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A transformative journey from linear to circular business models of a First-tier Supplier in the marine leisure industry

A Volvo Penta case

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Abstract

More and more companies are adopting Circular Business Models (CBMs), which can serve to foster a sustainable transition towards a Circular Economy (CE). Nonetheless, much of the CBMs adoption-related research in academia has a focus on end-user facing companies, which have direct access to final end-users, to whom they sell a complete product. However, a significant role in such settings is played by upstream suppliers who often manufacture key components for the final product without having direct access to end-users. Therefore, after understanding the current attributes of a traditional business model and supply/value chain for a First-tier Supplier (FTS), this research aims to explore which CE strategies and CBMs are most likely to be adopted by an FTS. Additionally, because of the nature of the business set-up, FTS rely on value chain partners: therefore, the research aims at understanding the role that collaboration with the surrounding network of stakeholders plays in the implementation of CBMs. For this purpose, the research gathers insights from a single case study with Volvo Penta (VP), a Swedish-based FTS in the marine leisure industry, which manufactures diesel engines, sold in a linear manner through dealers and boat constructors. For data collection, a review of company documents, 17 interviews with the company's employees, 2 interviews with external business consultants and researchers as well as one onsite visit at one of the company's operational plants in Sweden have been conducted. Key results show that FTS should focus on i) design stage; ii) leveraging on existing strategies, exploiting and expanding developed infrastructures and expertise; iii) establishing a closer relationship with the immediate steps of both the upstream and downstream supply and value chain. Further investigation needs to i) conduct research on other case studies within the same or different industries to understand the generalizability of current findings; ii) consider the role played by internal organizational structures and dynamics in the transition of an FTS from Linear Business Models (LBMs) to CBMs iii) explore how an FTS could be supported in this transition, through the lenses of change management literature.

Keywords: circular business models; not-end-user facing companies; first-tier suppliers; collaboration; value chain relations

Executive Summary

Problem Definition

The "take-make-dispose" logic of the current linear economic system is causing severe environmental-related problems, making it necessary to find ways to reverse this catastrophic trend. Among possible ways to solve these issues, implementing a Circular Economy (CE) can be considered. Although such an implementation could occur at different societal levels – individual, business, policy – firms represent a pivotal player in this scenario. Indeed, companies have the possibility to adopt circular business models (CBMs) which can act as "catalysts for a sustainability transition" (Hoffman, 2018, p.362).

In the last years, research on how the transition from linear business models (LBMs) to CBMs can unfold has increased. Nevertheless, the usual focus of the latest studies is related to the end-user facing companies, manufacturing complete products. However, a key role is also played by First-tier Suppliers (FTS) which commonly produce components for these final products and have no direct relation with final end-users who get to use the product. Although their critical importance in the supply chain, current research on the implementation of CBMs with respect to FTS is underdeveloped. Besides, much of the research on CBMs implementation takes into account the adoption of such models by startups, disregarding incumbent firms.

Aim and Research Questions

Thus, this thesis aims at understanding the possibilities that an FTS has to implement a transition from an LBM to a CBM, by exploring suitable circular strategies options best suited to its specific situation. To gather in-depth knowledge, a single case study of a Swedish-based FTS, Volvo Penta (VP) has been chosen.

Therefore, the logic to develop the RQs consisted of a stepwise approach: first, the author mapped the existing business model and supply/value chain of VP, understanding its current status quo as an FTS. Then she analyzed the possible CE strategies and CBMs that could be adopted by VP for both closing and slowing loops, starting from mapping the current status of circularity at the company. She took into consideration a 7R-strategies Framework, categorized under four CBMs archetypes: extended product value (reuse, repair, refurbish, remanufacture, repurpose), access and performance model (rethink), extended resource value (recycle) and industrial symbiosis.

Then, because collaboration with stakeholders in the supply/value chain is a central theme in an FTS business model set-up, with a high degree of dependency on collaborative strategies, due to the lack of direct access to final end-users, the author explored the role that collaboration plays in supporting VP in advancing towards circularity. By so doing, she aimed at answering the following RQs:

<u>RQ1- FTS STATUS QUO</u>
What are the central attributes of current traditional business models and the traditional value/supply chain of a First-tier Supplier in the marine leisure industry?

<u>RQ2 - SUITABLE CIRCULAR OPTIONS & CBMs FOR FTS</u>
Which circular strategies options and Circular Business Models is a First-tier Supplier in the marine leisure industry more likely to adopt?

RQ3 – Collaboration in the LBM to CBM TRANSITION FOR FTS

Which role does collaboration play for a First-tier Supplier in the marine leisure industry when implementing circular strategies options and transitioning from Linear Business Models to Circular Business Models?

Research design, materials and methods

Therefore, the research design follows a single case study of VP: an FTS in the marine leisure industry, thus a non-end-user-facing company, manufacturing critical components for boats, which are produced and sold in a traditional linear fashion to private end-users, after passing through dealers and boat constructors. Moreover, VP is a representative of the larger cluster of incumbent firms which belongs to the manufacturing sector that has a very high environmental impact.

For collecting data, a qualitative approach has been followed. After an initial literature review, data has been gathered through 17 interviews with the company's employees and 2 interviews with external business consultants and researchers. Moreover, one onsite observation at the Vara Plant, one of the operational plants of VP in Sweden has been carried out, and company-related documents have been reviewed. Data have been analysed through content analysis, via manual coding, by following both an inductive and deductive approach.

Findings

In the first step of mapping out the current status quo of a traditional business model of an FTS in the marine leisure industry, results show that VP's current status quo is mostly based on LBMs, as a typical approach of most manufacturing industries, producing and selling marine diesel engines in a linear fashion through dealers and boat builders.

Considering the usual FTS set up of facing a lack of access to end customers, usage data or end-of-life stage, particular attention should be paid to the *design stage*. Indeed, being for most part under the control of VP, since it is the one manufacturing the components, it proves as a likely step to consider when implementing circular strategies. Moreover, it would support and facilitate other circular strategies, e.g. design for easy disassembly for recycling. Nonetheless, it would still require strengthening relationships with suppliers which need to provide raw materials adaptable for circularity.

Moreover, because of the nature of today's businesses, VP is embedded in a traditionally complex value and supply chain with many different stakeholders involved in the business. Being inserted into a complex network of stakeholders shows that the degree of interdependency is remarkably high. Several transaction costs are involved in the reconfiguration of such a network to accommodate CBMs uptake. Furthermore, considering that VP is further away from the final end-user as typically any FTS would but has direct contact to the closest steps of the chain (upstream: suppliers; downstream: dealers and boat builders), to facilitate CBMs uptake, VP as an FTS should prioritise the CBMs where the closest steps of the supply and value chains are involved. As a consequence, it would be relevant to start by strengthening external vertical collaboration with the closest steps of the chain, with whom VP is mostly connected and that are extremely necessary for its business set up.

While mapping out the current status of circular strategies implemented at the company level, CBMs uptake seems not very widespread in business practice (Bocken et al., 2016), with most CE activities focusing on *remanufacturing*, one of the most common CBMs also for end-user facing companies (Rosa et al., 2019). However, new business lines could be explored, facilitated by exploiting existing infrastructures and expertise. Other circular strategies classified under the extended product value model – *refurbish* – show the interesting possibility to be strengthened and enlarged to other products offerings as well.

Contrary to what found in the literature for end-user facing companies, the *access and performance model* (based on the *rethink* strategy) does not seem to be one of the best options for an FTS. Indeed, while for an end-user facing company, implementing such a CBM has the potential to retain ownership over the final product and therefore strengthen the contacts with the final end-users, this might not be totally transferrable to an FTS situation. It will require shaping even stronger partnerships with boat builders/constructors. A key to achieving this could be building up a constellation of partners interested and willing to adopt themselves CBMs. This will entail providing both financial and environmental incentives for their engagement and thus decreasing the risk of defection.

Similarly, *industrial symbiosis*, which requires an external horizontal collaboration, will result in a time and resource-consuming endeavour. Finding the most appropriate partners, and developing interconnected operational units built in the same area to facilitate the transfer of outputs and inputs, might not be a feasible approach in the short term.

Moreover, for certain strategies such as *recycling*, it could be feasible to shift the focus from a product level to an operational level. In this case, rather than discussing recycling as a strategy for marine diesel engines, focus could be on recycling of materials from production processes. Bearing this in mind, for this specific case study, it could be useful to involve other divisions of the Volvo Group, starting an internal symbiosis mechanism for exchange and exploiting residual values of materials.

Still, for other extended product value strategies – *reuse, repurpose* - it might be more difficult to have a grasp on them, since, being focused on the end of life, they entail the product take-back from final end-users. So, it might be a next step to understand how to involve end users directly or how to strengthen even stronger partnerships with current downstream stakeholders. Also, interesting to notice how new partnerships with e.g. academia, researchers, innovative start ups could be fostered to find new and alternative solutions for these discarded products.

Therefore, it is clear that types of circular strategies and CBMs that can be adopted by an FTS as well as the role played by collaboration in the uptake of such circular strategies are interrelated, showing that current partnerships could be strengthened, since circular flows could be enabled by both vertical and horizontal collaborations. Moreover, while most of the partnerships are established with equally sized companies but also other companies and universities, a rather low level of engagement with government agencies and local municipalities can be noticed. Findings also suggest that it could be fruitful to explore the role played by collaborations with non-traditional actors, historically considered outside the ecosystem (such as Non Governamental Organizations and unauthorized repairers). An interesting result makes it clear that innovating the current BM would require a gradual diversified process, operating under different BMs, with the coexistence of current and new ones.

Conclusions and Recommendations

FTS current business set up and value/supply chain is mostly linear and interconnected with the surrounding network of stakeholders. Potentially, all CBMs configurations seem applicable. Nonetheless, some should be prioritized because they will require less time and an easier degree of collaboration. This study contributes to findings by exploring a specific sector, a specific industry, in a specific company setting. Providing an overview of the most suited circular strategies and CBMs for FTS, considering its business set up and supply/value chain peculiarities, and how collaboration supports FTS in transitioning from LBMs to CBMs uptake.

