**Dissertationes Forestales 223**

# Changing institutions and consumer-driven development of forest products and services

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Academic Dissertation

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## ABSTRACT

The forest sector has been able to develop many new bio-based and sustainable products catered to business-to-business markets, but the sector still lacks a breakthrough in new forest products and services targeting consumer markets. This is due to higher prices of forest products compared to competing materials, such as concrete, steel, and plastics, but also due to a lack of new product and service innovations targeting end-consumer markets. To understand the emergence of bioeconomy, also bringing new consumer market opportunities to the forest sector, we need to understand the new business ecosystem. The business ecosystem model is a holistic view of the current institutions capturing stakeholder relations and opportunities brought by various resources and technologies. Better understanding of these concepts can lead to consumer-driven development of forest products and services, and improved competitive advantage.

This doctoral dissertation introduces a holistic research and development model for new product and service innovations in the forest sector. This research was motivated by the fact that recent forest sector product introductions have been driven by the technology push, and therefore, this research concentrates on the consumer perspective to build new business models and the development of products and services to meet current consumer trends. Evolving sustainability trends among consumers, where bio-based forest products and services can fulfill consumer demand, are central in this thesis.

The doctoral thesis consists of one book chapter and three peer-reviewed articles, each using different methodologies. The subjects and results of the papers are grouped into three themes in the framework of the Consumer-Driven Business Ecosystem Research and Development (CDBERD) model. The model extends the classical “technology-push and demand-pull” innovation model, to better consider consumer values, enabling resources and dominant logics along with the smooth flow of information during each phase of the research and development process leading towards new consumer-driven solutions.

**Keywords:** Institutional theory, business ecosystem model, research and development model, consumer trends, bioeconomy, forest products and services, certified forest products

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Onkamo, June 2016

Jani Holopainen

## LIST OF ORIGINAL ARTICLES

This thesis consists of the following four articles referred to by their Roman numerals. Articles I, II, and III are reprinted with the permission of the publishers while Article IV is the author's version of the manuscript.

I Toppinen, A., Lähtinen, K., Holopainen, J. (2015). On corporate responsibility. In: Panwar, R., Hansen, E., Kozak, R. (ed.) Forests, business and sustainability. Chapter 5 pp. 70-90. Routledge, New York. ISBN 978-1-138-77929-7.

II Holopainen, J., Perttula, S., Toppinen, A. (2015). Impact of EU Timber Regulation on Forest Certification Strategies in the Finnish Wood Industry Value Chain. Forests 6: 2879-2896. http://dx.doi.org/10.3390/f6082879

III Holopainen, J., Häyrinen, L., Toppinen, A. (2014). Consumer value dimensions for sustainable wood products: results from the Finnish retail sector. Scandinavian Journal of Forest Research 29(4): 378-385. http://dx.doi.org/10.1080/02827581.2014.925138

IV Holopainen, J., Rekola, M., Lähtinen, K., Toppinen, A. (2015). Raw material origin and certification in consumer choice: case of outdoor decking materials in e-commerce choice experiment (Manuscript)

**DIVISION OF LABOR IN THE CO-AUTHORED ARTICLES**

| | I | II | III | IV |
|---|---|---|---|---|
| Conception & design | AT, KL, JH | JH, AT | JH, AT | JH, AT, MR, KL |
| Planning & implementation | AT, KL, JH | JH, AT | JH, AT | JH, AT |
| Data collection | AT, KL, JH | JH, SP | JH | JH |
| Analyses & interpretation | AT, KL, JH | JH, SP | JH, LH | JH |
| Writing the article | AT, KL, JH | JH, AT | JH, AT | JH, AT, MR, KL |
| Overall responsibility | AT | JH | JH | JH |

JH = Jani Holopainen, AT = Anne Toppinen, KL = Katja Lähtinen, MR = Mika Rekola, LH = Liina Häyrinen, SP = Sini Perttula

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# 1. INTRODUCTION

## 1.1 Background for research

In the emergence of bioeconomy and global awareness of sustainability issues, resource-based concepts, such as sustainable competitive advantage (Barney 1991) and maximization of the overall stakeholder value (Freeman 1984), have become strategic and organizational issues for companies also in the forestry sector. In addition, forest sector companies have begun building strategic alliances with other sectors to produce new sustainable products from the forests such as biofuels, chemicals, bio-based fibrils, and wood composite materials (Toppinen et al. 2015). While many of these alliances have been established between large industries and for business-to-business markets, the breakthrough of bio-based sustainable forest products and services to consumer markets is not yet visible. This is due to the higher prices of forest products compared to competing materials, such as concrete, steel, and plastics, but also to a lack of marketing and innovation strategies for new product and service developments targeting end-consumer markets (Hansen and Juslin 2011). To understand the potential of bioeconomy for also bringing new market opportunities to the forest sector, we need to expand the resource-based view to consider the new business ecosystem.

Better understanding of the business ecosystem (Moore 1992), or so-called service-ecosystems (Vargo and Lusch 2010), can be sought through the lenses of the institutional theory, stakeholder theory, and the analysis of operant and operand resources central in the Service-Dominant Logic (SDL) (Vargo and Lusch 2004). From the consumer perspective institutional theory (Scott 2001) covers issues such as norms, values, habits, culture, cognitions, and logics, rules, laws, regulations etc. The stakeholder theory (e.g. Freeman 1984) looks at the institutional elements from different stakeholder perspectives, but also analyzes the network and relationships between the focal firm and various stakeholder groups. Finally the SDL considers operant and operand resources (i.e. immaterial and material resources) and organization, value co-creation and synergies, evolvement, and innovation resulting from these resources (Vargo and Lusch 2004; 2010). Better understanding of the evolving business ecosystem via these concepts can lead to new user and consumer-driven product and service innovations.

From a managerial perspective, this doctoral dissertation introduces a holistic research and development model for new product and service innovations in the forest sector.

Especially because many of the recent forest sector product introductions have been driven by the technology push, this research concentrates on the consumer perspective to build new business models and the development of products and services to meet consumer trends. Central here is the evolving bioeconomy, including considerations on Corporate Responsibility (CR)[a], forest certification, and the sustainable production of forest products and services, as these factors can be seen to generate new business opportunities to the forest sector.

Results from a US startup accelerator Idealab's (2015) analysis suggested five most significant factors for successful new product and service introductions (percentage indicating significance): timing 42%, team 32%, idea itself 28%, business model 24%, and funding 14%. In terms of the business ecosystem model, this would mean the consideration of consumer values and norms, trends, regulations, culture, and overall logics along with resources and relations among and between different stakeholders. While this dissertation explores these institutional carriers, creating fertile ground for new product and service introductions, however, I need to restrict the approach to analyze the factors only from the perspectives of consumers and sustainability. On the one hand, these two perspectives are well justified as the user / consumer / end-user approach is dominant among successful businesses (Grönroos 2000). On the other hand, sustainability is definitely one of the major current megatrends among consumers (e.g. Callado-Muñoz and Utrero-González 2011; Koos 2011; Kim et al. 2014; Maniatis 2015).

Forest certification has been the most prominent sustainability practice also targeting consumer markets in the forest sector (Toppinen et al. 2014). Forest- and chain-of-custody certification considers all production levels in the supply chain, and eventually helps consumers identify products from sustainably and unsustainably managed forests. Companies attaining forest certification and also the majority of final consumer market-level researchers have been interested in consumers' willingness-to-pay a premium price for eco-labeled products (see review in Holopainen 2012). However, the reality in the field of forest products markets shows that the production and trade of certified forest products has increased but without substantial price premiums, and the demand comes largely from retailers, not from final consumers (Räty et al. 2016). Communicating intangible product values associated with product or corporate sustainability has not been achieved in the forest

[a] According to European Commission (2001), CR calls for "companies to integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis."

sector, and overall, literature on service business development in the forest sector remains highly scattered (see Mattila 2015, Näyhä et al. 2015).

While existing consumer and sustainability -related market research have focused on consumers' willingness-to-pay for certified forest products, less attention has been paid to the role of broader institutional factors and dynamics affecting consumer choices. In some other contexts institutional theory has been applied to explain consumer behavior, innovations, and market formation (e.g. Pioch et al. 2009; Humphreys 2010ab; Giesler 2012; Scaraboto and Fischer 2013). Institutional theory has been successful especially in explaining consumer market failures (Pioch et al. 2009), and it has been adopted also in innovation research (e.g. Lounsbury and Crumley 2007; Tumbas et al. 2015). The broader business ecosystem model extending the institutional theory has been applied in innovation research only quite recently by Vargo et al. (2015) and Siqueira et al. (2015).

Innovation research in the forest sector categorizes the areas of innovations into three, including product, process, and business system -innovations (Hansen 2007). According to Kajanus et al. (2014), forest sector practices and research have largely focused on product and process innovations in the business-to-business contexts (e.g. Bumgardner et al. 2001; Das and Alavalapati 2003; Crespell et al. 2006; Stendahl et al. 2007; Nikitin et al. 2010; Björkdahl and Börjesson 2011; Hansen et al. 2011; Leavengood 2011; Stone et al. 2011; Valente et al. 2011). Less focus has been given to business system innovations (Kajanus et al. 2014), and only little research can be found on non-timber forest product innovations (e.g. te Velde et al. 2006), while consumer market -related innovation research in the forest sector is largely absent. In general, the sector lacks consumer market orientation when it comes to new product and service development and innovations (Dasmohapatra 2011; Hansen and Juslin 2011). The review of these studies calls for focusing on user-driven holistic business ecosystem research and development for the sector to better consider the prevailing general consumer trends and also in capturing emerging weak signals in new product and service development.

## 1.2 Aim of research

As the existing forest sector product and service development has mainly targeted business-to-business markets while lacking consumer market solutions, the objective of this dissertation is to build understanding on institutional carriers of certified forest products and

the business ecosystem from the consumer perspective. This is done by exploring the interplay between involved stakeholders, evolving regulation, and company strategies along with consumer values and choice behavior in the context of certified wooden outdoor decking materials in Finland. Better understanding of the institutional carriers and overall business ecosystem helps in developing integrated partnerships and a Consumer-Driven Business Ecosystem Research and Development (CDBERD) model for the sector.

The doctoral thesis consists of four articles considering the following research objectives:

1. How is corporate responsibility implemented in forest industry during interaction with stakeholder groups, and what are its performance-related future challenges (Article I)?
2. How has the introduction of EU Timber Regulation affected the certification uptake, routines, and company strategies towards consumers in the wood industry value chain (Article II)?
3. What is the dimensionality of consumer-perceived norms and values in the context of sustainable forest products (Article III)?
4. What is the role of sustainability certificates, raw material origin, price, and substitute products affecting consumer market shares (Article IV)?

