 | 0,806713502 | 0,665876034 | 1 | 0,748813561 | 0,633016117 | 0,621926609 | 0,774095236 | 0,85464861 | 0,845763944 | 0,672429977 | 0,642974427 |
| A5 | 0,870542794 | 0,942100059 | 0,917062473 | 0,748813561 | 1 | 0,884202556 | 0,873113048 | 0,974718325 | 0,894164951 | 0,903049617 | 0,923616416 | 0,894160866 |
| A6 | 0,986340238 | 0,826302615 | 0,967140083 | 0,633016117 | 0,884202556 | 1 | 0,988910492 | 0,858920881 | 0,778367507 | 0,787252173 | 0,96058614 | 0,99004169 |
| A7 | 0,997429746 | 0,815213108 | 0,956050575 | 0,621926609 | 0,873113048 | 0,988910492 | 1 | 0,847831374 | 0,767278 | 0,776162665 | 0,949496632 | 0,978952183 |
| A8 | 0,845261119 | 0,967381734 | 0,891780798 | 0,774095236 | 0,974718325 | 0,858920881 | 0,847831374 | 1 | 0,919446626 | 0,928331291 | 0,898334741 | 0,868879191 |
| A9 | 0,764707745 | 0,952064892 | 0,811227424 | 0,85464861 | 0,894164951 | 0,778367507 | 0,767278 | 0,919446626 | 1 | 0,991115335 | 0,817781367 | 0,788325817 |
| A10 | 0,773592411 | 0,960949557 | 0,82011209 | 0,845763944 | 0,903049617 | 0,787252173 | 0,776162665 | 0,928331291 | 0,991115335 | 1 | 0,826666032 | 0,797210482 |
| A11 | 0,946926378 | 0,865716475 | 0,993446057 | 0,672429977 | 0,923616416 | 0,96058614 | 0,949496632 | 0,898334741 | 0,817781367 | 0,826666032 | 1 | 0,97054445 |
| A12 | 0,976381928 | 0,836260925 | 0,977098393 | 0,642974427 | 0,894160866 | 0,99004169 | 0,978952183 | 0,868879191 | 0,788325817 | 0,797210482 | 0,97054445 | 1 |

# Annex E-3: Similarity matrices End of life

| Economic | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0.950991674580236 | 0.894838538344478 | 0.979384427119231 | 0.903873302304827 | 0.90852034409847 | 0.915113680792973 | 0.88000775608634 |
| A2 | 0.950991674580236 | 1 | 0.845830212924714 | 0.971607247461005 | 0.854864976885063 | 0.859512018678706 | 0.866105355373209 | 0.830999430666576 |
| A3 | 0.894838538344478 | 0.845830212924714 | 1 | 0.874222965463709 | 0.990965236039651 | 0.986318194246009 | 0.979724857551505 | 0.985169217741861 |
| A4 | 0.979384427119231 | 0.971607247461005 | 0.874222965463709 | 1 | 0.883257729424058 | 0.887904771217701 | 0.894498107912204 | 0.859392183205571 |
| A5 | 0.903873302304827 | 0.854864976885063 | 0.990965236039651 | 0.883257729424058 | 1 | 0.995352958206357 | 0.988759621511854 | 0.976134453781513 |
| A6 | 0.90852034409847 | 0.859512018678706 | 0.986318194246009 | 0.887904771217701 | 0.995352958206357 | 1 | 0.993406663305497 | 0.97148741198787 |
| A7 | 0.915113680792973 | 0.866105355373209 | 0.979724857551505 | 0.894498107912204 | 0.988759621511854 | 0.993406663305497 | 1 | 0.964894075293366 |
| A8 | 0.88000775608634 | 0.830999430666576 | 0.985169217741861 | 0.859392183205571 | 0.976134453781513 | 0.97148741198787 | 0.964894075293366 | 1 |