Some recommendations can be provided to non-academic audiences: economic aspects will need to be discussed further to understand the feasibility of these CE strategies and CBMs configurations from a financial competitive standpoint. Moreover, to provide a more comprehensive overview of the role that collaboration types would play in the uptake of CBMs, it will be relevant to map out all the current collaborations in place. Furthermore, other CE strategies for different product lines – besides marine diesel engines – could be identified, therefore looking at other reference products could result in a beneficial exercise.

As regards future research implications, a focus on other FTS, within the same industry and in other industries could advance results, since the focus on a single case study might have limitations on generalizability. Moreover, it will be relevant to understand, besides collaboration with other relevant actors in the supply and value chain, which role internal organizational structures, routines and dynamics play in the transition from LBMs to CBMs for an FTS. Furthermore, after understanding which circular strategies and CBMs are most suited for an FTS, the author recommends looking into the ways that an FTS could be supported in the transition, through the lens of change management literature.

CE is not an end point and learning how to manage a CE-based process would support a company's sustainability journey.

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Abbreviations

BM – Business Model

BMI – Business Model Innovation

CBM - Circular Business Model

CE – Circular Economy

FTS - First-tier Supplier

HVM – High-Value Manufacturing

GHGs – Greenhouse Gases

LBM – Linear Business Model

OEM – Original Equipment Manufacturer

VP – Volvo Penta

1 INTRODUCTION

The "take-make-waste" approach of the current linear economy has been one of the main contributors to the current frightening climate crisis: companies extract materials intensively, consume energy to manufacture products which are used and eventually discarded by users (Ellen MacArthur Foundation, 2021). Critical environmental-related problems such as intensive resource use as well as increasing waste, and consequently increasing polluting emissions such as Greenhouse Gases (GHGs) emissions, represent a daily challenge worldwide which necessitates an imminent solution. The International Panel for Climate Change (IPCC) has forecasted that temperatures globally will rise by 3.2 degrees this century, while warning that already going beyond 1.5 degrees above pre-industrial levels (1850-1900) will cause severe climate impacts (Circle Economy, 2021). Fortunately, this course of action can be corrected: this "take-make-waste" logic that has characterized businesses so far can be substituted by one or more Circular Economy (CE) strategies with different aims namely narrowing, slowing, or closing resource loops (Brown et al., 2021). The ultimate purpose is to avoid waste, improve efficiency, and keep the integrity of both products and materials across a multiplicity of lifecycles (Brown et al., 2021). Resources are kept in use for as long as possible, the maximum values are extracted from them while they are used and materials, as well as products, are recovered and used again. The Ellen MacArthur Foundation (2021) estimates that following a CE approach "could reduce global CO2 emissions from key industry materials (cement, plastic, aluminium and steel production) by 40% or 3.7 billion tonnes in 2050" (Ellen MacArthur Foundation, 2021, p. 26).

Nonetheless, the 2021 Circularity Gap Report points out that, in 2020, out of the 100 billion tonnes of materials entering the economy worldwide every year, just 8.6% were cycled back into the economy (Circle Economy, 2021). Therefore, it is relevant to explore the possibilities society has to enable greater levels of circularity (Salvador et al., 2020). CE has attracted interest from a wide and diverse arrange of actors. Firstly, it has been sponsored and discussed by international bodies such as the Ellen MacArthur Foundation (Salvioni & Almici, 2020) and the European Commission which promoted the European Circular Economy package approved in 2018 by the European Parliament, as a series of policies to decrease waste all over Europe (Lahti et al., 2018). Secondly, while some could argue that business related activities are a source of such environmental problems (Frishammar & Parida, 2019) others would mention that, through the adoption of Circular Business Models (CBMs), which many societal actors perceive as "catalyst for a sustainability transition" of the current industrial economic system (Hofmann, 2019, p.362) firms play a key role in fostering the transition towards CE. For these reasons, in latest years, CBMs have received attention from practitioners, consulting firms, think tanks, policymakers and researchers (Nußholz, 2017; Hofmann, 2019). Infact, CBMs have the potential to act as a response to the contemporary socio-ecological megatrends that are challenging society: growing natural devastation, increasing scarcity of resources and climate change (Hofmann & Jaeger-Erben, 2020). For example, CBMs can reduce the undesirable environmental side-effects derived from the extraction, use, and disposal of natural resources and materials (OECD, 2018).

Among the actors paying particular attention to the topic, an interesting example is represented by the chosen case study of Volvo Penta (VP), a subdivision of the Volvo Group and a world-leading supplier of power solutions to marine and industrial applications. As a First-tier Supplier (FTS)[1] in the manufacturing sector working within the marine leisure industry, VP produces critical boat components. As part of its offerings, it supplies an integrated propulsion

[1] First-tier Supplier: a company that sells and delivers materials or goods to a customer's factory or shop (Longman Dictionary). Also known as primary supplier.

system - cockpit, steering, control; gearbox and driveline; propellers and drive systems – directly or through dedicated dealers, to boat manufacturers who then sell the whole boat themselves, to final end-users. To achieve the ambition of reaching zero emissions through fossil free and renewable fuels and electric and hybrid technology (VP website, 2022), VP is undergoing a transformation that envisions a complete shift to electrification – both in its internal operations and in its product offerings. A pivotal part of this shift is represented by the necessity of understanding which circular strategies options exist for such a future business set up and how the transition from the current linear business model (LBM) to future CBMs will unfold.

In the context of the realization of a CE (Okorie et al., 2021) the manufacturing sector especially plays a pivotal role: it is one of the main consumers of natural resources and one of the main contributors of negative environmental impacts (Nörmann & Maier-Speredelozzi, 2016). Looking at the European manufacturing sector, it can be observed that it needs a transition towards a CE, especially since it is facing a growing instability in the market (Urbinati et al., 2020) due to, for example, price volatility and disruption of supply chains. In general, scholars agree that the use of CBMs in the context of High Value Manufacturing (HVM) generates opportunities for developing new forms of value (Okorie et al., 2021). By implementing CBMs as the core element of their daily operations, companies in the manufacturing industry can achieve many benefits: to develop brand value, reduce costs, satisfy new demands and create a competitive advantage beyond product sales by benefitting from aftermarket sales are highlighted as the most popular ones (Hansen & Revellio, 2020). Companies follow also strategic business reasons, it is not only a matter of complying with regulations or bending to pressures from stakeholders. It results that the necessity of moving towards a CE is embedded in a broader agenda of change: megatrends of decarbonization imperatives, electrification of motion and digitalization are disrupting the current markets, leading VP to take action. Such issues concern firm managers and stakeholders alike, and bold creation of new BMs for these technical platforms is critical for the future of firms such as the chosen case study.

Moreover, because of the nature of this particular case study, attention has to be paid not only to the manufacturing sector but also to the marine leisure industry which is a part of the manufacturing sector. Several studies and statistics exist for gathering data on the environmental impact of the commercial maritime transport sector (or shipping industry – including cargo ships, passenger ferries, fishing boats), relative to the use phase. According to a 3rd International Maritime Organization (IMO) GHGs study, maritime transport emits 940 million tonnes of CO2 per year and it contributes to 2.5 % of GHG emissions globally (EU Commission, n.d.). Similar reports related to data on GHG emissions cannot be easily found for the marine leisure industry. Similarly, there exist differences in legislation regulating the two industries. On the one hand, the shipping industry is still excluded from the Paris Agreement and compulsory regulation on air emission requirements was only enforced since 2005 (Milios et al., 2019), through a special amendament in the International Convention for the Prevention of Pollution from Ships (MARPOL). As of now, IMO Member States have adopted a strategy for the maritime transport sector to cut total annual GHG by 50% below 2008 levels by 2050 (UNFCCC, 2021). Furthermore, the EU Commission has acknowledged the necessity to address emissions if EU climate targets have to be achieved, by introducing regulations on monitoring, reporting and verification (MRV) under the EU MRV Regulation 2015/757 (EU Commission, n.d.) which will use the IMO Data Collection System to gather information on fuel consumption of large ships (above 5 000 gross tons) engaged in international shipping (EU Commission, n.d.). After this initial phase, GHG targets and further measures will be introduced for the maritime transport sector, starting from 2023 (EU Commission, n.d). Overall, small steps have been taken but the journey has just started.

When looking at the marine leisure industry, and regulations on CO2 emissions, the situation is even more in its infancy: a relevant piece of legislation is represented by the first Recreational Craft Directive 94/25/EC, amended by the Directive 2003/44/EC which was entirely replaced by the Directive 2013/53/EU since 18 of January 2017 (European Boating Association, n.d.). It contains several updated requirements that manufacturers need to respect when designing and producing crafts – such as safety requirements - as well as limitations in terms of noise and exhaust emissions (European Boating Association, n.d.). However, it will require more stringent legislations. Following the latest developments in the environmental political agendas on climate policy, it is inevitable that the marine leisure industry might also be subject to policy interventions in the future. Therefore, working on a shift towards a CE to address the emissions issue, in preparation to a future based on electrification, as VP is planning to do, can represent a business opportunity to preempt this legislation and can be a driver for first-mover advantages in the sector.

Additionally, in the transition towards a CE, firms cannot enable the shift just by themselves: Brown et al. (2019) argues that the CE concept is "systemic and commonly seen as collaborative" (p.2). Indeed, managing stakeholders in CBMs through a proactive approach is one of the main elements highlighted by Geissdoerfer et al. (2018) as a contributor to sustainable development by promoting economic, environmental and social goals. Collaboration is a highly investigated topic in the academia, oftentimes seen as one of the greatest accelerators of CE (Vlajic & Hsiao, 2018); in fact, several authors highlight that CE requires supplementary coordination efforts in the value chains, both upstream and downstream (Hansen & Revellio, 2020). To address the evolution of CE and CBMs, researchers agree that manufacturers are required to shift from an operational logic centered on the network rather than the firm (Okorie et al., 2021). Therefore, VP represents a very relevant case: infact, as an FTS, it does not have a direct contact with final end users of the complete final product, thus requiring a stronger collaboration with partners.