The composition of this thesis and the key objectives for each article are illustrated in Figure 1. Article I introduces the overall network of stakeholders, and their relations and roles in the forest sector from the corporate responsibility perspective. Article II explores the regulatory impact on certification uptake, routines, and company strategies towards customers and consumers. Consumer norms and values concerning sustainability and forest products are assessed in Article III, while consumer choice behavior including market shares, substitutes, habitual purchasing, and the image of different materials are analyzed in Article IV. The overall framework extends our understanding of consumer behavior affected by institutional elements and carriers, e.g. regulations, norms, and habits.

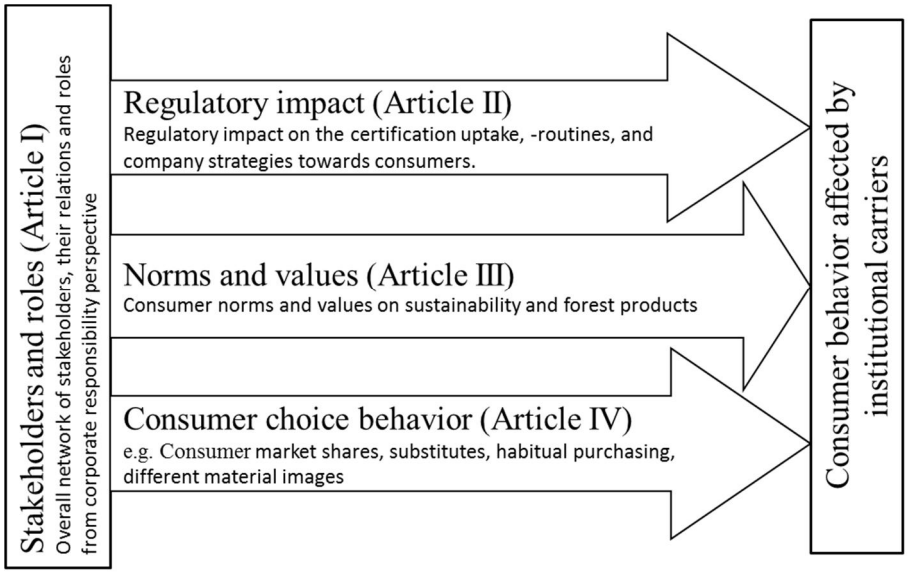


**Figure 1.** The research design, with the overall objective of building understanding of institutional elements and carriers affecting consumer behavior by using evidence from articles I–IV

The overall research framework (introduced in Chapter 2) is based on the institutional model (Scott 2001), in which the institutional elements and carriers are explained from the consumer and sustainability perspectives. The business ecosystem literature extends the view of institutional influences on consumer behavior. This setup also introduces the consumer-driven business ecosystem research development framework and the role of keystone organizations. Chapter 2 also introduces the philosophical theories on values and psychological information processing, as they can be perceived under the institutional theory, stakeholder theory, and SDL, i.e. in holistic business ecosystem research. Finally, the larger consumer business ecosystem is considered in Chapter 2 by reviewing general consumer values and associated trends in addition to a review of the state of the art in certified wood product consumer market research.

Chapter 3 introduces the methods and discusses the key findings of the research articles, while Chapter 4 synthesizes results from the business ecosystem point of view. Based on the empirical part, the dissertation develops a CDBERD model for the forest sector (introduced in the conclusions in Chapter 4). The results of each article (Figure 1) are grouped into three themes in the CDBERD model by extending the classical "technology-push and demand-pull" innovation model. The respective themes in the model include consumer trends, values,

and norms (as pull factors), resources, technologies, and regulations (as push factors), and consumer choice behavior and business logics (as part of a business process). The three themes are braided in the model by considering a smooth flow of information and good relations between the actors involved in the research and development process. While the entire dissertation is conducted in the context of the forest sector, the model itself is specially designed for developing forest products and services in cooperation between different sectors. The model guides to further plan actions, strategies, and business models towards building a keystone organization in the bioeconomy business ecosystem. The conclusions also introduce some cases where the developed model has been applied in the research and development projects creating new consumer-driven solutions. Finally, the limitations and future research are discussed to address the further development of the model.

# 2. RESEARCH FRAMEWORK

## 2.1 Summary of key concepts

This chapter introduces the major concepts that are used to tie together various articles in this doctoral thesis. The main concepts include 1) role of institution (norms, regulations, cultural-cognitive setup), 2) role of stakeholder groups (primary, secondary, or their values and expectations) 3) role of service-dominant logic (operant/operand resources, institution-consumer interactions, value over-time, or value co-creation and synergies). Each of these concepts is introduced from the consumer perspective under the business ecosystem concept also introduced in this chapter. Figure 2 introduces the principal concepts for framing the CDBERD model, which is built up from the results of individual articles and introduced in the conclusions of this dissertation summary.

According to DiMaggio and Powell (1983), institutional theory attempts to explain social and organizational phenomena. Scott (2008) adds that the institutional stability searched by all organizations is obtained through legitimation processes by balancing institutional pillars: normative, regulative, and cultural-cognitive, where the normative pillar and pressure is the primary initiating the legitimation processes (Zucker 1987). According to Habermas's social theory (1999), norms are valid if they are publicly accepted without coercive pressure, but institutional theory recognizes different existing norms parallel to a more harmonized cultural-cognitive element (DiMaggio and Powell 1983). The institutional theory also

recognizes that institutions influence society and consumer preferences, and that behavior and choices are more influenced by the cultural-cognitive setting (i.e. habits, Jackson 2005) than the normative setting (Scott 2008). Consumer trends, values, and behavior can generally be used to reflect the overall institution and consumer culture (Oliver 1999; Aaker et al. 2001; Hofstede 2001).

Business ecosystem literature extends the view of institutional influences concerning consumer behavior. The main concept is that several institutions exist, i.e. a whole ecosystem influencing consumers (Moore 1993; Javalgi et al. 2005). In addition, this influence is interactive so that consumers and their preferences also shape institutions (Vargo and Lusch 2010). These interactive networks are called service ecosystems. These complex systems consider value in exchange, value in use, and value in different institutional and cultural contexts, where the overall and overtime value is considered and co-created in the business ecosystem (Moore 1993; Javalgi et al. 2005; Vargo and Lusch 2010). The concept, such as the value network, lacks the value co-creation element, and the value constellations lack the element of co-evolution. However, the business ecosystem especially considers both co-creation along with organizational co-evolution, so thus it considers a constant flux in institutions, strategies, consumer cultures, trends, and values.

The institution as defined by Scott (2008) is balancing its institutional pillars (i.e. regulative, normative, and cultural-cognitive) through institutional carriers including routines, artifacts, symbols, and relations (Figure 2). In a balanced and legitimatized institution, or in a symbiotic business ecosystem comprising of several institutions, symbolic carriers, such as rules, values, and logics, are shared and aligned (Scott 2008). Relational structures and networks also equally support the symbolic system. In this context, routines reflect the institutionalized values, while artifacts more represent the emerging issues and evolvement in the institution (Moore 1993; Scott 2008).

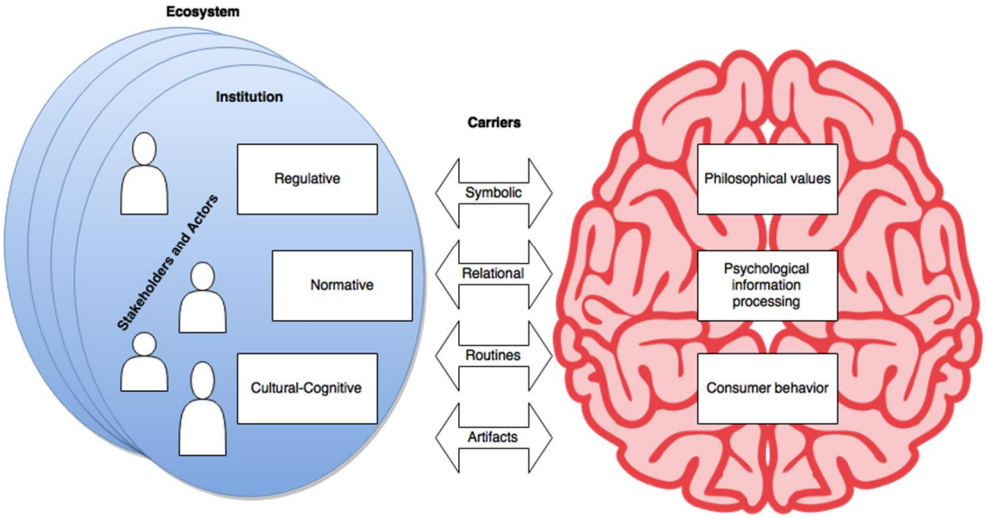


**Figure 2.** The ecosystem / institutional influence on consumer values, information processing, and eventually behavior through different carriers

According to the stakeholder theory (e.g. Freeman 1984; Clarkson 1995), the interactions between companies and the surrounding environment can be categorized into associations with the primary stakeholders (those whose continuing participation is essential to the company's survival, i.e., shareholders, employees, customers, suppliers, and the government) and secondary stakeholders (who do not directly interact with the company, but who are otherwise affected by it, such as communities, civil society organizations, competitors, or the media). The business ecosystem literature uses similar categorizations e.g. core business, extended enterprise, and business ecosystem, while it also defines different roles for these actors on vaious spheres (Heikkilä and Kuivaniemi 2012). The role categorizations can include technological change, research insights, customer demand, competition/coopetition, social environment, policies, and legal environment (Heikkilä and Kuivaniemi 2012). The service-dominant logic (Vargo and Lusch 2004) and service ecosystems (Vargo and Lusch 2010; Vargo et al. 2015) consider the operant and operand resources, i.e. immaterial and material resources within these categories. These strands of literature also underline the importance of value in exchange, values in use, and values in different contexts along with how the value is perceived from different stakeholder perspectives to grow and regenerate value to sustain and evolve business ecosystems (Vargo and Lusch 2004; 2010). These forms of stakeholder engagements include models for establishing dialogue and integration of various stakeholders (e.g. Robèrt et al. 2002) and together with business ecosystem model

and categorization tasks (e.g. Heikkilä and Kuivaniemi 2012), the remaining work can be better targeted for synergistic value co-creation and stakeholder co-evolution within the business ecosystem. Thus, the identification and work towards enhancing stakeholder dialogue and engagement are crucial for creating a synergistic business ecosystem research and development agenda.

Figure 2 presents the overall theoretical framework for this dissertation for building understanding on the role of institutional carriers affecting consumer values, information processing, and eventual behavior. While each type of carrier has a different meaning, the task for this dissertation is to search for the institutional carriers under each different institutional pillar within the chosen research context. With better understanding of the role of carriers, the theoretical framework helps us describe the contemporary business ecosystem for certified wood products in Finland from the consumer perspective. Furthermore, this can be used to provide ingredients to support related research and development.