| Environmental | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0.927344454527303 | 0.749804449397975 | 0.953208065178237 | 0.740769685437626 | 0.973566579337527 | 0.705999895184774 | 0.696105819891408 |
| A2 | 0.927344454527303 | 1 | 0.677148903925278 | 0.88055251970554 | 0.668114139964929 | 0.953777875189776 | 0.633344349712077 | 0.62345027441871 |
| A3 | 0.749804449397975 | 0.677148903925278 | 1 | 0.796596384219738 | 0.990965236039651 | 0.723371028735501 | 0.956195445786799 | 0.946301370493433 |
| A4 | 0.953208065178237 | 0.88055251970554 | 0.796596384219738 | 1 | 0.787561620259389 | 0.926774644515764 | 0.752791830006537 | 0.742897754713171 |
| A5 | 0.740769685437626 | 0.668114139964929 | 0.990965236039651 | 0.787561620259389 | 1 | 0.714336264775153 | 0.965230209747148 | 0.955336134453782 |
| A6 | 0.973566579337527 | 0.953777875189776 | 0.723371028735501 | 0.926774644515764 | 0.714336264775153 | 1 | 0.679566474522301 | 0.669672399228934 |
| A7 | 0.705999895184774 | 0.633344349712077 | 0.956195445786799 | 0.752791830006537 | 0.965230209747148 | 0.679566474522301 | 1 | 0.990105924706634 |
| A8 | 0.696105819891408 | 0.62345027441871 | 0.946301370493433 | 0.742897754713171 | 0.955336134453782 | 0.669672399228934 | 0.990105924706634 | 1 |

| Social | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0.931783482956559 | 0.923503205786341 | 0.822048357438186 | 0.998123100815161 | 0.871898766479679 | 0.655563383348771 | 0.796526462159698 |
| A2 | 0.931783482956559 | 1 | 0.991719722829781 | 0.753831840394745 | 0.92990658377172 | 0.940115283523119 | 0.58734686630533 | 0.728309945116258 |
| A3 | 0.923503205786341 | 0.991719722829781 | 1 | 0.745551563224527 | 0.921626306601501 | 0.948395560693338 | 0.579066589135111 | 0.720029667946039 |
| A4 | 0.822048357438186 | 0.753831840394745 | 0.745551563224527 | 1 | 0.823925256623026 | 0.693947123917865 | 0.833515025910584 | 0.974478104721512 |
| A5 | 0.998123100815161 | 0.92990658377172 | 0.921626306601501 | 0.823925256623026 | 1 | 0.870021867294839 | 0.65744028253361 | 0.798403361344538 |
| A6 | 0.871898766479679 | 0.940115283523119 | 0.948395560693338 | 0.693947123917865 | 0.870021867294839 | 1 | 0.527462149828449 | 0.668425228639377 |
| A7 | 0.655563383348771 | 0.58734686630533 | 0.579066589135111 | 0.833515025910584 | 0.65744028253361 | 0.527462149828449 | 1 | 0.859036921189072 |
| A8 | 0.796526462159698 | 0.728309945116258 | 0.720029667946039 | 0.974478104721512 | 0.798403361344538 | 0.668425228639377 | 0.859036921189072 | 1 |

| Relational | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0.931783482956559 | 0.847961926843219 | 0.865991472914018 | 0.998123100815161 | 0.868358943470829 | 0.855372036326568 | 0.899713033638621 |
| A2 | 0.931783482956559 | 1 | 0.91617844388666 | 0.934207989957458 | 0.92990658377172 | 0.93657546051427 | 0.923588553370009 | 0.967929550682061 |
| A3 | 0.847961926843219 | 0.91617844388666 | 1 | 0.981970453929202 | 0.84608502765838 | 0.97960298337239 | 0.992589890516651 | 0.948248893204598 |
| A4 | 0.865991472914018 | 0.934207989957458 | 0.981970453929202 | 1 | 0.864114573729178 | 0.997632529443188 | 0.989380563412551 | 0.966278439275397 |
| A5 | 0.998123100815161 | 0.92990658377172 | 0.84608502765838 | 0.864114573729178 | 1 | 0.86648204428599 | 0.853495137141729 | 0.897836134453782 |
| A6 | 0.868358943470829 | 0.93657546051427 | 0.97960298337239 | 0.997632529443188 | 0.86648204428599 | 1 | 0.987013092855739 | 0.968645909832208 |
| A7 | 0.855372036326568 | 0.923588553370009 | 0.992589890516651 | 0.989380563412551 | 0.853495137141729 | 0.987013092855739 | 1 | 0.955659002687947 |
| A8 | 0.899713033638621 | 0.967929550682061 | 0.948248893204598 | 0.966278439275397 | 0.897836134453782 | 0.968645909832208 | 0.955659002687947 | 1 |