1.1 PROBLEM DEFINITION AND BACKGROUND

Despite the considerable interest by the scientific community on the topic with research on CE growing tenfold over the last 10 years (Geissdoerfer et al., 2017) few studies on the operationalization and integration of CBMs have been conducted (Salvador et al., 2020). Looking at academic literature, the field can be considered relatively new: most of the research is very current, highlighting the recent concern with the theme (Salvador et al., 2020) that involves the necessity to gather more knowledge. The concept of CBMs has existed for some time, but its first mention (under this name) by scholars seems to have been made only in 2013 (Oghazi & Mostaghel, 2018). LBMs still seem to be the status quo of most manufacturing industries (Linder & Williander, 2017).

When it comes to practical recommendations for a transition from an LBM to a CBM, there is still a considerable gap in the literature (Salvador et al., 2020). Moreover, the discussions on CBMs are still scattered and underdeveloped (Reim et al., 2019). It follows that CBMs have yet to be implemented in industrial settings (Reim et al., 2019). Oftentimes, CBMs are conceived as a "one-size-fits-all solutions" disregarding product-specific criteria and firm's capabilities (Reim et al., 2019) which hinder their potential. Additionally, previous studies have had a focus on CBMs in start-up companies rather than incumbent manufacturing companies (Reim et al., 2021).

As an incumbent company, VP produces critical boat components and as an FTS, it supplies, as part of its offering, an integrated propulsion system - cockpit, steering, control; gearbox and driveline; propeller/drive system –, directly or through dedicated dealers, to boat manufacturers who then sell the whole boat themselves. The peculiarity of VP's case is related to the fact that VP does not have a direct relationship with the end users of the final complete products. The usual researched scenario on LBMs to CBMs transition sees businesses having direct contact with end users, selling not just a part of a product but the entire product. Several studies research the transition from LBMs to CBMs but such research with a focus on FTS such as VP is lacking. In understanding how to implement circular strategies, VP faces the challenge of having less control over the product use because of its FTS nature: thus, it is deemed necessary to find ways to work with its value chain partners to support circularity and improve as well as restructure the link to the end users. This link is particularly important, due to the complexity of VP business model, composed by several different stakeholders.

For a successful CBM implementation and operationalization, the involvement and collaboration of multiple stakeholders plays a pivotal role (Sousa-Zomer et al., 2018). From previous research, it appears that collaboration is an important aspect for the implementation of CE principles (Witjes & Lozano, 2016) and transitioning to a CE requires a perspective on the larger ecosystems of partners, providers, and customers (Reim et al., 2021). From the side of the industry practitioners, a "knowledge gap" arises: while everyone at the company level seems incredibly positive towards CBMs which are conceived as an opportunity, VP contact person has explained that there are uncertainties related to necessary changes to implement them, as well as expectations on the side effects in the long run.

So, essentially, this study's relevance is justified from two perspectives: first, on the practical perspective, it will enable defined VP and other FTS audiences to take meaningful and impactful decisions on CBMs configurations and collaborations to support them, therefore contributing to further shape their environmental sustainability agenda. Second, it will address deficiencies in extant knowledge, researching on what the existing body of literature does not adequately address. Also, this study will contribute to findings by exploring a specific sector (manufacturing sector), a specific industry (marine leisure industry), in a specific company setting (VP).

1.2 AIM AND RESEARCH QUESTIONS

From a general societal perspective, this thesis project's context is related to the negative issues brought about by the "take-make-dispose" logic of the current linear industrial system in the manufacturing sector (with a focus on the marine leisure industry), and to the necessity of shifting from an economy based on linear principles to one based on circular ones.

Specifically, the research problem this study tries to address deals with the fact that VP (case company) as an FTS of operationally critical components system for boats in the marine leisure industry does not have a direct relationship with the final end users and in going circular it needs to find ways to work with its value chain partners. This stated problem aligns with the overarching aim that this study sets to achieve **which is understanding the possibilities an FTS has to implement a transition from an LBM to a CBM, by exploring suitable circular strategies options best suited to its specific situation.** In this transition, a key role will be played by collaborating with the surrounding network of partners and stakeholders. The case study of an FTS like VP presents itself as ideal for examining how to work with collaboration and networks in CBMs: indeed, this aspect represents a necessary condition required by the business set up, fueled by urgency compared to other end user-facing firms which might perceive it as something optional. Because of the important role played by collaboration in the necessity of shifting towards a CE, this study will further explore how collaborative approaches between an FTS and its partners can support the circularity of its business model.

In turn, achieving the aim of this research will contribute to resolve the research problem: overall, the research brings additional insights into ways to achieve the LBM-CBM shift, acting as a potential starting point to stimulate the research and consequently practically accelerate the transition towards a CE, providing additional information related to companies that do not face end users, such as FTS; a topic that has not been explored previously and therefore presents unused potential.

Considering what is already known about the research problem that the study investigates, the worthiness of this research's findings and conclusion is embedded in significant results. Knowledge will be useful to several actors, on different levels.

First, for the company (VP management group) and its partners' network: the answers to the Research Questions could help VP achieve its vision to become world leader in sustainable power solutions (VP website, 2022). Moreover, it will help the company to understand how to address their customers' needs and answer to the pressure from buyers: in fact, VP contact person has pointed out that VP receives questions about options for remanufacturing, recycling. Most of these queries are advanced by technology and brand leading Original Equipment Manufacturers (OEMs) of heavy equipment in the marine commercial segment: understanding how to address such doubts will be a good starting point for developing knowledge that could be used to address similar concerns from the private leisure segment as well. Also, the research will be a part of a work that is performed in preparation for a future where electrification will be the main status quo.
Second, for FTS, especially in the manufacturing sector and the marine leisure industry: the findings could serve as inspiration for other companies in the same situation as VP to follow the lead and implement CBMs solutions that enable a faster and sounder transition to CE.
Third, for the scientific community: this study is adding to the existing conversation on transitioning from LBMs to CBMs. As Rosa et al. (2019) highlights, involving researchers and industry experts can favour both the detection of specific types of CBMs and its related benefits in a peculiar domain. A scientific problem exists: transitioning from linear to a CBM is important, there is plenty of literature about it but the field of exploring this shift in the context of FTS (therefore companies not having a direct relationship with the end users) has not been deeply searched yet. Consequently, the problem can be handled by producing new knowledge that could also be used by other researchers. Moreover, the study adds to the research literature by exploring a specific sector of the economy, a specific industry and a specific company and by generating rich insights that might then be transferred to other contexts.
Fourth, for society and the environment at large: understanding possible enabling factors to guide the transition towards a CE and to implement new circular solutions for solving these issues or at least addressing the problem in a better way, taking into account relevant societal players such as an FTS. After these considerations, the RQs that the study wishes to answer for producing new knowledge are the following:

RQ1 – FTS STATUS QUO
What are the central attributes of current traditional business models and the traditional value/supply chain of a First-tier Supplier in the marine leisure industry?

RQ2 - SUITABLE CBMs & CIRCULAR OPTIONS FOR FTS
Which circular strategies options and Circular Business Models is a First-tier Supplier in the marine leisure industry more likely to adopt?

RQ3 – Collaboration in the LBM to CBM TRANSITION FOR FTS

Which role does collaboration play for a First-tier Supplier in the marine leisure industry when implementing circular strategies and transitioning from Linear Business Models to Circular Business Models?

1.3 SCOPE AND DELIMITATIONS

To develop an in-depth analysis, one exploratory case study – Volvo Penta – has been chosen to collect data then used to answer the RQs. The results will have some limitations because the focus is on one case study, but they will be valuable for reference for the rest of the industry. This will be further discussed in Chapter 5.2.

Even if VP works also with the commercial application, the leisure segment has been chosen as the focus of the research. In this segment, the engines and drivelines – after going through dealers and boat manufacturers – are used by private consumers, e.g., tourists who buy a boat or charter a yacht. VP contact person has expressed that it is a more difficult case for the company (compared to the commercial industrial segment) since it has less control of how and where boats are being used but also a much larger part of the business, hence centrally important to prioritise at this stage of research. In line with Boyer et al. (2021), manufacturers can start the LBM-CBM transition by assessing their existing product portfolio and identifying which circularity dimension will be optimal for each product. VP has very wide customers and product portfolio as a company but a midsize leisure powerboat with one or two diesel aquamatic systems has been identified as a product category that is best suited to research at this stage. Specifically, this study has been conducted by focusing the case on the *D6 440 DPI* package (which includes engine block together with all the necessary apparatuses – engine mounting, lubrication system, fuel system, air inlet and exhaust system, cooling system, electrical system, electrical vessel control and drive) as a reference product. Indeed, this engine family is VP high volume product and with a remarkably high degree of in-house produced content. However, the author has used the reference product to get more acquainted with VP portfolio and to get a more concrete sense of the tangible technical aspects of marine diesel engines to prepare interview guides. Nevertheless, due to a limited knowledge of technical aspects, recommendations will be more generic, not looking at CBMs for a specific product category. Moreover, for practical reasons of time availability, the research does not consider discussions on finance and costs; results serve as a preliminary understanding of possible circular strategies to look into and possibly test in the future, from a strategic environmental management perspective. Therefore, the outcome of the project will require additional research on financial viability and technical feasibility of the suggested CBMs.

On this note, as regards the theoretical and literature scope, the study draws on literature related to CBMs and collaboration. Even if considered to be very relevant, the study does not include broader discussions of CE, but it is limited to introducing the concept to the extent deemed necessary for providing the audience with a suitable background.

Additionally, the thesis project does not look at one specific geography since it has been pointed out by VP contact person that there is a low degree of variability between different markets: marine leisure products are primarily sold through independent dealers, thus a dealer in Sweden, France, Italy would be representative of the business. Nonetheless, it is important to clarify that all the 17 interviews conducted with VP employees, included interviewees working in the Swedish context.

1.4 ETHICAL CONSIDERATIONS

Research topic and focus have been developed in collaboration with VP. This might have influenced the nature of the research and of the conclusions, with the risk of steering the conversation towards VP's interests. In turn, the validity and generalizability of the findings might have been compromised. Nevertheless, to avoid the aforementioned limitations and to ensure researcher honesty and personal integrity, triangulation methods were employed, which will be further explored in Chapter 3.