The regulative institutional pillar, for example, can include carriers such as laws and regulations in the forest sector (symbolic), laws and regulations of other sectors (relational), certification uptake (routines), strategies, business models, and codes-of-conduct targeting consumer markets (artifacts). The normative pillar can include carriers, such as consumer norms and values related to forests (symbolic), more general norms and values (relational), economic behavior (routines), or the use of certificates representing value offerings (artifacts). The cultural-cognitive pillar includes carriers such as consumption culture, identified in the form of market shares of different materials (symbolic), relative material characteristics in different contexts (relational), habitual purchasing (routines), or different material images (artifacts). In Figure 2, the business ecosystem is taken into account by recognizing the parallel institutions, which have common consumer markets and evolving issues i.e. regulations, technologies, resources, business logics, market environments, and potentials as suggested by Vargo and Lusch (2010).

Consumer-related literature based on the business / service-ecosystem framework is very new and limited. Gretzel et al. (2015) describe “the smart technology supported tourism ecosystem” to envision new ways in which value is created, exchanged, and consumed, which furthermore gives support to required technologies, institutions, and business models. Korpela et al. (2013) combine the multi-stakeholder view and more detailed enterprise architectures i.e. information flows, processes, and strategies, to describe a digital business ecosystem and organization to meet contemporary consumerism, i.e. digital culture, where traditional theories alone do not provide adequate conceptual frameworks. As this

dissertation framework explores especially the institutional carriers including routines, artifacts, symbols, and relations (Scott 2008) i.e. the role of interactive and evolving channels, the work is also related to the contemporary omni-channel marketing literature (e.g. Bodhani 2012; Verhoef et al. 2015).

## 2.2 Consumer-driven business ecosystem research and development framework

The forest sector lacks consumer market orientation when it comes to new product and service development and innovations (Hansen and Juslin 2011; Kajanus et al. 2014). In addition, Jackson (2005) evaluated the social and institutional impacts on consumer motivations, information processing, and sustainable behavior in the field of social psychology. He recognized the insufficient consideration of norms, regulations, and habits in the rational choice models in economics, and suggests a shift from "deliberation" to "elaboration" as a working model of behavioral change. This suggests the need for evaluating consumer values embedded in more holistic research and development models (e.g. the braided design model by Kilain et al. 2015) producing fast prototypes of new products and services based on research and furthermore on testing / validating these prototypes. With a holistic research and development approach, more competitive products and services could eventually be introduced to the forest sector, along with consumer-driven solutions and business models.

In a braided design model, design, strategy, and technology work together in lockstep (Kilain et al. 2015). The braided design model (Kilain et al. 2015), as design-driven research in general (e.g. Verganti 2008), is based on the "technology-push and demand-pull" innovation model, but extended with the organization process building the resources (e.g. business strategy, management attitude, organizational receptivity) (Zmud 1984), and also with the market process delivering value for users (e.g. market environment dynamics and business logics) (Brem and Voigt 2009; Corniani 2008). The process of building resources and delivering value are crucial, and thus all (push-pull-processes) can be seen as factors for new product and service innovations. Moreover, processes should also vary depending on the nature of the innovation involved (Zmud 1984; Verganti 2008; Kilain et al. 2015).

Figure 3 represents a consumer-driven business ecosystem research and development framework, as it adds consumer and business ecosystem perspectives to the design-driven

and push-pull-process innovation –models in the "frame". The themes scrutinized in the model include consumer trends, values and norms, i.e. hedonic and utilitarian values (pull), resources, technologies and regulations (push), organization strategy, consumer choice behavior, and business logics (process). This is a simplified thematic presentation of the institutional pillars (i.e. normative, regulative, and cultural-cognitive) and carriers (symbolic, relational, routines, artifacts), which are the research topics of individual articles (Figure 1, Figure 2). The framing stage should not only pay attention to prevailing trends, values, and logics, but also to weak signals, giving a great opportunity to detect new product and service innovation areas (Day and Schoemaker 2006). After framing, the following steps in the braided design model are co-creation, prototype, validation, and governing (Figure 3). Each of these steps embeds and aligns various themes in research and development providing support for holistic inter-sectoral and –disciplinary decision-making (Kilain et al. 2015).

Vargo et al. (2015) and Siqueira et al. (2015) have only recently conceptualized a broader business ecosystem model in innovation research. These studies extend the traditional or institutional views of markets by considering business-to-business and business-to-consumer encounters as processes, i.e. user behavior is not just a single action, but it is rather a longer-term process affected by many instances. The major extension is more heterogeneous stakeholder interactions, and considerations of value and resources. In practice, the business ecosystem innovation models encourage inter-sectoral value creation and innovation. In addition, according to business ecosystem thinking, new market innovations do not always require new products or technologies, but sometimes introducing new services and logics, which better fit the current institutional environment e.g. regulations, norms and values, and cultural-cognitive setup, may be successful.

The consumer-driven business ecosystem research and development framework also builds the organization's business strategy, processes, and governance towards constant evolvement and consideration of user and business ecosystem requirements. Such an organizational model in the business ecosystem literature is called a keystone organization (Iansiti and Levian 2004). By definition, a keystone business is an organization model that excels complex networks and information towards a productive, robust, and diverse business ecosystem (Iansiti and Levien 2004; Sydänmaanlakka 2011). The keystone organization's main tasks are to create and share value in the business ecosystem by "i) providing a stable and predictable set of common assets to its ecosystem, ii) connecting network participants to one another or by making the creation of new products by third parties more efficient, iii) consistently incorporating technological innovations, iiii) encouraging ecosystem niche

creation by offering innovative technologies to a variety of third-party organization" (Iansiti and Levien 2004). For example, currently in many cases of social media platforms and peer-to-peer market places the design of a keystone organization is implemented in company policy, strategy, operations, product / service designs, and expansion to ensure stakeholder commitment, constant inputs, and evolution. There are several examples of successful business ecosystems e.g. Microsoft, Walmart, and Silicon Valley (Iansiti and Levien 2004). The keystone design with peer-to-peer inputs can be especially successful in innovation and introducing new products and services to the markets by establishing co-operation and partnerships between various companies along with other actors in the fragmented business networks (see Heikkilä and Kuivaniemi 2012). Concrete activities for companies moving towards establishing themselves as keystone organizations can also include hackathons, innovation competitions, and reverse pitching (Almirall et al. 2014).

· Pull
· Process
· Push

## Frame

· ”Trendscrape”: identify consumer trends, values and norms and define experience principles.
· Map business opportunity and strategy based on market and organization factors: consumer choice behavior, business logics and organization strategies.
· Identify resource, technology and regulation -developments; assess current environment

## Co-create

· · Reframe problem statement based on particular context and customer feedback.
· · Define value propositions.
· · Conduct workshops with customers and experts to create optimal experience.
· Identify data and methodology.

## Prototype

· Build rapid prototypes.
· Iterate design as required with customer feedback.
· Create technology-development (agile) plan.
· Build business case.

## Validate

· Test usability.
· · Access technology, process, and organization needs for realization.
· Validate with overall business strategy.

## Govern

· · Role model best-practice innovation process tied to business strategy.
· · · Build governance model for ongoing investment and evolution.

**Figure 3.** The consumer-driven business ecosystem research and development framework (Adapted from Kilain et al. 2015)

## 2.3 Philosophical perspectives on values

In hedonistic philosophy (e.g. Weijers 1995) the key assumption is that all people seek pleasure or value and avoid pain or disvalue. Two main disciplines for hedonistic theories are motivational hedonism, also known as psychological hedonism, and normative hedonism, i.e. ethical hedonism (Figure 4).

Motivational hedonism includes both conscious and unconscious desires for pleasure. Institutions (i.e. information flows, processes, strategies, and culture) have a significant impact on consumers' motivational values and eventual behavior by raising awareness of certain issues, while other issues are unconsciously taken for granted (Hofstede 2001, Scott 2001).

Ethical hedonism (e.g. Weijers 1995) can be divided into hedonistic utilitarianism and hedonistic egoism. Hedonistic utilitarianism as a philosophical theory assumes that people strive to maximize the net happiness for all actors concerned; however, they do so because of their own egocentric perspectives. This is a fundamental approach in the maximization of stakeholder value (Freeman 1984) or value to all in SDL (Vargo and Lusch 2004). Hedonistic egoism as a philosophical theory, on the other hand, assumes that individuals seek egoistic values only to maximize their own pleasure despite any negative effects on other actors (Weijers 1995). Hedonistic egoism is often fundamental in the rational choice theories in economics (e.g. Schoemaker 1982), as pointed out by Jackson (2005), Kahneman (2011), and Carlsson and Johansson-Stenman (2012), however, empirical research often indicates that human behavior is often a mix of both hedonistic utilitarianism and hedonistic egoism. Moreover, in different contexts even the same individuals may shift between egoistic vs. non-egoistic behavior.

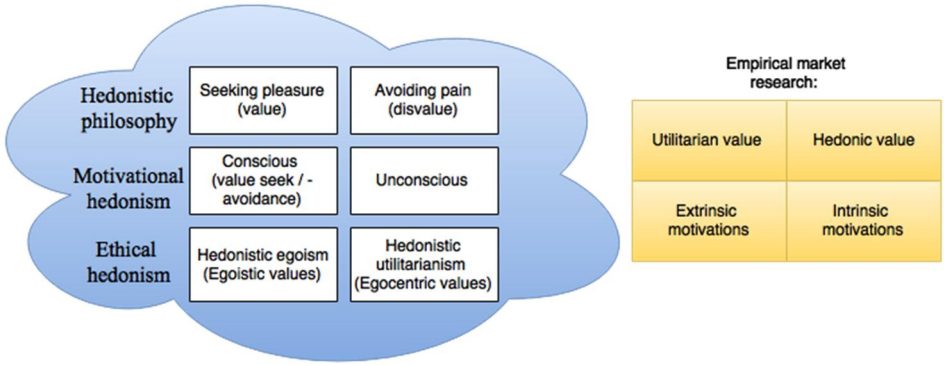


**Figure 4.** Hedonistic theories in hedonistic philosophy and their counterparts in empirical market research (Source: Weijers 1995; Dhar and Wertenbroch 2000; Watchravesringkan et al. 2010)

Contemporary empirical market research has adopted terms, such as utilitarian- and hedonic values along with intrinsic and extrinsic motivations, from hedonistic philosophy (Figure 4), but they are used somewhat differently compared to the original philosophical definitions (e.g. Batra and Ahtola 1991; Dhar and Wertenbroch 2000; Childers et al. 2001; Voss et al. 2003; Cardoso and Pinto 2010; Paswan et al. 2010; López and Ruiz 2011; Davis and Hodges 2012; Saarijärvi et al. 2013; Mehta et al. 2014).