| Functional | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 |
|---|---|---|---|---|---|---|---|---|
| A1 | 1 | 0.887214185966051 | 0.626431043683056 | 0.976535607773299 | 0.840650181502477 | 0.858170786514511 | 0.990694867369598 | 0.91928463528399 |
| A2 | 0.887214185966051 | 1 | 0.739216857717005 | 0.910678578192752 | 0.953435995536426 | 0.97095660054846 | 0.896519318596453 | 0.967929550682061 |
| A3 | 0.626431043683056 | 0.739216857717005 | 1 | 0.649895435909757 | 0.785780862180579 | 0.768260257168545 | 0.635736176313458 | 0.707146408399066 |
| A4 | 0.976535607773299 | 0.910678578192752 | 0.649895435909757 | 1 | 0.864114573729178 | 0.881635178741212 | 0.985840740403701 | 0.942749027510691 |
| A5 | 0.840650181502477 | 0.953435995536426 | 0.785780862180579 | 0.864114573729178 | 1 | 0.982479394987966 | 0.849955314132879 | 0.921365546218487 |
| A6 | 0.858170786514511 | 0.97095660054846 | 0.768260257168545 | 0.881635178741212 | 0.982479394987966 | 1 | 0.867475919144913 | 0.938886151230521 |
| A7 | 0.990694867369598 | 0.896519318596453 | 0.635736176313458 | 0.985840740403701 | 0.849955314132879 | 0.867475919144913 | 1 | 0.928589767914392 |
| A8 | 0.91928463528399 | 0.967929550682061 | 0.707146408399066 | 0.942749027510691 | 0.921365546218487 | 0.938886151230521 | 0.928589767914392 | 1 |

**École Nationale Supérieure des Mines de Saint-Étienne**

**NNT: 2019LYSEM030**

Martha ORELLANO CARRASQUILLA

A methodological framework to support sustainable value creation in innovative offer design

**Speciality:** Industrial Engineering

**Keywords:** value creation; collaboration; innovation; sustainability; multi-criteria decision analysis

## Abstract:

The increasing environmental and social needs require the adoption of more sustainable practices in the industry. This pushes companies to integrate new criteria related to the creation of sustainable value in their innovation process, i.e. economic, but also environmental and social. The main objective of this thesis work is to provide a methodological support to companies for the integration of sustainable development criteria into their innovation processes. The contribution of this thesis is threefold. Firstly, a framework for conceptualizing sustainable value creation is proposed. This framework is based on fi e dimensions of value: the three dimensions of sustainable development, economic, environmental, social, to which are added two dimensions, relational and functional. Secondly, a system modelling approach is adopted to analyse the process of aligning customer value expectations with feasible alternatives in terms of suppliers' value propositions. Finally, given the diversity of stakeholders and the multidimensionality of sustainable value, a multi-criteria and multi-stakeholder decision support approach is adopted to evaluate feasible alternatives to value creation. The proposed framework is then applied to a project aiming at revisiting the provision process of safety clothing to employees of a large French company (EDF).

**École Nationale Supérieure des Mines de Saint-Étienne**

**NNT : 2019LYSEM030**

Martha ORELLANO CARRASQUILLA

Cadre methodologique pour l'analyse de la valeur durable dans la conception collaborative d'offres innovantes

**Spécialité :** Génie Industriel

**Mots clefs :** création de valeur; collaboration; innovation; développement durable; aide á la décision multicritéres

**Résumé :**

L'augmentation des pressions environnementales et sociales nécessite l'adoption de pratiques plus durables dans l'industrie. Pour les entreprises, cela se traduit par la prise en compte dans le processus d'innovation de nouveaux critères liés à la création de valeur durable, dans le sens économique, mais aussi environnementale et sociale. L'objectif principal de ce travail de thèse est de fournir un cadre méthodologique aux entreprises pour l'intégration de critères axés sur le développement durable dans leurs processus d'innovation. La contribution de cette thèse est triple. Tout d'abord, un cadre permettant de conceptualiser la valeur créée par une innovation est proposé. Ce cadre s'appuie sur cinq dimensions de la valeur : les trois dimensions du développement durable, économique, environnementale, sociale, auxquelles s'ajoutent deux dimensions, relationnelle et fonctionnelle. Deuxièmement, une approche de modélisation des systèmes est adoptée pour analyser le processus d'alignement entre les attentes des clients en termes de création de valeur et les alternatives possibles en termes de propositions de valeur par les fournisseurs. Enfin, compte tenu de la diversité des parties prenantes impliquées et du caractère multidimensionnelle de la valeur durable, une approche d'aide à la décision multicritères et multi-acteurs est adoptée pour évaluer les alternatives réalisables au regard des objectifs de création de valeur. Le cadre proposé est alors appliqué à la transformation du système de fourniture de vêtements de sécurité aux employés d'une grande entreprise française (EDF).