As regards ethical responsibilities to the subjects of research, in writing the thesis with a company and employing interviews as the main method of data collection, issues of confidentiality arise. Because the thesis is in the framework of the Mistra REES (Resource-Efficient and Effective Solutions) Project, the author of this study has signed a Non-Disclosure Agreement (NDA), to protect sensitive data. Moreover, during interviews, the author made sure that voluntariness, privacy and anonymity of participants was guaranteed. Additionally, the content of the study has been reviewed by the assigned contact person at VP before publishing in public domain to avoid any conflicts. The results of the research should not be harmful to the reputation, dignity or privacy of the subjects. Data collected through interviews or first contacts with the company have been stored in the hard drive of the author's password-protected pc and on the author's Google Drive/OneDrive account.

1.5 AUDIENCE

This thesis research will be helpful to several societal actors. First, it will support VP in its journey towards the implementation of CBMs, preparing for the future shift towards electrification. Second, it will contribute to understand, on a broader level, how other FTS could implement circular strategies and CBMs, through restructuring the surrounding network of stakeholders. Third, it will be beneficial for academia by providing additional insights on the transition from LBMs to CBMs with a focus on FTS. Lastly, researchers involved in the Mistra REES project could benefit from collected and analysed data, to be used for contributing to the programme's mission to advance the transition of the Swedish manufacturing industry towards a circular and sustainable economy.

1.6 DISPOSITION

Chapter 1 introduces the nature of the problem addressed in this research. The content then identifies related aim and research questions, scope and delimitations as well as ethical considerations and intended audiences the research is addressed to. Chapter 2 presents the literature review where a more thorough analysis of the immediate field of study and the main gaps in the research field are outlined. Based on these gaps, detailed research questions are confirmed, and a framework used for data analysis is presented. Chapter 3 presents the research design, the methods used to collect data as well as to analyse them. Chapter 4 presents the main findings and analysis of the results. Chapter 5 presents the discussion of the results. Chapter 6 presents the main conclusions of the work, provides recommendations directed to non-academic audiences and outlines areas for future research.

2 LITERATURE REVIEW

The following literature review provides an overview on the concept of LBMs for FTS (section 2.1), clarifying the main aspects of a Business Model Canvas (BMC). Section 2.2 describes the current knowledge related to the CE with its main characteristics and highlights the circular strategies as associated to the R Frameworks. Since the adoption of circular principles by a company requires the transition of the company from an LBM to a circular one, section 2.2.1 explores the different types of CBMs, aligning them with the R Frameworks circular strategies. Section 2.3 describes Business Model Innovation (BMI) as the main conceptual framework used throughout the research. Section 2.4 concludes with a discussion on collaboration and its relevant role in supporting an FTS transitioning from LBMs to CBMs. Finally, section 2.5 underlines the knowledge gaps this thesis will try to fill.

2.1 Linear Business Models for First-tier Suppliers

In most manufacturing industries like the case study of this research, Linear Business Models (LBMs), also known as open loop systems, are found to be the status quo of the current way of doing business (Gusmerotti et al., 2019; Linder & Williander, 2017; Accenture, 2014). In the common business set up, after a single use phase, a product is downgraded, losing its embedded value (J. Nußholz, 2017). When discussing about transitioning from an LBM to a CBM, it is important to clarify what the characteristics of the model are. For this study's purpose, the author followed the definition of Business Model as provided by Osterwalder and Pigneur (2010): "A business model describes the rationale of how an organization creates, delivers and captures value" (p. 14). A successful BM needs to find valuable ways to provide answers to the type of product or service offered to the customer (value creation), ways in which processes and activities are employed to deliver the value (value delivery) and the financial viability of the revenue model (value capture) (Frishammar & Parida, 2019). Nine basic building blocks constitute the fundamental components of a business model: offer and value proposition, customer segments, customer relationships, key resources, key activities, key partners and suppliers, key channels, cost structures and revenue streams. Table 2-1 provides a visual representation of a BMC.

Table 2-1. Essential elements of a Business Model Canvas

Value type	Key elements	Guiding questions
Value creation	Offer and value proposition Customer segments Customer relationships	What value do we deliver to customers? What bundles of products and services are we offering to our customers? For whom are we creating value? Which types of relationships have we established with our customers?
Value delivery	Key resources Key activities	What key resources and key activities do we require? Who are our key partners and suppliers?

	Key partners & suppliers Key channels	Which channels do we use to reach our customers?
Value capture	Cost structure Revenues streams	What are the most important costs for our business model? How much does each revenue stream contribute to overall revenues?

Source: Adapted from Osterwalder & Pigneur (2010)

A successful transition towards CE requires firms to transform the modalities they implement to create, deliver and capture value (Okorie et al., 2021). For example, in LBMs, creation of value derives only from virgin materials (Linder & Williander, 2017) rather than recycled inputs such as in CBMs (Linder & Williander, 2017). For this thesis project, since the author will not address the financial viability of CBMs, the value capture dimension as described by the BMC in cost structure and revenues streams will not be taken into account.

2.2 CURRENT KNOWLEDGE RELATED TO THE CIRCULAR ECONOMY

As a concept, CE started to gain momentum around the end of the 1970s (Geissdoerfer et al., 2017; Ellen MacArthur Foundation, 2013). Although it cannot be attributed to a single author, several schools of thought have refined the concept itself such as regenerative design (Lyle, 1994), performance economy (Stahel, 2006), cradle to cradle (McDonough & Braungart, 2002), industrial ecology (Frosch & Gallopoulos, 1989) and biomimicry (Benyus, 1997). Widespread interest of the scientific community in a CE has been proven by academic research which has been growing ten times over the last ten years (Geissdoerfer et al., 2017). Moreover, it is worth noticing that few studies have been conducted prior to 2015, pointing out that research is very contemporary (Salvador et al., 2020). On a practitioner's perspective, by proving not only to have positive impacts on the three pillars of sustainability - environmental, economic, social – but also to improve the way companies use resources as well as their competitiveness (Staaf & Sundstrom, 2021), CE has entered more and more in practitioners' discussions around modalities to improve a company' sustainability. As noted, there is an abundance of CE conceptualizations: this "circular economy babble" can represent a challenge in the definition and interpretation of CE by scholars (Kirchherr et al., 2017, p.228).

For the aim of this research, the simple but quite comprehensive definition provided by Geissdoerfer et al. (2017) has been chosen: CE is defined as "a regenerative system in which resource input and waste, emission, and energy leakages are minimised by slowing, closing, and narrowing material and energy loops" (p. 759). In this light, to enable a CE, companies can follow several mechanisms: narrowing resource loops by using fewer resources, slowing resource loops by extending or intensifying use of resources and closing resource loops by reusing used resources for both material and energy flows (Bocken et al., 2016; Konietzko et al., 2020). Figure 2-1 provides a visual representation of the different types of resource loops.

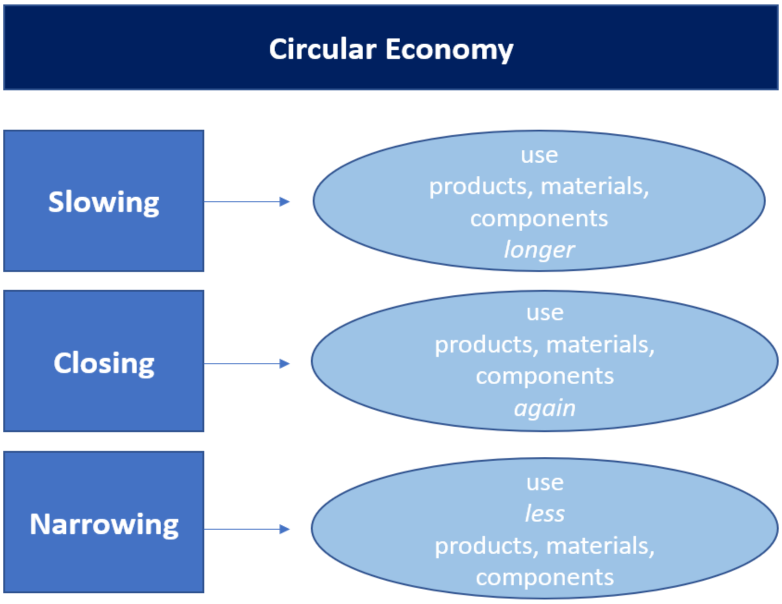

Figure 2-1. Slowing, Closing, Narrowing loops in a CE

Source: Author

Among the different loops that can be implemented to achieve this outcome, slowing and closing seem to be the ones that can be mentioned as inherently circular. In contrast, there is a disagreement among scholars as to whether narrowing loops should be considered among the strategies for CBMs since its resource efficiency logic to use fewer resources per product is an approach followed by industrial linear thinking as well (Bocken et al., 2016). Moreover, this last loop does not take into consideration the time dimension: potentially, resource efficiency could lead to speeding up resources and offsetting expected environmental savings (for example, through the increased sales of a more efficient product) (Bocken et al., 2016). Thus, since the main contributions of a CE lie in slowing and closing loops, narrowing the loops will not be taken into consideration for the purpose of this research.

Practically, slowing and closing loops can be achieved through several circular strategies, in line with what many authors call the "R Frameworks"(Potting et al., 2017; Kirchherr, 2017). Even if different authors agree on different types of frameworks, based on different numbers of "Rs" (4Rs; 6Rs etc), for this thesis, the following 7 circular strategies have been chosen: remanufacture, repair, reuse, repurpose, refurbish, rethink, as considered most appropriate to the case study. Figure 2-2 provides a summary of the chosen R-Framework and related definitions.

At the company level, implementing a CE can provide several benefits: on an economic level, it provides greater competitiveness and profitability, reducing costs of materials and improving resilience towards supply risks (Ellen Macarthur Foundation, 2013). On an environmental level, it helps to reduce the use of virgin materials and of waste (Bocken et. al, 2014). On a social level, it can contribute to increased employment (EMF, 2013) and to address new policies and legislation (Frishammar & Parida, 2019). Nevertheless, respecting the principles of a CE requires changing the current traditional linear business model towards a circular business model.