From the consumer market research perspective, utilitarian values reflect task orientation often related to price, quality, and convenience, while hedonic values indicate personal gratification and self-expression associated with the overall shopping experience (Holbrook and Hirschman 1982). Similarly, consumers' intrinsic and extrinsic motivations can be associated with utilitarian and hedonic values, where utilitarian values are associated with extrinsic and hedonic with intrinsic motivations (e.g. Watchravesringkan et al. 2010; Kauppinen-Räisänen et al. 2014).

CR can provide three forms of value for a consumer: functional, emotional, and social (Green and Peloza 2011) i.e. utilitarian and hedonic. However, only a few CR and certification studies have explored utilitarian and hedonic values (e.g. Ha-Brookshire and Hodges 2009; Pollach 2009; Nasir and Karakaya 2014; Andreu et al. 2015).

In some CR cases utilitarian and hedonic values can be mixed, providing both for providers and users e.g. in business processes using byproducts, recycled materials, and waste in innovative ways (see e.g. Nidumolu et al. 2009; Toppinen et al. 2015). A product's

improved environmental and social performance could lead to greater consumer motivation and loyalty, and furthermore to lower price sensitivity, insurance against negative events, and occasionally even the accrual of positive price premiums (Bhattacharya and Sen 2004). As a downside, lack of consumer motivation, awareness, and apathy are barriers for companies to gain benefits from corporate responsibility activities (Gleim et al. 2013).

In addition to the marketing literature, certification and CR are suggested to be affiliated in economics with hedonic parameters in so-called hedonic regressions (e.g. Roe et al. 2001; Carlsson and Johansson-Stenman 2012). In the case of certified forest products, e.g. the value of certification can be perceived as fundamentally hedonic (e.g. perceived fairness, social norms, social approval and status), providing no individual utilitarian value for the consumer. While several studies in the forest sector show mixed results on consumers' willingness-to-pay for forest certification (see meta-analysis by Aguilar and Cai 2013a), the economic literature suggests the usage of hedonic models for improved results validity (Roe et al. 2001; Carlsson and Johansson-Stenman 2012).

In addition to hedonic and utilitarian value categories, the social psychology and related consumer research recognizes a third value category named 'normative values related to moral values and judgment of doing right' (e.g. Lindenberg 2001; Barbopoulos and Johansson 2016). This third value category, i.e. social values, was also present in the CR consumer value study by Green and Peloza (2011). While the hedonic and utilitarian value categories (in empirical market research) can both relate only to the hedonistic egoism in the philosophical value theory, the normative value category is especially related to social value and common good also recognized in hedonistic utilitarianism. Normative values, however, are often overlooked in the consumer literature (Sanchez-Fernandez and Iniesta-Bonillo 2007).

All in all utilitarian and hedonic values and motivations have become more and more popular in consumer research. This has led to creating multiple definitions of consumer perceived value (e.g. Sweeney and Soutar 2001), along with usability and value over time (Chen and Dibb 2010; Chen and Hu 2010; Karvanen et al. 2014). SDL (Vargo and Lusch, 2004) has conceptualized this by using the terms 'value in exchange', 'value in use', and 'value in context'. By considering the overall lifetime value, SDL also considers the value contribution to consumer behavior and loyalty i.e. motivations.

This extended value consideration used in the SDL is also recommended in the forest product and services sector (Mattila 2015; Matthies et al. 2016). For example, rethinking the value propositions by creating synergies and new business models with an extended business

ecosystem can lead to new product and service innovations also in the CR and certification contexts (Nidumolu et al. 2009).

## 2.4 Psychological perspectives on information processing

While institutional theory categorizes the different carriers affecting consumer behavior (Figure 2), and the philosophy adopted in consumer market research often categorizes various values and motivations, we also need to consider the psychological process, i.e. how the institutional carriers (information), values, and motivations are processed by consumers to end up with certain kind of behavior.

The theoretical foundations in the fields of marketing, psychology, and behavioral economics include theories such as Schwartz's (1977) "Norm-Activation Theory", Ajzen's (1991) "Theory of Planned Behavior" and Stern's (1999) "Attitude-Behavior-Context" model. Contemporary psychological market research has shown that behavior is not motivated solely by consumers' utility maximization (Kahneman 2011; Carlsson and Johansson-Stenman 2012), but people often make automatic and habitual purchase decisions (Duhigg 2012). O'Rourke and Ringer (2015) noted that this research vein has "challenged rational choice theories in economics that model consumers as rational actors optimizing their utility through calculated trade-offs in price, quality, and so on" and "this rich field of research has shown that even the most straightforward acts of consumption can be complicated, conflicted, and appear irrational".

Information processing is often divided into three main categories in psychology and consumer behavior research, namely affective, cognitive, and conative (or higher-order affective) information processing (e.g. Berkowitz 1993). Fundamentally this research has its philosophical roots in the hedonistic utilitarian theory and value research (Cushman et al. 2010).

First-order affective processing is relatively basic, automatic, or unconscious and quickly associates the product / material with positive or negative information cues (Berkowitz 1993). Higher-order cognitive or conscious processing is the next phase in consumers' preference formation, possibly involving social rules to specify or support the first impression of affective processing (Berkowitz 1993). Finally, higher-order affective reactions and conscious motivations may evolve after more careful affective and cognitive processing (Berkowitz 1993, Cushman et al. 2010). Depending on the information available and the context, the action may take place after each processing phase (Shiv and Fedorikhin 1999).

Among empirical consumer studies, affective and cognitive influences on consumer choice behavior have been widely applied since studies by Schwartz (1977), Donovan and Rossiter (1982, 1994), Ajzen (1991), Stern (1999), and Shiv and Fedorikhin (1999). Most of the studies advocate that affective or emotional influences are only additional to cognitive influences such as quality, price, and perceived utility (Donovan et al. 1994). However, affective influence may have a greater role over cognitive choice behavior in spontaneous situations (Shiv and Fedorikhin 1999). In addition to cognitive and affective influences, normative or conative influences (Rook and Fisher 1995), i.e. the judgment of doing right, have been applied in consumer retail sector research to explain consumer behavior and choices (e.g. Smith and Vogt, 1995; Da Silva and Alwi 2006; Harris and Goode 2004). Such normative or conative influence can be considered to be under higher-order affective information processing (Berkowitz 1993). Normative or conative influences have especially been of interest in country-of-origin consumer studies (e.g. see meta-analysis by Verlegh and Steenkamp 1999), and recently also in CR -related consumer research (Plewa et al., 2014).

Psychological research has presented indications and assumptions that utilitarian values, and conscious and extrinsic motivations (e.g. cognitions and prevailing logics) are processed under cognitive information processing, while hedonic values, unconscious motivations, and intrinsic motivations (e.g. general norms, institutional and social rules, moral issues, culture) are processed under affective information processing. However, these associations are yet to be elaborated by cognitive psychology and neurological science (Cushman et al. 2010), and evidence exists from empirical research showing that such categorization of values and information processing is way too simplistic (Duhigg 2012).

## 2.5 State of art in the literature of consumer values and trends

This chapter reviews the to-date literature to summarize the state-of-knowledge of general consumer values and trends (Figure 5)[b] in terms of whether they represent utilitarian values (e.g. conscious and extrinsic motivations, cognitions, and prevailing logics) or hedonic values (e.g. unconscious- and intrinsic motivations, general norms, institutional- and social rules, moral issues, culture). Often times no clear straightforward categorization is observable between utilitarian values / business logics and hedonic values. However, the simplified categorization applied here is suitable for building the CDBERD model for the forest sector, which is done in the conclusions (Chapter 4). The overview also recognizes consumer megatrends as current tendencies[c] and weak signals as emerging sources of new trends[d]. Consumer megatrends are factors or patterns behind current consumer purchase decisions among the majority of the population, while weak signals are emerging issues in some contexts or driving only some consumer groups' behavior. This definition was also applied in the qualitative coding and the categorization of the findings between the megatrends and weak signals.

References of the utilitarian values and prevailing business logics are highly valued price and quality considerations among consumers (e.g. Divisekera 2010; Lee et al. 2010; Li and Hitt 2010; Abdul-Muhmin 2011; Gehrt et al. 2012; Flint et al. 2013; Nguyen and Klaus 2013; Wang and Tsai 2014). Price and quality generally work hand-in-hand according to consumer perceptions (Brucks et al. 2000).

In terms of hedonic values, strong consumer trends, such as personal health and well-being are observable (e.g. Wells 2013; Waterlander et al. 2013). Concerns of sustainability and social responsibility (e.g. Callado-Muñoz and Utrero-González 2011; Koos 2011; Kim et al. 2014; Maniatis 2015) are also common good and shared values referring to hedonic values. The search for social networking and communities is another of the contemporary

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[b] This overview is based upon my review of the literature on consumption and consumer trends / factors in international retail and e-commerce -level publications during 2010–June 2015 in international journals (a total of 218 hits, with the most relevant ones cited here in the text).

[c] Megatrend: A "general tendency or direction of a movement/change over time. A megatrend is a major trend, at global or large scale." (FAO 2014)

[d] Weak signal: "An early indication of a potentially important new event or emerging phenomenon that could become an emerging pattern, a major driver or the source of a new trend." (FAO 2014)

consumption trends in this category (Cardoso and Pinto 2010; Penz and Hogg 2011; Pookulangara and Koesler 2011; Barnes and Pressey 2012; Jun 2012; Chen and Scott 2014; Hong and Pavlou 2014). Online markets and the vast amount of available products and information have increased the need for building trust and credibility in the overall value chain, which has placed impetus in adopting the usage of third-party verification and certification systems (Kantsperger and Kunz 2010; Wang et al. 2010; Shainesh 2012; Chiu et al. 2013; Lu et al. 2013; Watson et al. 2013; Brun et al. 2014). Trust and credibility are fundamentally also hedonic product values.

Many weak signals have hedonic value basis such as local consumption (Megicks 2012; Lang et al. 2014), social- and cultural heritage, and environmental benefits (Morales-Nin et al. 2013, Ailawadi et al. 2014). Among the weak signals are also some new competitive business logics offering utilitarian value for consumers such as faster delivery times (Stanton et al. 2012) along with value co-creation and innovations among different actors and consumers (Bailey and Seock 2010; Chen 2013; Kim and Martinez 2013; Kang 2014; Chen et al. 2015). Many of these weak signals and business logics are concretized in the market concept of the sharing economy and peer-to-peer markets e.g. Airbnb and Uber (Cohen and Kietzman 2014). In addition, establishing and recognizing small consumer communities has enabled, together with more rapid diffusion of information and technological enhancements, the creation of more individual and customized products and services, but also the provision of do-it-yourself solutions (Doherty and Ellis-Chadwick 2010; Hsiao et al. 2010; Brynjolfsson et al. 2011; Ghose et al. 2012). These issues can be seen as part of consumer demand for increased alignment of company values with their own (see e.g. Freeman 1984; den Hond et al. 2014 for company alignment).