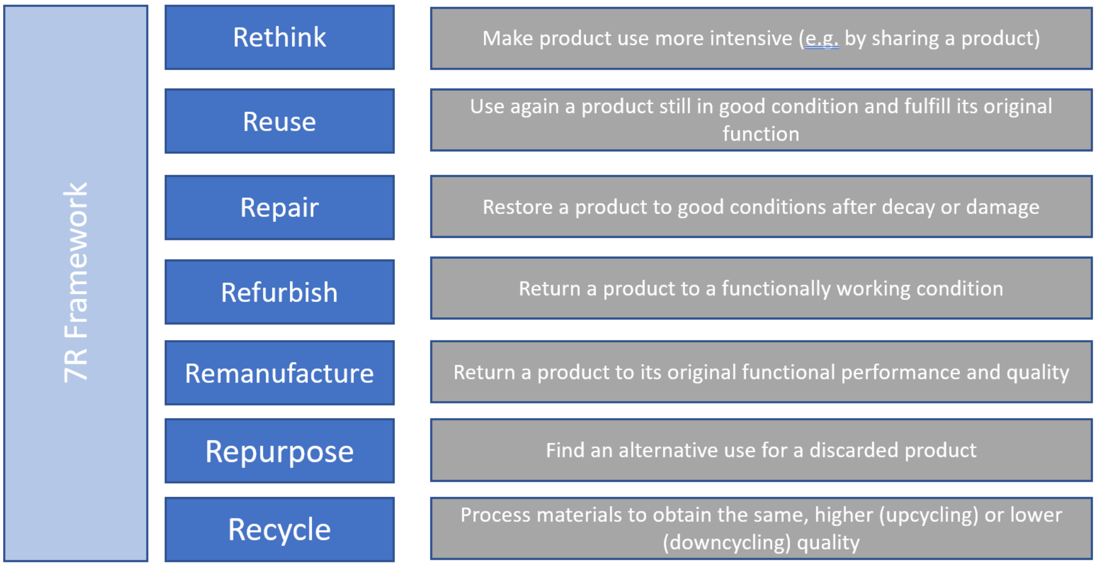

Figure 2-2. 7R Framework

Source: Author. Definitions adapted from Blomsma et al. (2019); Konietzko et al., 2020; Bocken et al., 2016; Kirchherr et al. (2017); Potting et al. (2017)

2.2.1 Circular Business Models for First-tier Suppliers

Based on the idea of an LBM, business approaches containing some CE activities have been developed under the name of CBMs, which is often associated with the concept of closed-loop supply chains (Geissdoerfer et al., 2018; Albertsen, 2020). However, when it comes to defining a CBM, the process results in a challenging endeavour: a clear definition of CBM is provided just by few scholars (Nußholz, 2017).

One of the most accepted definitions is the one offered by Bocken et al. (2016), who define CBMs as "business model strategies suited for the move to a circular economy [based on the] taxonomy of slowing, closing, and narrowing resources" (p. 317). Ludeke-Freund at al. (2018) suggests that, because of the many possible combinations, hundreds of relevant CBMs should be available in practice, with most of them relying on cooperation with other firms (Ludeke-Freund et al., 2018).

For the purpose of this research, four CBMs archetypes have been chosen, based and adapted from Bocken et al. (2016): for CBMs related to slow resource loops, i) Access and performance model and ii) Extending product value. Whereas, for CBMs related to close loops, i) Extending resource value and ii) Industrial symbiosis. Moreover, products need to be reconceived by taking into account all phases, from raw material extraction to end of life (Gusmerotti et al., 2019). However, among the most relevant stages for implementation of CE, it is relevant to highlight that design is mentioned by several authors in the literature as being the most important one for addressing CE concerns (Bocken et al., 2016). Infact, it results more challenging to make changes once product specifications (infrastructures, resources, activities) are finalized (Bocken et al., 2016).

Figure 2-3 illustrates the analytical framework used during the research which describes how these 4 archetypes relate to slowing and closing loops and can be combined with circular strategies options of the R Framework, before providing an explanation of their definitions and interrelations. It is important to bear in mind that it is not a clear-cut division and hybrid forms are also possible (Bocken et al., 2016).

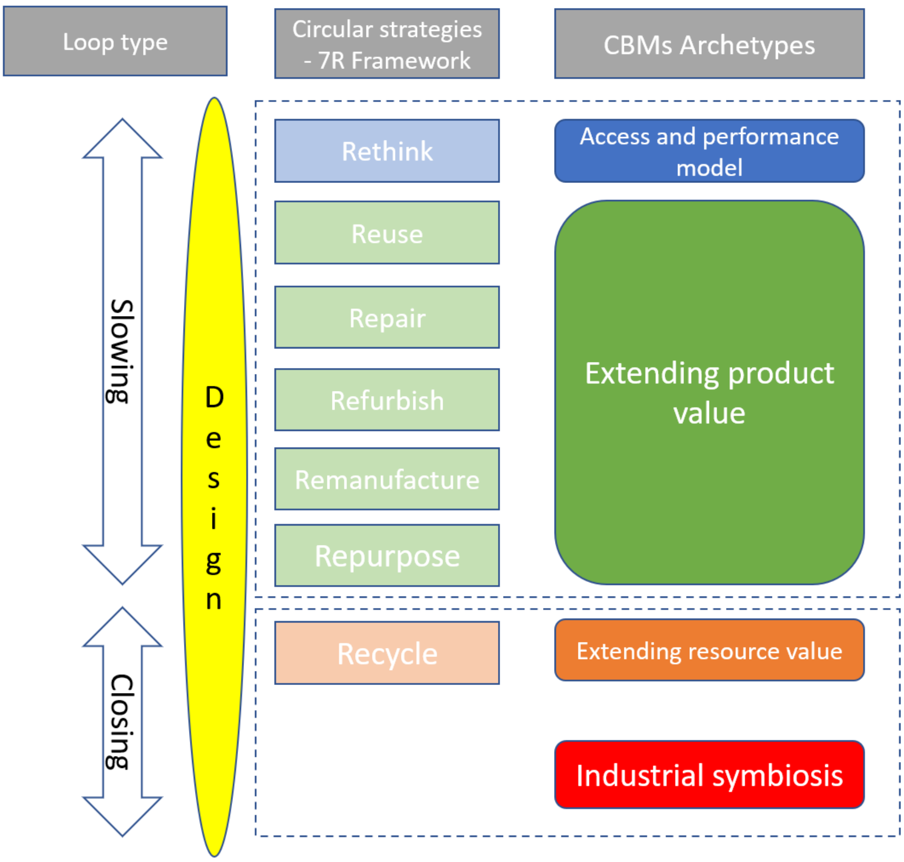

Figure 2-3. Circular strategies options and associated CBMs archetypes

Source: Author

Slowing loops

Slowing loops has the objective to extend the products lifetime by using products, materials and components longer. This aim could be achieved through applying i) access and performance model and ii) extending product value

i) Access and performance model

This model is based on the idea of delivering a service rather than a product (Bocken et al., 2016), infact it is also known as "Product Service System" (PSS). Many different definitions and subcategories exist but the most common ones see:

Product-oriented PSS: Ownership belongs to the customer but additional services such as maintenance, repair, upgrading are included (Vezzoli et al., 2018). In this way, responsibility for the use and disposal of the product from the user side is reduced (Vezzoli et al., 2018).
Use-oriented PSS: Ownership belongs to the company which is providing the product while the customer pays for the time the product is used (Vezzoli et al., 2018). This structure includes

leasing (long-term), renting (short-term), sharing or pooling (simoultaneous use) of certain goods.
Result-oriented PSS: Ownership belongs to the company and the customer pays a fee for the agreed results (Vezzoli et al., 2018).

Rosa et al. (2019) describes PSSs as quite popular: in practice, leading manufacturing firms focus on resource efficiency throughout the lifecycle of a product by implementing PSS-based business models, especially, use-oriented and result-oriented (Frishammar & Parida, 2019) which enable the company also to hold control over a customer's experience. Reim et al. (2019) suggests that i) a firm should question if it is able to handle the risks related to service agreements; ii) if that is possible, then the firm should consider whether it is feasible to retain ownership of the product. By retaining the ownership of the product, the company can implement product-looping business models which would facilitate remanufacturing and upcycling (Reim et al., 2019). Nevertheless, it is important to highlight that the schemes to borrow and return products need to consider transportation costs (as well as the emissions from transporting acitivites) and therefore they are not always considered as sustainable (Vezzoli et al., 2018). Moreover, rebound effects need to be taken into account: for example, careless behaviour exercised by the user because of the lack of ownership and responsibility over the product (Vezzoli et al., 2018).
The associated circular strategy from R Framework is represented by *rethink* which can be summed up as the reconsideration of the product use, for example by making it more intensive through PSS (Kirchherr et al., 2017), as mentioned.

ii) Extending product value

This model considers exploiting the residual value of products: it is centered around remanufacturing or repairing activities and other product life extension strategies (Bocken et al., 2016). It requires establishing take-back systems and setting up different types of collaborations to ensure the return of products (Bocken et al., 2016). It is pivotal to bear in mind that not all CBMs are necessarily environmentally friendly (Salvador et al., 2020). For example, setting up a reverse logistic system can foster circularity but also increase the use of energy and resources (e.g., increasing air emissions from transportation) compared to production from virgin materials (Salvador et al., 2020). Thus, Hofmann (2019) suggests that firms need to consider potential negative effects, particularly in the early stages of CBMs implementation. Rosa et al. (2019) describe reuse, remanufacturing based CBMs as among the most common ones. Based on the R Framework, slowing loops can be achieved through:

Reuse which implies using again a product still in good condition and fulfilling its original function (Blomsma et al., 2019).
Repair which can be described as the process of restoring a product to good conditions after decay or damage (Konietzko et al., 2020; Bocken et al., 2016). It is distinguished from maintenance which is the act of inspecting or performing tasks (e.g., technical) to retain the functional capability of a product (Bocken et al., 2016).
Refurbish which can be described as the process of returning a part/product to a satisfactory working condition (usually inferior than original condition) (Blomsma et al., 2019).
Remanufacture which can be described as the process of returning a product to original performance specification and quality (Blomsma et al., 2019).
Repurpose which is related to using a product for an alternative use compared to what it was initially designed for (Blomsma et al., 2019).