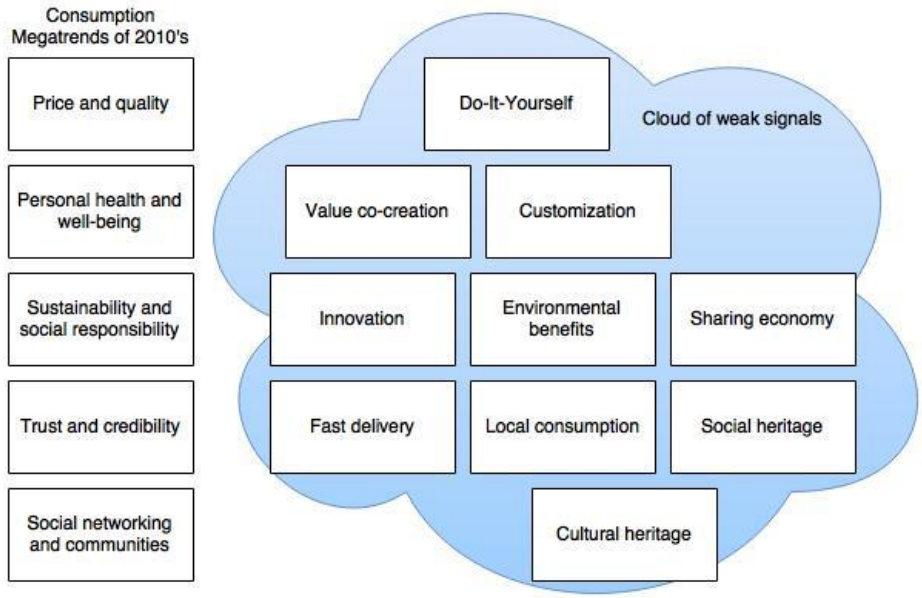


**Figure 5.** Main themes based upon literature review of consumer values and trends between 2010–June 2015

## 2.6 Literature review and identification of research gap in forest product consumer studies

While the findings of previous sections concerning consumer values and trends are crosscutting themes, consumer and user values are instead more fundamental and individually determined by consumers in various contexts (Vargo and Lusch 2004). Consumer values in the case of certified wood products have been studied by applying various stated preference elicitation methods. However, most of this literature has omitted the recent developments in online markets and trends, which have revolutionized the consumption culture (Klein and Ford 2003, Deuze 2006). Neither utilitarian and hedonic values, extrinsic and intrinsic motivations, nor information processing have been considered in this branch of the literature, although these approaches are dominant in the general consumption literature and market research (e.g. Dhar and Wertenbroch 2000; Watchravesringkan et al. 2010; O'Rourke and Ringer 2015).

The stated preferences and willingness-to-pay premiums, along with the determination of market shares for certified wood products, have been analyzed in the US (Ozanne and Vlosky 1997; Ozanne and Smith 1998; Vlosky et al. 1999; Grönroos and Bowyer 1999; Aguilar and Vlosky 2007), Canada (Forsyth et al. 1999; Kozak et al. 2004), the UK and Norway (Veisten 2002; Veisten 2007) based on consumer survey research. The study by Vlosky et al. (1999) suggests a conceptual model for consumer intrinsic motivations and willingness-to-pay for forest product certification, however, the scaled questions in their survey are not actually built to consider the essence of intrinsic motivations. All in all, the results of these stated preference surveys indicate that a little less than one third of US consumers have expressed their willingness to pay more for eco-friendly wood products, while this share is likely to be somewhat higher in Europe. However, consumer survey results from 1997, analyzed by Rametsteiner et al. (1998), show that only approximately 6% of respondents in the survey conducted in the four largest European markets including Germany, France, Italy, and the UK were willing to pay more for wood products from sustainable sources. Overall, estimates of consumers' willingness-to-pay premiums for certified wood products reported in the literature range from 1.0% to 39.3% over non-certified options (Cai and Aguilar 2013a).

The conjoint analysis method has also been applied in forest certification consumer market research (e.g. Bigsby and Ozanne 2002; Anderson and Hansen 2004a, Anderson and Hansen 2004b, Anderson et al. 2005, Roos and Hugosson 2008; Thompson et al. 2010; Choi et al. 2011). For example, Anderson and Hansen (2004a) detected a more than 30% drop in market share when a certified product was offered at a 2% premium over a non-certified option. By comparing a certified versus a non-certified product, Anderson and Hansen (2004b) found that both retailers and consumers cut down their supplies and consumption of certified products when price premiums were introduced. However, price premiums may exist if a direct relation between certification and legality is established and communicated to consumers, as shown in a field experiment in Guatemala (van Kempen et al. 2009). In addition to demographic segments (e.g. in Anderson and Hansen 2004a), Thompson et al. 2010 also found psychographic segments of consumers willing to choose and pay for the certification of forest products.

Contemporary indirect preference elicitation methods, such as the Discrete Choice Experiment (DCE) -method (Louviere 1992; Louviere et. al 2010), have only been applied for wood products by Veisten (2007), Aguilar and Cai (2010), Cai and Aguilar (2013b), Sakagami et al. (2014), and Shoji et al. (2014). These studies have shown that raw material quality and origin are typically more important for consumers than the implementation of

(forest or CoC) certification. Aguilar and Cai (2010) also demonstrated that various levels of price premiums may exist, but the consequence of a higher premium is a decreased market share, suggesting that a segment of consumers might remain indifferent to greater price changes and would continue to prefer certified products (e.g. 3% of consumers when the certified option is priced at a 50% premium) (Aguilar and Cai 2010).

Besides the price effect, survey-based studies have found that consumers commonly consider environmental label information and credibility of the certification organization along with wood product origin in their purchasing decisions (Teisl et al. 2002; Basu et al. 2003; O'Brien and Teisl 2004; Leire and Thidell 2005). Environmental attributes in the case of outdoor wooden decking materials were also valued very highly by Norwegian consumers according to the results of a conjoint analysis by Roos and Nyrud (2008).

Wood origin is one key attribute for consumers when making a purchasing decision (Aguilar and Vlosky 2007). Studies in the US market show consumer preference for wood products sourced from the domestic market (O'Brien and Teisl 2004). Wood products from temperate forests have additionally been preferred over tropical products, e.g. Kozak et al. (2004) reported negative consumer preferences toward tropical hardwoods in Canada based on a qualitative study. This finding is congruent with the results of Aguilar and Cai (2010) for the US and UK markets. However, the results of Aguilar and Cai (2010) suggest that a forest certification label could partly offset negative consumer perceptions of tropical wood products.

In addition, Aguilar and Cai (2010) demonstrated that younger consumers in the US are more sensitive to price changes, while older respondents have stronger preferences for certified products. In contrast, younger respondents in the UK were less price sensitive, while older respondents in the UK had a stronger preference for government agency-issued labels. Both in the US and UK, consumers with higher incomes preferred certified products to unlabeled products. However, in a meta-analysis Cai and Aguilar (2013a) found income level to be insignificant for forest certification in terms of consumer preferences.

Studies concerning consumer preferences on the credibility of certification organizations suggest that consumers perceive private non-governmental organizations (NGOs) as more trustworthy entities for issuing forest certificates than governments (Ozanne and Vlosky 1997; Rametsteiner et al. 1998; Ozanne and Vlosky 2003). However, some later studies among US and UK consumers show no statistically significant differences between the credibility of governments and NGOs as certifying entities (O'Brien and Teisl 2004; Aguilar and Cai 2010). There are also some conflicting results demonstrating that among US

customers a federal agency is the most trustable entity for a certifier, followed by environmental groups and independent certifiers, leaving industry groups to be the least trustworthy among consumers (Teisl et al. 2002).

Interestingly, contrastingly to general consumer preferences identified in Macias and Knowles (2011), architects in the US consider price and wood origin as the most important factors when specifying hardwood flooring, leaving environmental certification as the least important factor (Macias and Knowles 2011). Environmental-minded architects favored the domestic origin of wood over price and environmental certification.

All in all, environmental or forest certification can be a major factor behind consumer preferences when other product attributes (e.g. price or raw material origin) are held constant. In addition, when only the assessment of product "willingness-to-pay for premium" is considered, consumer reactions and market shares of certified products seem to vary based on wood product type and end use (Grönroos and Bowyer 1999; Ozanne and Vlosky 2003; Aguilar and Cai 2010). In a meta-analysis of existing studies on consumer's willingness-to-pay premiums for certified wood products, Cai and Aguilar (2013a) also found that frequently purchased wood products and wood products with lower base prices tend to capture higher than average percentage premiums.

In sum, the existing consumer market research in the case of forest products has touched upon some of the relevant themes concerning general consumer trends and value research (Chapter 2.5), i.e. the role of product quality, raw material origin, or credibility of the information supplier, whereas the themes e.g. different forms of sustainability and social responsibility, personal health and well-being, social networking and communities have been studied less in the forest product context[e]. However, these general trends along with the weak signals could also have potential in new product and service innovations in the forest sector and thus they are considered in building the CDBERD model for the forest sector.

[e] An exception is Wan and Toppinen's (2016) study on Lifestyles of Health and Sustainability (LOHAS) consumers in China.

# 3. METHODOLOGY AND RESULTS

This doctoral thesis consists of one book chapter and three peer-reviewed articles, each using different methodologies including a synthesis of the relevant literature and a conceptual study (Article I), a qualitative interviews case study (Article II), a quantitative questionnaire, and factor analysis (Article III) and Discrete Choice Experiment (DCE) (Article IV). Article I introduces the overall network of stakeholders from the CR perspective, Article II explores the regulatory impact on the certification uptake, consumer norms and values on forest product sustainability are assessed in Article III, and finally consumer choice behavior is analyzed in Article IV. The objective of this dissertation is to build understanding on the institutional carriers of certified forest products and the business ecosystem from the consumer perspective to develop a research and development model for the sector. Table 1 summarizes the methodologies, main results, and implications from the institutional point of view. Chapters 3.1–3.4 introduce the methods and discuss the key findings of the research articles. Chapter 4.1 will synthesize the results and implications of individual articles from the business ecosystem point of view.