Closing the loops

Closing the loops has the objective to reduce the use of resources by using products, materials and components again. This aim could be achieved by applying i) extending resource value and ii) industrial symbiosis.

i) Extending resource value

This model considers the "collection or sourcing of otherwise wasted materials and resources to turn them into new forms of value" (Bocken et al., 2016, p. 314). Collaboration and take back systems must be put in place. The associated circular strategy as described by the R Framework is *recycle*: it can be described as processing used materials to turn them into new products. A distinction can be made between i) downycling: converting used materials into materials of lower value (e.g. clothing turned into stuffing) and ii) upcycling: converting used materials into higher quality materials (e.g. ocean plastic turned into clothing) (Ludeke-Freund et al., 2018).

ii) Industrial symbiosis

This model considers transforming waste outputs or by products from one process into feedstock for another process or product line (Bocken et al., 2016). It is based on an exchange of material and energy resources which can occur on different geographical levels – within the same facility and among firms both in close or not close proximity (Kanda et al., 2021). In this particular approach, collaborative strategies are notably important: establishing collaboration can support in developing new business lines based on previous waste streams and reduce costs (Bocken et al., 2016). For example, the Päijät-Häme Waste Management Ltd (PHJ) in the city of Lahti in Finland has developed the Kujala Waste Centre project where several waste related businesses have been collocated on a single site for easily transferring outputs (EU Commission, 2018).

Even if some circular strategies have existed for many years (such as repair and reuse), it seems like discussions revolve around a few common models (Ludeke-Freund et al., 2018) and some have experienced an accelerated growth in the last years (OECD, 2018). Incumbent companies usually try to implement principles based on a CE by following a cradle-to-cradle approach: the usual logic is for the firm to assume responsibility for products' lifecycles, abandoning the use of non-renewable energy, fostering the development of reusing, refurbishing and recycling while improving commitments on maintenance and repair (Frishammar & Parida, 2019).

Within this complex landscape, Rosa et al. (2019) provides a systematic literature review on possile strategies for approaching a CE, finding that the most common circular strategies discussed in literature are recycling and use-oriented PSS. Other types of CBMs are focused on "reuse and refurbishing/remanufacturing practices, result-oriented and product-oriented PSSs and industrial symbiosis" (Rosa et al., 2019, p. 12). Indeed, several authors agree that PSS based CBMs are one of the simplest innovation strategies to achieve a CE (Rosa et al., 2019).

2.3 Conceptual Framework: Business Model Innovation (BMI)

As explained by Geissdoerfer et al. (2020), the CBMs notion is based on the overarching concepts of CE and Business Model Innovation (BMI). To understand how the transition from a linear BM to a CBM can occur, BMI can be used. In fact, there is wide consensus among researchers that BMI is an extremely relevant strategy for firms to promote circularity (Bocken et al., 2016; Nußholz, 2018). Moreover, from the author's perspective, while theories on model reconfiguration prioritise one or few aspects over others, BMI proves to be comprehensive and thus the most appropriate conceptual framework for supporting the research. Therefore, the author of this study has used BMI for analysing the empirical phenomenon of VP transitioning from LBMs to CBMs.

Although the increasing literature on business models, there is still ambiguity for what constitutes a BMI (Bocken et al., 2014). However, Bocken et al. (2014) explains that BMI's core element is the shift from a company focus to a network focus, necessary for transforming the BM and thus seems to be very appropriate for this case study. In this specific type of innovation, traditional innovation related activities such as new products, new processes and new organizations leave room to a reconfiguration of the elements of a business model including new content, new structure and new governance of responsibilities (Massa, n.d.).

Business model innovation is described as "the conceptualisation and implementation of new business models that can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another. The transformation can affect the entire BM or individual or a combination of its value proposition, value creation and deliver, and value capture elements, the interrelations between the elements, and the value network" (Geissdoerfer et al., 2018, p.405).

Literature highlights that usually it is very common for incumbent firms to operate under multiple business models (Frishammar & Parida, 2019). Also, many companies pursue CBMs alongside LBMs (Whalen, 2017). Moreover, transition pathways can be shaped differently. On the one hand, some authors suggest that the transition from the traditional to the new business model is usually gradual (Sitra et al., n.d.): some BMs would lead to incremental change. On the other hand, other authors point out that companies can also start new subdivisions or pilots that are quite radical and then diversify their portfolio from there (Geissdoerfer et al., 2020).

Enablers and Barriers to LBMs to CBMs transition

Besides looking at the most suitable types of CBMs, it is relevant to bear in mind that different factors play a role: several authors agree on some of the enablers that can support the transition from LBMs to CBMs such the relevance of CBMs with several cycles across own operations and value chain as well as the necessity for companies to deliver a dynamic value proposition subjected to reconfiguration along the product lifecycle (Hofmann & Jaeger-Erben, 2020; Sitra et al., n.d.).

Technology has also been pointed out as key transition facilitator (Sitra et al., n.d.): interconnected products, material databases can act as a tool to inform CE in the company (Konietzko et al., 2020).

On the contrary, recurrent themes in the literature related to barriers that are usually faced by companies that start the transformation journey are organization & culture: mindset change has been reported as one of the most relevant aspects of CBMs implementation (Rizos et al., 2016).

Moreover, finance and ecosystem (e.g., changing supply chain in a complex global supply chain configuration is difficult) (Sitra et al., n.d.) have been highlighted as challenging aspects. Especially this last point underlines that because of a high degree of specialization and division of labor, the majority of incumbent firms today do not provide a full CBMs just by themselves (Frishammar & Parida, 2019). On the contrary, a business model transcends the boundaries of an organization and therefore requires the engagement of multiple stakeholders (Frishammar & Parida, 2019). Thus, transitioning from LBM to CBM will require change internally, at the organizational level but also externally, at the value chain level. Although it could be argued that this is the case for both LBMs and CBMs, a clear distinction can be made: on the one hand, LBMs are more organization centric, considering key partners and suppliers as a key building block. On the other hand, CBMs are more ecosystem centric and, especially in the case of a

FTS, the set up depends on collaboration with the actors involved in the network. Indeed, because collaboration is a central theme in VP business model set up as an FTS and the company is very dependent on collaborative strategies, when looking at implementation of CBMs, a need to explore required changes to external value chain relations has to be prioritised.

2.4 Collaboration for achieving LBM-CBM transition

The development of CE strategies in existing BMs requires, among other things, getting involved in collaborative circular networks and partnering with various actors in society (Salvador et al., 2020; Holesova & Ivashneva, 2021), shifting from a firm-centric to a network-centric approach (Bocken et al., 2016). Infact, implementing circular strategies oftentimes extends beyond the boundaries of a firm (Nußholz, 2017). Additionally, transitioning from an LBM to a CBM requires changes which often necessitate collaboration with old and new stakeholders in the company's ecosystem (Frishammar & Parida, 2019). Indeed, to complete a firm's offer, third-party service providers might be needed, with a specialized expertise (Frishammar & Parida, 2019). Although collaboration results challenging to define, as described by Brown et al. (2021), the majority of definitions describe collaboration as the "intentional and voluntary interactions (linking or sharing of information, resources, activities, and capabilities) between two or more organisations (and those individuals involved) directed towards the achievement of a common goal or purpose that could not be achieved individually" (p.2).

From a structural perspective, collaboration is usually categorized as internal or external, further divided in vertical and horizontal. While the first describes the position along the supply chain, highlighting the relationship between e.g. a company and its suppliers or customers; the second describes the connection between a company and its competitors or organizations that operate in the same sector (Vlajic & Hsiao, 2018). Vlaji & Hsiao (2018) explore the role of collaboration in supply chains: the authors point out that circular flows are enabled by both vertical and horizontal collaboration, highlighting that this occurs both within the same sectors and among different sectors. Table 2-2 provides a visualization of the structural view of collaboration.

Table 2-2. Structural view of collaboration: internal and external collaboration.

Structural view	**Internal collaboration**	Within the organization: between different departments in a firm	
	External collaboration	Outside the organization: with business partners	*Vertical*: along the supply chain – between firm and its suppliers/customers *Horizontal*: outside the supply chain – between firm and its competitors or other organizations

Source: adapted from Vlajic & Hsiao (2018)

As described by Osterwalder and Pigneur (2010), key partnerships represent one of the nine fundamental blocks of a business model. Building up a network of partners and suppliers represents a cornerstone of a successful company (Osterwalder & Pigneur, 2010). New types of partnerships can help firms to launch CBMs, by complementing lack of internal capability

(Frishammar & Parida, 2019). Table 2-3 provides a summary of most relevant motivations for companies to engage in collaboration, as described by literature.

Table 2-3. Motivations for collaboration

Motivation for collaboration	Meaning
Joint learning	Co-develop new knowledge (Staaf & Sundstrom, 2021; Brown et al., 2019)
Shared goals	Work towards achieving common set targets or goals derived from aligning future strategy visions (Staaf & Sundstrom, 2021; Brown et al., 2019; Frey et al., 2006)
Resource sharing	Access to resources, assets, capabilities, skills across actors (Staaf & Sundstrom, 2021; Brown et al., 2019)
Finance alignment	Share costs, risks, benefits (Staaf & Sundstrom, 2021; Brown et al., 2019)
Joint product development	Co-develop new offerings (product or service propositions) (Staaf & Sundstrom, 2021)

Source: Author. Definitions adapted from Staaf & Sundstrom (2021), Brown et al. (2019), Frey et al. (2006)

Understanding and applying collaboration in the CE context is extremely important for the purpose of this thesis project – even if it is not the only factor needed. Collaboration is especially important for VP because, being an FTS, VP does not have a direct relationship with the end users. Indeed, the peculiarity of this case study, from a circularity perspective, is that VP supplies an integrated propulsion system - cockpit, steering, control; gearbox and driveline; propeller/drive system - as components, directly or through dedicated dealers, to boat manufacturers who sell the whole boat themselves. This leads to the necessity of overcoming the challenge, while going circular, of retaining control over the product use: it is deemed necessary to find ways to work with its value chain partners to support circularity. Thus, collaboration is necessary to ensure that a misfit between different CBMs is avoided. For example, starting from the design stage, all the components should be designed bearing in mind the importance of their interconnection: if the transimission system is built for durability but the boat itself is built for easy reconfiguration and modularity, then the full potential of CBMs would not be exploited. Moreover, due to the complexity of VP business model (several different suppliers, dealers and complex steps in its supply/value chain), when implementing circular strategies and CBMs, it will be pivotal to understand how to collaborate with the surrounding network of partners and stakeholders to redefine, improve and restructure links with end users. Therefore, this particular case study can advance the theory by exploring the collaborative strategies most suited for an FTS and not user-facing company.