**Table 1.** Summary of methods and results

| **Article** | **I** | **II** | **III** | **IV** |
|---|---|---|---|---|
| **Type of research** | Conceptual study | Empirical | Empirical | Empirical |
| **Method** | Synthesis of literature and conceptual study | Qualitative interviews case study | Multivariate factor analysis and one-way analysis of variance (ANOVA) | Discrete Choice Experiment (DCE), multinomial logit, and latent class -models |
| **Data sources** | Peer-reviewed journals, company documents | 39 semi-structured interviews of stakeholders *ex-ante* and *ex-post* EUTR | Quantitative questionnaire, 208 completed responses | Online survey of 231 responses with 2772 choice tasks. |
| **Target population (and product)** | Finnish companies, global CR strategies | Finnish wood industry value chain stakeholders | Finnish consumers (outdoor decking materials) | Finnish consumers (outdoor decking materials) |
| **Main results** | Establishment of cross-sectoral stakeholder communication and understanding the potential value addition and synergies from the partnerships, e.g. cross-sectoral alignment of institutional carriers. | Regulative initiatives are only slowly changing cultural-cognitive measures including the overall strategies of companies. Regulative initiatives create new regulative carriers, which should be recognized and harnessed in the business ecosystem development e.g. partnerships. | Consumer value dimensions on wood products: price, sustainability information, origin, consumer sustainability activity, product image, and quality. | Price and preference for choosing wood products as dominant factors for consumer choice and market shares, followed by origin and certificates. Relational carriers may also bring competitive advantage and even help to introduce new product and service innovations. Well-communicated sustainability features and domestic origin had a positive effect on the product image, giving competitive advantage over non-certified and imported products. |
| ***Implications*** | *More efficient CR communication through normative carriers i.e. affective marketing communication. Green governmental procurement policies, i.e. regulative carriers, can act as a catalyst for promoting CR across sector boundaries.* | *Customer-facing strategies without end-user focus prevail in the Finnish Forest sector, while public and integrated outward-facing strategies could be the key for open-source, peer-to-peer and end-user innovations as well as for meeting trends.* | *General values and norms could be better considered in the new product and service development in the forest sector. Also communication should target the overall normative consumer values.* | *Environmental management and communication can work as artifacts improving not only the perceived value of the product-, but also the overall sectoral image.* |

## 3.1 Stakeholders and corporate responsibility perspective (Article I)

Article I is a review considering CR implementation and interaction with stakeholder groups in the forest industry. Based on a review of the literature and industry documents on corporate responsibility it provides insights into industry practices. The article concludes that sustainable value creation and stakeholder engagement in the forest industry is essentially composed of the following elements. The first element considers the establishment of a coherent CR management system (e.g., decisions on sustainability investments and forms of stakeholder dialogue), and an extension of product-level thinking on value creation to include recycling and disposal (e.g., Life Cycle Assessments) and the incorporation of industry byproducts and investments into flexible production systems to produce both inter-firm and inter-sectorial synergies and advance sustainability at a more systemic level. The second element highlights more efficient and transparent communication of the sector's sustainability efforts to its stakeholders, e.g., not only using eco-labels and certificates, but also utilizing new innovations for ensuring future competitiveness and the acceptability of operations at a more general level. This can be based on such things as improved energy and resource efficiency, targeting more synergic value creation between various stages in the forest-wood value chain and finding better solutions for increasing customers' quality of life by providing durable and safe products with integrated service components (e.g., wooden houses heated with renewable energy) instead of simply focusing on tangible products (e.g., just wooden houses). Consequently, sustainability is perceived to improve the forest sector's competitive advantage via deepened stakeholder engagement. Sustainability together with more efficient stakeholder engagement can build a more harmonized and synergistic forest sector business ecosystem via sustainability performance measurement, communication, identified needs of cross-sectorial and stakeholder collaboration, and the means to enhance forest industry managerial culture for sustainability.

A remaining challenge identified in Article I is how to develop *CR performance measurement* systems that can increasingly clearly link the implementation of CR practices with traditional corporate objectives (e.g., profitability and market growth). One potential concrete business benefit of such systems is the simultaneous recognition of both resource-efficiency gains (e.g., reducing the usage of raw materials, resulting in ecological benefits and decreasing costs) and profit generation potential (e.g., designing business processes to meet specific stakeholder needs). By transparently aligning the implementation of CR practices with the economic objectives of companies, the requirements of heterogeneous

stakeholder groups, such as forest owners and consumers, can also be considered in a more balanced way (see e.g. Panwar et al. 2006; Jamali et al. 2008). In addition, questions of equity and the distribution of economic benefits throughout the entire value chain are issues that also need to be tackled when developing new business logics.

More efficient *CR communication* through e.g. normative carriers and stakeholder engagement (Clarkson 1995; Manetti 2011) therefore also becomes of increasing importance, as establishing long-term dialogue and solid company/stakeholder/local-community relationships are a pre-requisite. For example, the present transition of the pulp and paper industry towards reliance on plantations as sources of fast-growing fiber is typically based on water intensive, genetically modified monocultures whose long-term effect (see, e.g., D'Amato 2015) on both forest ecosystem services and local-level firm interdependencies with communities is currently not well understood. From the sustainability communication perspective, better understanding of stakeholder needs and use of improved communication channels, which also target consumers, could allow for more efficient dissemination of information for benchmarking wood with other material sectors. A higher level of general awareness and recognition of wood as a genuinely renewable and recyclable material could eventually lead to sustainable leadership becoming comparable to larger material markets in the forest-based sector. Here, various governmental instruments, i.e. regulative carriers, could also act as a catalyst for promoting a higher level of CR across sector boundaries as advocated in Article I.

The use of *cross-sectoral collaboration* could be beneficial for creating synergies and new innovations crucial for the evolution and success of the forest sector. As Article I shows, some large forest industry companies are shifting their strategies towards cross-sectoral collaborations, including areas such as the production of renewable fuels, chemicals, bio-based fibrils, and wood composite materials. From the sustainability perspective, such a strategy may bring some benefits by using the forest sector knowledge in raw material sourcing and production. The challenge for creating cross-sector partnerships is not only in connecting interested parties, but also in finding right people and relevant issues within problem domains (see also Koschmann et al. 2012). The pivotal issue is thus in the establishment of cross-sectoral communication and understanding the value basis and potential value-added benefits from the partnerships, i.e. cross-sectoral alignment of institutional carriers.

Eventually, the question is whether sufficient strategic commitment and organizational alignment of institutional carriers exists among the top management and the creation of a

*company culture of sustainable leadership* in the forest industry? In line with Heikkurinen and Bonnedahl (2013), the articles observe that the key question is whether forest industry CR practices mainly deal with a weak form of sustainability. If this is true, there may be a lack of intrinsic motivation to establish long-term stakeholder relationships, as the implementation of CR and related corporate strategies would then simply be the result of reactive actions driven by external stakeholder pressures (see Matten and Moon 2008). To gain more value from CR, the entire value chains need to co-create value with stakeholders and create synergistic strategies and practices to enhance the industry image among consumers.

## 3.2 Regulatory impact on certification (Article II)

The regulative carriers influencing the institution of forest certification were assessed in Article II. The study was especially set up to explore whether more integrated strategies and collaborative networks have emerged for enhanced communications throughout the industry value chains, as the institutional changes are generally seen as good opportunities for such co-evolution within the business ecosystem (Lukkari and Parvinen 2008). The empirical part of the research was a qualitative interview study carried out by conducting 39 semi-structured interviews of stakeholders involving wood industry value chain members and experts in Finland during 2011–12 and in the *ex-post* phase of the European Union Timber Regulation (EUTR) (EU No 995/2010) in 2015. EUTR is the first reform in the EU aimed at prohibiting the trade and import of illegally harvested timber and timber products (European Commission 2010). Since data collection was performed by conducting interviews along with collecting evolving EU legislation documentation over a nearly five-year time span, the process provided the possibility of comprehensively reflecting upon its content.

The results of this qualitative case study confirmed that business-to-business customer demand continues to be the major driver for the forest and Chain-of-Custody (CoC) certification uptake in European context (Schepers 2010). Moreover, the demand for certified products does not inherently originate from consumer markets (Schepers 2010; Räty et al. 2016), but the pressure comes from the retail level, global corporations, governments, NGOs, and investors (McNichol 2002; Bartley 2003; Gulbrandsen 2006; Overdevest 2010; Schepers 2010; Cashore and Stone 2012; Matilainen 2013; Johansson 2014).

According to the results, the interviewed Finnish wood industry companies have currently established customer-facing forest and CoC certification strategies as adopted in the industry total quality management (Bessant 1990; Dean and Bowen 1994). These companies, however, seem to mainly be conveying the certification information to their industrial customers, without being more deeply aware of their consumer or customer values or trying to communicate their own company values in a similar manner as mainstream customer relationship management (Grönroos 2000). Forest certificates therefore seem to have been adopted fairly spontaneously by these companies, and implementing the industry-dominant culture without intent of strategic planning. Only a few wood industry companies in Finland have developed more outward-facing strategies (see e.g. Frohlich and Westbrook 2001), in which they also use certification for marketing and communicating their company values or product-level environmental claims.

However, all companies in the sample provided information to their customers and stakeholders without knowing more explicitly what the actual value and use of this information is for their customers. In theory, a better understanding of customer value could contribute to more product and service innovations and improved customer engagement and loyalty (e.g. Grönroos 2000; Lee et al. 2008). In general, no established cooperation was exhibited between the companies and stakeholders for publicly communicating sustainability issues or attempts to capture value based on wood raw material certification.

While institutional changes are generally seen as good opportunities to integrate strategies and improve the cohesiveness of the entire value network (Lukkari and Parvinen 2008), the beginning of the implementation period of the EUTR has shown that the materialized changes in the overall Finnish wood industry value chain are so insignificant that the overall situation is likely to remain as it is, with no significant changes in certification strategies and uptake. The findings furthermore suggest that the EUTR is not likely to impact domestic timber producers and large importers with existing certification in Finland, while the major impact will be on Small and Medium-sized Enterprises (SMEs) importing timber from outside the EU, with no existing traceability systems and thus carried by downstream wholesale/retail companies. These findings were in line with Trishkin et al. (2015) noting that SMEs in Russia are most likely to find it difficult to deal with the EUTR requirements and due diligence because of a lack of certificates along with human and technical resources. The interviewed managers and experts in the study were skeptical that these SMEs in particular would adopt forest and CoC certification in the future, instead of less costly legality verification systems, which would reflect in diminishing role of forest certification among these companies.