From literature analysis, the most connected collaboration practice within CE strategies result to be sharing responsibility for product recovery, which enables collection of return/End of Life (EoL) products (Sudusinghe & Seuring, 2022) which leads to higher rates of repairing, refurbishing and remanufacturing (Sudusinghe & Seuring, 2022). Furthermore, it is evident that multiple stakeholders in the innovation process have to be incorporated for the development of CBMs, including unconventional partners that might be somehow different from the common value chain partners (e.g. Non Governmental Organizations) (Bocken et al., 2018).

Enablers and Barriers in collaboration

Engaging in collaboration requires to take into account trade offs, in the form of: search costs (for gathering information to identify trading partners), contracting costs (for negotiating and writing down an agreement), monitoring costs (for ensuring partners are respecting clauses) and enforcement costs (for sanctioning parterns who do not respect the agreement)(Dyer, 1997). Among other challenges in collaboration, it is pivotal to ensure that stakeholders are prepared to engage in CBMs and that they share the firm's CE-related goals (Salvador et al., 2020; Salvioni & Almici, 2020). Even if there are options of becoming more circular through network and collaboration, are the partners going to be ready or willing to collaborate towards more circularity?

It might be complicated for a company to complete the transition towards CBM if stakeholders in its value chain are not willing to adjust to the necessary changes (Lahti et al., 2018). Therefore, it is pivotal to ensure that the necessary understanding and incentives to move towards a CBM are created for key partners (Linder & Williander, 2017). Frishammar & Parida (2019) define this "ecosystem orchestration" (p.22): companies can actively collaborate to ensure alignment through actions such as nurturing (in the form of providing incentives) and negotiating (in the form of resolving tensions). Additionally, to ensure a smooth management of collaborative partners, companies would benefit from engaging with a limited number of them (Staaf & Sundstrom, 2021; Barratt, 2004).

2.5 Knowledge gaps

CBMs uptake seems not widespread in business practice: the need to change the key building blocks of the business and to go against dominant business paradigms slow the process down (Bocken et al., 2019). Some scholars' point to a wide central issue and main theoretical focus of the thesis in terms of new ideas related to how to transform in practice an LBM into one that is circular (Rosa et al., 2019). Focus on literature is much on developing tools, design principles but it is still unclear how companies actually move forward with this. It is rare to witness firms implementing CBMs as envisioned by researchers in the academia world and usually, when implementation occurs, companies tend to prioritize one intervention rather than multiple ones although they might pursue multiple strategies (Whalen, 2017).

In general, it is evident that a clear line of action to practically support a BM change from linear to circular is still missing (Rosa et al., 2019). Often, CBMs are presented as "one-size-fits-all" solution: however, for a correct choice and implementation of CBMs, it is important to consider product-specific criteria and company capabilities (Reim et al., 2019), hence the relevance of a single case study such as VP in exploring and identifying a CBM that is best suited to the company's prevailing situation.

Among the few studies that exist on the implementation of CBMs by companies, it is worth noticing that a lack of investigations on how to support incumbent firms in navigating the transition towards CBM emerges (Hofmann & Jaeger-Erben, 2020). Usual focus of research on CBMs tends to prioritize start-ups (Reim at al., 2019) rather than incumbent firms. However, it is pivotal to explore such topic through the lens of incumbent firms since their large market shares can lead to substantial environmental effects, even after following small circular upgrades (Frishammar & Parida, 2019).

Moreover, a focus on the manufacturing sector is underexplored (Linder & Williander, 2017; Okorie et al., 2021), altough there has been increasing research. Furthermore, while several studies research the transition from LBMs to CBMs such research with a focus on FTS is lacking, since most of research assumes that companies business set up is either B2C or B2B (Pieroni et al., 2021). In addition, FTS are relevant as a type of incumbent firm, as a good case for studying role of collaboration because collaboration is particularly central to an FTS and represents an "extreme case". From previous research, it appears that collaboration is an important aspect for the implementation of CE principles (Sousa-Zomer et al., 2018), however authors highlight that CE requires supplementary coordination efforts in the value chains, both upstream and downstream (Hansen & Revellio, 2020).

In conclusion, based on literature review, it is clear that the current status quo of Business Models in incumbent firms in the manufacturing sector, is mainly characterized by traditional LBMs (Accenture, 2014; Gusmerotti et al., 2019; Linder & Williander, 2017). However, an increasing number of researchers discussing CBMs implementation can be observed even if uptake of such CBMs option is not very widespread outside academia. Additionally, among the studies that exist on the implementation of CBMs by companies, it is worth noticing that a lack of investigations on how to support incumbent firms in navigating the transition towards CBM emerges (Hofmann & Jaeger-Erben, 2020). The usual focus of research on CBMs tend to prioritize start-ups (Reim at al., 2019) and a focus on the manufacturing sector (Linder & Williander, 2017; Okorie et al., 2021) as well as FTS is underexplored, assuming that key features of case companies are direct contact with end users (either B2C or B2B) (Pieroni et al., 2021) with recycling and PSS based CBMs as the most common archetypes in this case (Rosa et al., 2019). In understanding how an FTS can achieve a successful transition from a business model mainly based on linear principles to one (or more than one) based on circular strategies, BMI can be employed, with its focus on enlarging the perspective from the product to the ecosystem.

The peculiarity of a study focusing on FTS transitioning to CBMs is related to the lack of direct contact with the end user, which implies the necessity of developing collaborative strategies with key stakeholders. Such a development ultimately leads to restructuring processes involving a reconfiguration of value chain relations, structures and dynamics. Therefore, this study aims to find the answers to the central attributes of current traditional business models and value/supply chain of an FTS in the marine leisure industry (RQ1); to which circular strategies options and CBMs an FTS is more likely to adopt (RQ2); the role played by collaboration for an FTS in the implementation of circular strategies and the transition from LBMs to CBMs (RQ3). Figure 2-4 provides a visual illustration of the reasoning process of research gaps found in the literature and how this research aims to contribute to fill missing knowledge.

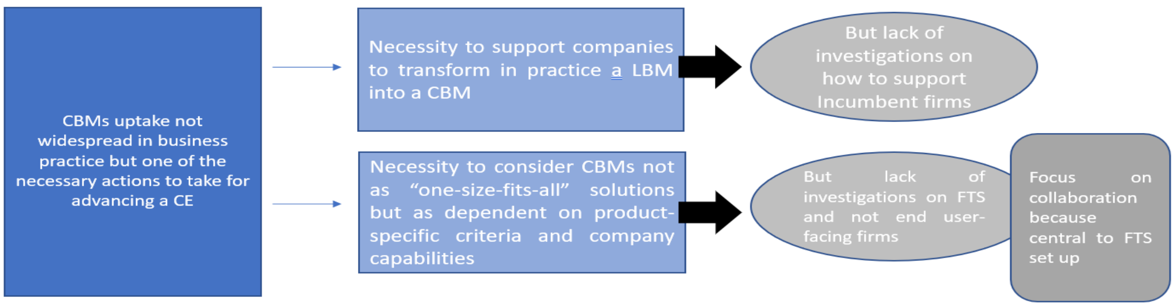

Figure 2-4. How the thesis aims to fill the researh gaps found in literature

Source: Author

3 RESEARCH DESIGN, MATERIALS AND METHODS

This section describes the technical design chosen for this study. Moreover, it highlights the choice of using a single cases study, with related strengths and limitations. It then describes the materials used for data collection as well as how the author conducted the analysis of the materials collected.

3.1 Volvo Penta: a single case study

This research follows a single case study: Volvo Penta, a Swedish-based multinational component manufacturer which produces engines and drivelines for both marine and industrial applications. The suitability of case studies is particularly evident for providing a thorough understanding of a contemporary topic in a real-world context (Yin, 2018) and a more in-depth analysis of research phenomena (Sousa-Zomer, 2018). Furthermore, Flyvbjerg (2006) explains that case studies are relevant for researchers since they allow for a level of closeness to real-life situations and for gathering of multiple details. A single case study allows the researcher to dedicate more time to one specific observation which means capturing more effectively the complexity of the situation. However, it is important to highlight that criticisms may arise, mainly related to the reliability and generalizability of case studies.

To mitigate some of these limitations, the author has rigourously highlighted methodic procedures, as well as transparently discussed any biases that might have influenced the research. The rationale for the chosen approach has been thouroughly described in terms of how data was collected, how analysis was conducted, providing motivations for the author's choices. Furthermore, internal validity of this study structure has been ensured by following triangulation, achieved by using more than one data source and combining different types of data collection methods (company interviews, documents, on-site observations). Throughout the project, there has been exchange of information and understanding between the author and other REES project researchers: some have participated to some interviews and to the on-site observations since considered relevant to their own stream of research. Moreover, several debriefing sessions with other peer reviewers supported the development of the research. Comparing and combining interpretations from different observers was utilized to increase reliability and reduce bias.

3.1.1 Pilot study

As regards the research design, it is important to clarify that before the thesis project, a pilot study was conducted, to set the basis for further research. The pilot study involved review of literature on the chosen topic and website of VP as well as 1 interview with the contact person at the company (Electromobility Director). VP had expressed its proactive interest in participation in the research to address concerns related to CBMs and collaboration. This proved fruitful in understanding how to better frame the direction of research but also guaranteed access to a series of interviewees whose insights were considered pivotal for the study. Thus, as regards the research design, the most suitable way to approach the research problem is a qualitative approach rather than a quantitative one. Indeed, based on Creswell (2018) one of the features of qualitative research is generating meaning and understanding through rich description: so using a qualitative approach rather than a quantitative one results more appropriate. Moreover, during the interview with the contact person, it was highlighted that currently at the company level there is not a very high level of circularity as such, besides for some remanufacturing activities of engines, neither specific targets for being a fully circular company. Rather, it was emphasized by VP contact person that this research was envisioned as a way "to help VP get going" on the journey towards circularity.