The article's results of the *ex-post* EUTR analysis further confirmed that only SMEs without existing traceability systems have been forced to consider the establishment of new legality verification systems whereas the state of business-as-usual has continued for the other players. Contrary to the expert opinions, implementation of forest and CoC certification is the preferred option for the majority of SMEs instead of other legality verification systems, due to forest certification requirements and demand from larger wholesale/retail companies. This finding was also in line with Cashore and Stone (2012), who suggested that public policies such as the Lacey Act in the US and the EUTR, with formal requirements for timber legality verification, may have a positive effect on the uptake of forest certification. These findings also give support to the previous observation that only minor changes and incremental costs are likely to occur for firms with existing forest and CoC certifications (EFI 2011, Brown and Bird 2007), but some shifts in international trade flows from more reliable sources are nevertheless likely to happen (UNECE 2013).

The *ex-post* EUTR results also confirmed that the EUTR has been unable to create any substantial end-consumer demand for certified timber products, and end-consumer demand for forest and CoC certification therefore continue to be of limited scope, as also suggested by Räty et al. (2016). However, some interest in certification is also originating from large-scale construction companies looking for green building projects and wholesale-/retail-level companies initiating certification schemes (Wang et al. 2014).

Based on Article II, the EUTR appears to enforce the supplier-client relations in the Finnish wood industry value chain. However, the sector still lacks public and integrated outward-facing strategies to enhance the creation of added value from the forest certificates at each value-chain level and eventually in the broader competing material markets. In this regard, the existence of two parallel forest certificates (Forest Steward ship Council (FSC) and the Programme for the Endorsement of Forest Certification schemes (PEFC)) appears to hamper the effective communication and building of an image of sustainable wood products among customers and end consumers, who are also exposed to general environmental communication e.g. in the building material markets.

## 3.3 Consumer norms and values on sustainability and forest products (Article III)

Article III aimed to scrutinize normative carriers and values by assessing how consumers perceive the sustainability of wooden products in the Finnish context. The four dimensions of sustainability-based consumer value were identified using a multivariate analysis on survey data consisting of 208 responses collected in the home and building material retail sector in May–June 2013. The direct stated preference survey addressed the consumers' conscious motivations towards sustainability and forest certification.

In the empirical part of Article III a new measurement scale for perceived consumer value was designed and implemented in the sustainability assessment of wooden terrace materials. The study revealed that when using a specific example of wooden terrace materials, consumer value is a four-dimensional construct in addition to a price dimension, consisting of 1) Information and origin, 2) Consumer activity, 3) Product image, and 4) Quality. The article reinforced existing knowledge on the environmental and social sustainability of wood products as identified in the previous literature and found some, albeit weak, indications on the ability of the built measurement scale to segment the consumer market by key respondent background factors.

Some limitations of research design apply to the data and analyses employed in this study, which is not based upon a representative sample of consumers. The respondents were purposively selected among consumers visiting building material retail shops during a certain time period. This study, as many earlier ones, is additionally not sufficiently detailed in identifying the profile of the environmentally and socially sensitive consumer segment for wood products, which would allow for the practical assessment of the attractiveness of the market with regard to market size and stability. However, the article explores some potential avenues from the perspective of sustainability communication targeted to these basic consumer segments.

Regarding respondent background characteristics, there was indication that in comparison to the "young adults" reference age group, all older age groups were relatively more demanding, emphasizing the first dimension of "Information and origin" as a basis of product-level social and environmental sustainability in their (stated) purchasing decisions. The same finding held true when comparing female respondents with males. From the sustainability marketing perspective, one possible solution for attracting the attention of these

more demanding consumer groups could be to increase detailed verbal information and improve the information content (Belz and Peattie 2012; Gleim et al. 2013), along with using digital and social media communication applications.

Similarly the concept of ”Consumer activity” was detected to more strongly influence the perceived value among elderly and female respondents. The interpretation here is that to a larger extent these consumer groups actively search for more environmental and sustainable consumption options, while the other consumer groups show some degree of consumer apathy (see e.g. Gleim et al. 2013). A possible solution to activate consumers could be to launch awareness campaigns and environmental education to influence social norms (Gleim et al. 2013).

The product dimension “Quality” was highly valued by all consumer groups; however, some differences between the age groups were found. On the other hand, the “Product image” dimension was the least valued product attribute, also exhibiting some differences between age groups. Young and middle-aged respondent groups had stronger preferences for these latter two value dimensions. The existing literature suggests the application of greenness only as a complementary product attribute as a possible solution for advancing sustainable consumption behavior (Gleim et al. 2013), and to establish sustainable/responsible branding with lead consumers and brand communities (Kujala et al. 2011).

The most essential consumer value dimension, named “Information and origin”, was characterized by a variety of information issues concerning the sustainable origin of wood materials and social issues such as product legality. These also include a requirement for more information about the environmental effects of wood products and health impacts, confirming the preliminary results presented in Toppinen et al. (2013).

## 3.4 Consumer choice behavior and habits (Article IV)

The consumer cultural-cognitive carriers and behavior prevailing in the certified forest product markets were approached in Article IV using the indirect stated preference elicitation method, i.e. DCE (Louviere 1992). The data of 221 consumers and 2652 choice tasks was collected in Finland via an Internet survey conducted on a platform resembling a digital market place and mirroring a shopping situation during 2015.

The DCE is a relatively new method, but apart from Veisten (2007), Aguilar and Cai (2010), Cai and Aguilar (2013b), Sakagami et al. (2014), and Shoji et al. (2014), it has seldom been applied in forest sector consumer studies. The advantage of DCE over traditional conjoint analysis methods is that it better mimics a purchase situation where the respondent has to choose one product among multiple products with different attribute combinations present in the market.

Existing DCE forest certification consumer studies have shown that raw material quality and origin are more important attributes for consumers than the use of forest certification. Moreover, Cai and Aguilar's (2013a) meta-analysis concluded that only a few cases exist where some consumer segments have shown a significant percentage of willingness-to-pay for forest certification, and this situation is more likely to happen with frequently purchased wood products and in the case of wood products with lower base prices.

Our results for mimicking the e-commerce purchase situation for terrace materials confirmed previous studies suggesting that raw material and price are the most important choice attributes, but also that certification and raw material origin in particular significantly impact consumer choices and product markets shares (e.g. Macias and Knowles 2011). The results from multinomial logit model simulations suggest that the market shares for wood products are greater when the products are domestic and carry environmental certificates. Concrete terrace tiles, on the other hand, gain market shares only when compared to wood products that are imported and non-certified. When wood raw material origin and certification attributes are identical or not communicated at all, the market share for concrete terrace tiles increases. By implication, the use of domestic and certified forest sector products are likely to have some competitive advantage against other material (namely concrete) sectors. The results also showed habitual choice behavior, as some consumer groups in the choice tasks constantly preferred certain materials, e.g. high-processed wood products, wood composites, and concrete tiles. However, habitual purchasing is difficult to change by any communication efforts (Duhigg 2012).

Results from Article IV suggest that raw material origin and certification can increase the market share of forest sector products in the larger terrace material markets against substitute products. Several previous studies and observations suggest that forest certifications and the use of eco-labels are not effective in increasing product demand and creating any price premiums (see e.g. Räty et al. 2016). However, the simulations of this study imply that those results may not be valid, if the overall sectoral image concerning origin and sustainability is included. Article IV results therefore support the development of more integrated and

harmonized communication across the sector value chains for improved sectoral image. Beyond the scope of the research design, digital marketing and e-commerce hold a new significant potential for the communication of these intangible product attributes.

# 4. DISCUSSION AND CONCLUSIONS

## 4.1 Synthesizing results from the business ecosystem point of view

This chapter synthesizes the article results from the business ecosystem point of view (Table 1) and frames these with the CDBERD model for the forest sector. Methodologically, various stated preference methods combine and address different hedonic theories. For example, more direct stated preference surveys (e.g. simple Likert scale surveys) consider more consumers' conscious decisions, while unconscious preferences and values can also be addressed through indirect stated preference elicitation methods, e.g. DCEs (Bargh, 2002; Mueller et al. 2010)[f]. Consequently, direct stated preference surveys address conscious motivational hedonism, while indirect preference elicitation methods include some values according to the unconscious one. However, both conscious and unconscious motivations, along with hedonic and utilitarian values, can be considered for various research settings by carefully planning the observed and controlled attributes. More robust results and better understanding of consumer preferences can be achieved by combing various elicitation methods (Veisten 2007; Mueller et al. 2010), which was also the starting point for this dissertation.

From the business ecosystem synthesis perspective, conceptual Article I focused on the stakeholder perspective on values in exchange, values in use, and values in various contexts (Vargo and Lusch 2004; 2010). This synthesis of literature helps to understand the different stakeholders and actors along with the role of various institutions involved in the business ecosystem for certified forest products. For the CDBERD model, the outline of Article I is applied to recognize key stakeholders, their resources, and relations i.e. to create a forest sector stakeholder business ecosystem for more harmonized and synergic value creation also

[f] Louviere et al. (2010) revealed that many studies claiming to utilize Conjoint Analyses (CA) are really performing DCE.

with surrounding institutions and sectors. The evolving bioeconomy is essential, including considerations on corporate responsibility, forest certification, and the sustainable production of forest products and services, as these issues can be seen to generate negotiation power and competitive advantage to the forest sector. This could be used in developing stakeholder communication and in understanding the potential value addition and synergies from the partnerships, e.g. the cross-sectoral alignment of institutional carriers. Article I also suggests more efficient CR communication through e.g. normative carriers, meaning more effective marketing communication instead of cognitive communications concerning e.g. price premiums, market shares, and market access. Finally green governmental procurement policies, i.e. regulative carriers, are seen to act as a catalyst for promoting CR across sector boundaries in the reviewed literature.

From the business ecosystem synthesis perspective, Article II analyzes the regulative institutional carriers e.g. forest sector and relational laws, certification uptake routines, and company strategies targeting consumers. For the CDBERD model the implication is that any regulative initiatives only slowly change cultural-cognitive measures including company overall strategies, while normative initiatives are often the initial and most influential according to institutional theory (Scott 2008). However, the regulative initiatives create new regulative carriers, which should be recognized and harnessed in business ecosystem development. In this particular case the identified carriers included EUTR regulation and national laws strictly creating new requirements (i.e. symbolic value). In comparison, other sectors' laws and regulations remained unchanged, creating a disadvantage for the forest sector, but with a strategic change this could be turned into a competitive advantage and sectoral competitive advantage in terms of sustainability-, value-chain- and origin management systems (relational). Among the regulative carriers, the forest certificates' role as a routine was enforced without any additional value from the consumer perspective, because of only minor changes in company strategies, business models, and codes-of-conducts i.e. in regulative artifacts set to align activities with the new regulations. Moreover, customer-facing strategies without end-user focus prevail in the Finnish Forest sector, while public and integrated outward-facing strategies could be the key for open-source, peer-to-peer, and end-user innovations along with meeting trends.

For the business ecosystem synthesis, Article III revealed prevalence of some existing institutional norms and carriers especially related to consumer perceptions of certified forest products. For example issues were raised in terms of symbolic norms and values guiding consumer behavior, i.e. symbolic carriers such as price, sustainability information, origin,

consumer sustainability activity, product image, and quality. Price and quality are general routines across different products, services, and sectors that consumers look for, as observed in the review on consumer market trends (Chapter 2.5), while sustainability information, i.e. certificates as normative artifacts, are also recognized in general literatures. As forest certification is associated with general sustainability along with raw material origin, and social and health issues, it means that certification communication could more efficiently use these relational carriers in marketing communication. Other relational carriers found from the general review on consumer market trends (Chapter 2.5) included personal health and well-being, trust and credibility, social networking and communities, and a wide range of weak signals. These more general values and norms could be better considered in future product and service development in the forest sector, and therefore they are considered in the CDBERD model.

Furthermore, findings of Article IV revealed that cultural-cognitive carriers prevail in the market for certified forest products in the business ecosystem context. Product material and price were found to be the dominant product attributes for consumer choice of terrace materials in Finland. Other material characteristics, such as origin and certificates, were found to be relational carriers, as they also held significance in choice making, but they were considered only after material and price. However, it should be borne in mind that relational cultural-cognitive carriers can also include many other options of general consumer behavior (e.g. social networks, do-it-yourself, local consumption, fast delivery, co-value creation and -innovation, sharing economy, or the use of peer-to-peer market places (Chapter 2.5)). These relational carriers may also potentially bring competitive advantage, and even help introduce new product and service innovations. Some materials showed habitual choice behavior, i.e. routines. For example certain consumer segments always chose high-processed wood products, while others chose wood composites or concrete tiles, irrespective of other product attributes. Overall, well-communicated sustainability features and domestic origin had a positive effect on product image, giving competitive advantage over non-sustainable and imported products. Environmental management and communication practices can therefore work as artifacts improving not only product, but also overall sectoral image.

## 4.2 Implications for research and development

The institutional evolution of the forest sector, as with many other large and traditional sectors, can be seen as quite slow, incremental, and limited to the core business, rather than searching for consumer-driven market solutions from the extended business ecosystem. For example, despite some recent examples on inter-sectoral alliances and innovations offering new products, raw materials, and even services for business-to-business markets, the sector still lacks solutions for consumer markets. However, better understanding of the overall business ecosystem and finding integrated partnership and consumer-driven research and development models for new product and service innovations could produce more consumer market solutions. Considering global bioeconomy development, companies in the forest sector have the potential to be seen as attractive partners in the business ecosystem by offering knowledge and value in sustainable raw material and services management, sourcing, and production.

The results of the individual articles are synthesized in the CDBERD model for the forest sector (Figure 6). The themes scrutinized in the model include consumer trends, values and norms, i.e. hedonic and utilitarian values (pull), resources, technologies and regulations (push), and organization strategy, consumer choice behavior, and business logics (process). This is a simplified thematic presentation of the institutional pillars (i.e. normative, regulative, and cultural-cognitive) and carriers (symbolic, relational, routines, artifacts), which were the research topics and findings of the individual articles (Articles I–IV).

The business ecosystem recognizes the parallel institutions with common consumer markets and evolving issues (e.g. regulations, technologies, resources, business logics, market environments and potentials). The broader business ecosystem approach was considered in the articles, but it was particularly considered in Chapter 2.5 on general consumer values and trends, which were used as proxies of parallel institutions. As the general consumer values and trends represent the prevailing business ecosystem and potential for new product and service development, they are also introduced in Figure 6.

As the idea of institutional and business ecosystem models in general, the created research and development model in particular tries to better consider interactions, value co-creation, and constant evolution undergoing in the consumer markets. The state of general consumer trends and the prevailing values towards the forest sector also represented in the frame (Figure 6) show that sustainability has increasing value and meaningfulness among consumers and industries. This is supported by broad contemporary CR and sustainability

literature and e.g. Nidumolu et al. (2009) suggest that it is basically impossible to introduce new products and services to the markets that are unsustainable and cause damage to societies and nature.

· Pull · Process · Push

## Frame

· **"Trendscrape": identify consumer trends, values, and norms, and define experience principles, for example**
-Consumer value dimensions on wood products: price, sustainability information, origin, consumer sustainability activity, product image, and quality (Article III).
-General consumer trends in values: price and quality, personal health and well-being, sustainability and social responsibility, trust and credibility, social networking and communities, and weak signals: local consumption, social and cultural heritage, and environmental benefits (Chapter 2.5).
*-Implication: Consumer expectations for forest products and services are equivalent as in general consumer markets, which is also the experience principle / threshold for new product and service innovations. Communication should also target overall normative consumer values.*

· **Map business opportunity and strategy based on market and organization factors: consumer choice behavior, business logics, and organization strategies, for example**
- Price and preferences for wood as dominant factors for consumer choice and market shares, followed by origin and certificates (Article IV).
-General consumption trends and weak signals in business logics targeting consumers: fast delivery, co-value creation and innovation, customized- and do-it-yourself solutions, sharing economy (e.g. peer-to-peer market places) etc. (Chapter 2.5).
-Customer-facing strategies without end-user focus prevail in the Finnish Forest sector (Article II).
*- Implication: Establishment of keystone organization with public and integrated outward-facing strategies to accelerate the development of open-source, peer-to-peer, and end-user innovations along with meeting trends by organizing hackathons, innovation competitions, reverse pitching etc.*

· **Identify resource, technology and regulation -developments; assess current environment, for example**
- Establishment of cross-sectoral stakeholder communication and understanding the potential value addition and synergies from the partnerships, e.g. cross-sectoral alignment of institutional carriers along with resources e.g. in the field of biofuels, chemicals, bio-based fibrils, and wood composite materials (Article I).
-Breaking the routines: constantly identifying new policy developments and opportunities for new partnerships (Article II). The same applies to emerging resources and technologies.
*- Implication: Integration of resources and finding synergies e.g. by making better use of bioeconomy development, established sustainability management systems and certificates with new user / consumer -driven strategies and cross-sectoral partnerships.*

**Figure 6.** The model and implications for Consumer-Driven Business Ecosystem Research and Development (CDBERD)

The developed CDBERD model (Figure 6) has already been applied in initiating some ongoing research and development projects in the forest sector, and it is the task of future research to test and develop the applicability of the model for the sector. Examples of such projects include virtual reality in the forest sector, 3D-printed wood composite profiles for modular wooden furniture, and the use of a social media market place for primary producers, e.g. forest owners. All these projects have begun with elaboration of the consumer and organization trends including norms, values, and logics listed in the model. Secondly, the available resources and emerging technologies along with the regulative environment have been screened. According to the author's own experiences, the results of individual articles summarized in Figure 6 can be extremely useful in initiating these projects and guiding the development of new business models.

Co-creation, i.e. collecting resources and establishing partnerships along with designing a product and/or system to also implement the general trends as much as possible is the foreseen next phase in the initiated projects, following the braided design model (Figure 3, Kilain et al. 2015). The model targets fast prototyping, which can currently be achieved with low resources in many cases, even in the traditionally resource-intensive forest sector. For example, virtual reality applications produced in the established start-up community are fast and rather cheap prototypes, and some of them only require little refinements to be born as market products. In the case of 3D-printed wood composites, 3D printing again is very cheap prototyping, and the know-how and partnerships are found among the emerging businesses. In the third project example of a primary producer market place, system development has become easier, faster, and cheaper thanks to open-source code and modules enabling more and more coders to build fast prototypes. This is also the case in this peer-to-peer market place, which is also applied in the case of wood composite 3D printing.

The next phase is validation (Figure 3), including testing usability and markets of the fast prototypes and developing the product or service to better fit the different user requirements, and also developing the business model from the user perspective. Therefore even in business model development the overall user experience and service design are principal goals. The final phase in the model is to develop a governance structure and establish research, development, and innovation as part of every-day business activities, and also to establish the new business as a keystone in the business ecosystem (Iansiti and Levien 2004). Some simple ways of doing this include establishing open-source, peer-to-peer, and end-user innovation market platforms along with organizing hackathons, innovation competitions, reverse pitching etc.

## 4.3 Limitations of work and future research

Combining various methods and perspectives in individual articles to achieve more comprehensive results also has its limitations. For example, Article I was a synthesis of literature and conceptual design of stakeholder roles and communication, in which the analysis is performed without testing the assumptions with empirical data. Article II and qualitative interviews on EUTR and regulatory effects applied another concept and different angle for the sake of comprehensiveness, but the findings were bound with the theory lacking generalizable results. Articles III and IV as empirical surveys had limitations such as representative samples and results based upon a very narrow product segment and geographic context.

In terms of limitations of the CDBERD model, the limitations of individual articles suggest that the model and its implications have limited context and the model should always be re-evaluated for new projects. Moreover, it should be noted that the themes introduced in the CDBERD model, including consumer trends, values and norms (pull), resources, technologies and regulations (push), and organizational strategy, consumer choice behavior and business logics (process) are in constant evolution in the business ecosystem. They are also very case-specific, and therefore their framing and fit always require specific research focus and elaboration.

Also in this regard, as consumption behavior, trends, and experiences are complicated psychological processes considering various values and motivations, all these should be better considered in the market interviews, surveys, and experiments conducted in the future forest sector research. This could furthermore contribute to better understanding of associations (e.g. carriers) between institutions and consumer behavior in the field of social psychology. In addition, the forest sector and consumer market -related research in general does not consider the third value dimension, named social (Green and Peloza 2011) or normative (i.e. conative) information processing (Rook and Fisher 1995), which is causing problems to holistic institutional / business ecosystem models attempting to explain consumer behavior, and also in new product and service development through norms, regulations, and habits (Jackson 2005). Future forest sector consumer market and marketing research could therefore better consider the three main value dimensions including hedonic, utilitarian, and social value, along with information processing including affective, cognitive, and normative. This triangular setup is well-proven by philosophical and psychological

theories, and it is also crucial for developing future consumer-driven business ecosystem research and development in addition to considering the value in context and value over time.

Eventually the framing approach (Figure 6) gives an overall starting point for consumer-driven research and development projects in the forest sector, and subsequent phases including co-creation, prototyping, validating, and building governance (presented in Figure 3). Even though this fast prototyping will inevitably result in some failures, this mindset helps to develop consumer / user-driven solutions and experience principles along with business models and organization strategies with better fit to the overall business ecosystem.

As introduced earlier, the CDBERD model has been applied in initiating a few research and development projects in the forest sector, and future research will test and develop the applicability of the model for the sector. In this regard, the concept of keystone organization as a design to govern the business ecosystem can also be tested and developed by elaborating the concepts of open-source, peer-to-peer, and end-user innovation market platforms in the forest sector.

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