These statements proved useful to further understand which research design to consider more suitable for the aim of this study. For example, considering that the knowledge about CBM options at the company level is not well developed yet, methods such as running a quantitative survey on managers in VP on different CBM options was excluded, providing additional evidence on the feasibility of a qualitative approach. Therefore, this research could serve as a starting point to build new insights rather than confirming or testing theory; it could act as a supporting tool for VP but also for other reseachers investigating the topic in more depth.

This thesis project shares the aims of qualitative research as described by Creswell (2018): explore (identify patterns, themes, get an initial understanding of the phenomenon), describe (convey information about what research is studying) and interpret events (making sense of what is going on). Also, by the end of the research, the author summarizes recurrent themes which are considered to be common products of qualitative research. This will guide VP in deciding which CBM is most suitable for them and for FTS peculiar situation.

Figure 3-1 shows the stepwise approach the author followed to design, research and answer RQs.

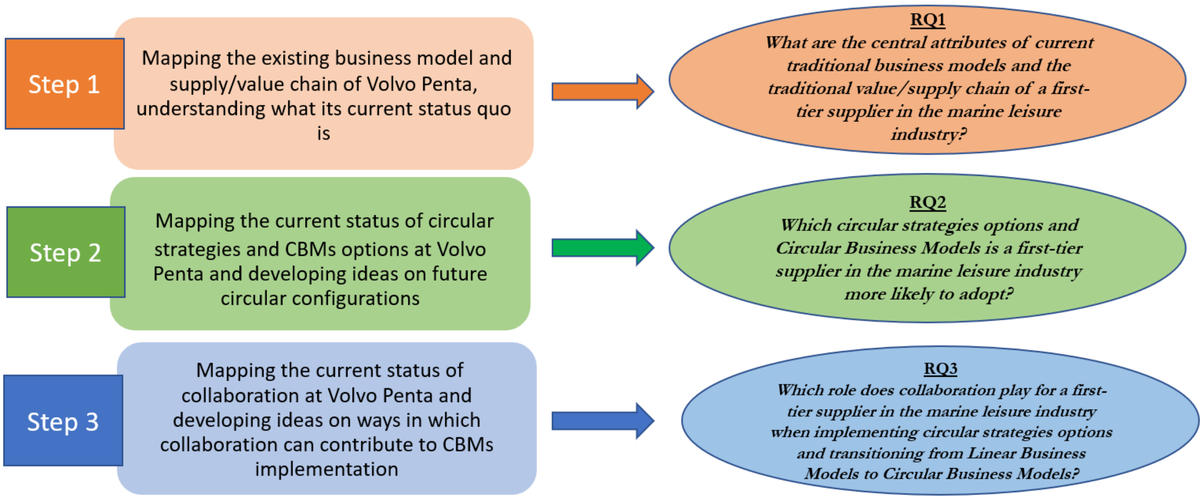

Figure 3-1. Author's stepwise approach to design, research and answer RQs

Source: Author

3.2 METHODS USED TO COLLECT DATA

The empirical research has led the author to restrict/focus constantly. After conducting literature review, data collection methods were confirmed as ii) problem-centered interviews, iii) documents and iv) on-site observations. Because of the nature of qualitative research, the design has proven to be flexible, evolving, emerging and iterative (Vaismoradi et al., 2016).

i) Literature review

In parallel with understanding how to best shape the research design, a literature review on CBMs and collaboration was conducted, using both grey and academic literature. Grey literature included reports and working papers. Academic literature included a variety of peer reviewed journals (e.g., Journal of Industrial Ecology, Journal of Cleaner Production) and conference papers published in English only, primarily spanning a timeframe between 2016 and 2022 in order to collect information on the most updated developments around the topics in the past 7 years. For conducting the literature search, the author identified important keywords and then she consulted Google Scholar for results. The search was divided in 2 topics streams, based on problematization, RQs and aim of the study:

1. Topic stream 1: examples of key words used are "First-tier Suppliers circular business models", "First-tier Suppliers' circularity", "First-tier Suppliers circular", "manufacturing sector circularity", "circular business in manufacturing".

2. Topic stream 2: examples of keywords used are "collaboration", "collaborative approaches", "collaborative strategies", "collaboration in CBMs", "collaboration in Circular Business Models", "collaboration in FTS", "collaboration in First-tier Suppliers".

A few papers focusing on literature review of existing CBMs tools and archetypes themselves, were used to identify additional literature, through the review of references cited, following the snowballing technique.

Out of all the papers collected, after reading the abstract, some where discarded because they were found to be not truly relevant for the purpose of the study. Collection of the final papers (38 papers for topic stream 1 and 23 papers for topic stream 2) was conducted until point of saturation was reached, e.g. the same themes were recurring and no new insights were given by additional sources of data.

ii) Problem-centered interviews

Problem-centered interviews are the representation of a method that allows to integrate both deductive and inductive thinking for improving the knowledge of a specific phenomenon (Hofmann & Jaeger-Erben, 2020). They have allowed the author of this research to access stories, explanations and understandings. Through deductive thinking, the author moved from broad generalizations (collected by reading academic papers and journals – essentially the literature review) to specific observations (formulated when conducting interviews with VP).

In inductive thinking, the author made inferences based on observations (especially from the interviews and on-site observations) towards broader generalizations (formulating ideas that might be applied to other FTS as well). After understanding the mechanisms of how and why things work a certain way and explaining these mechanisms not just the patterns (the what), the research aims at adapting and transferring certain insights to other cases. However, results might be vulnerable to interviewees biases.

A total number of 17 interviews with VP employees was conducted: 15 interviews were carried out on Microsoft Teams or Zoom, ranging from 30 to 45 minutes and 2 interviews were carried out in person during the on-site observation at the Vara Plant (as it will be explained in the next paragraph). Moreover, because the thesis project has been in collaboration with VP, there has been a continuous interaction with VP contact person through regular meetings and email exchanges. The selction of the interviewees followed this logic: the author of this research has provided the contact person with a list of relevant interviewees to reach out to for collecting data (based on their expected knowledge contribution to the project and their professional position in the company). Based on the suggested list, the contact person has identified suitable employees' names, reached out to them and scheduled the most suitable timing for interviews. It is important to mention that the contact person was present in 10 interviews with VP employees that the author of this research has conducted. While this might be perceived as a limitation, with interviewees feeling observed and having to reply in a certain way, on the other hand, none of the interviewees was reporting directly to the contact person as a manager which reduced the risk of biased answers. Overall, the atmosphere in the interviews was open and constructive.

As regards the format, semi-structured open-ended questions have been used to allow for comparison but to make sure that interviewees could add their reflections as well. However, the interview guide has been prepared in a slightly different way depending on the participant (balancing between getting rich material and comparability) but also, after learning from participants about certain meanings, interviews questions have been adjusted accordingly. To gather information about different tools/frameworks on LBMs and CBMs in the marine leisure industry, respondents' opinions related mostly to business models and organizational structure have been collected. A list of interviewees can be found in Appendix 1.

Moreover, as a source of knowledge generation, the author contacted business consultants and researchers who can be considered as advisors using their expertise, networks, and abilities to consult firms (Hofmann & Jaeger-Erben, 2020). They observe LBMs to CBMs transitions, in their everyday life, therefore providing inspiration and inputs on exploring ideas on how CBMs may need to be adapted. Unfortunately, out of the 2 business consultants and 6 researchers contacted and the open messages published on online platforms (e.g., Sustainability Professionals LinkedIn Groups), only 1 business consultant and 1 researcher agreed on interviews (30 minutes each via Zoom, for a total time of 1 hour). A list can be found in Appendix 1.

While conducting interviews, the author took handwritten notes to make sure key points were recorded. To ensure the possibility of going back to these main points and understand if there was a need of sending a follow up email or scheduling a follow up interview for clarifications, the interviews have been audio recorded and transcribed with Otter.ai, a transcription software. Participants have been asked for their consent to audio record the interview. The voluntariness of the interviews has been explicitly mentioned, as well as the purpose of the data collection. Privacy and anonymity of participants is respected by referring to the interviewees' position, focusing on the professional views and experiences of a certain role. Names and surnames have been deleted as soon as data from interviews have been processed. Throughout the project, both the author and the supervisors had access to the files, shared on a Google Drive folder.

iii) Documents

To complement the lack of interviews with business consultants and other researchers, consultant reports have been reviewed instead. Documents from Volvo Group and Volvo Penta - media; podcasts; annual report; intranet publications - have been reviewed to research about context related information on VP and the marine leisure industry. Such documents allowed the author to access information which proved fruitful in cross-checking facts gathered through interviews. Table 3-1 provides a summary of such consulted documents.

Table 3-1. List of documents consulted as a source of data collection

Category of documents	List of documents consulted
1. Media	- Premiere episode of Volvo Penta Podcast on sustainability (Volvo Penta, 2022) - YouTube video: Volvo Penta remanufactured components (Volvo Penta, 2015)

	- YouTube video: Volvo Penta hybrid concept behind the scenes (Volvo Penta, 2022) - YouTube video: Volvo Group innovation process leads to new start-up Cetasol (Volvo Penta, 2021)
2. Reports and presentations provided by VP	- Volvo Penta company presentation - Vara Plant presentation
3. Documents publicly available	- Annual and Sustainability Report 2021 Volvo Group - Written interview to Heléne Mellquist, President of Volvo Penta "Becoming world leader in sustainable power solutions" (Volvo Penta, 2021) - Article on "Remanufacturing engines and exchange components makes them as good as new literally" (Volvo Penta, 2021) - Article on "Volvo Penta to accelerate sustainability ambitions" (Volvo Penta, 2020) - Article on "Partnership is the new leadership" (Volvo Penta CTO and SVP, Peter Granqvist, 2022) - Article on "The silent future of tourism: Volvo Penta to power Hurtigruten Svalbard's new hybrid vessel" (Volvo Penta, 2021) - Several pages on Volvo Penta website

Source: Author

iv) On-site observations

To complement the interviews and other consulted documents as well as to get a more comprehensive understanding of current operations, the author conducted direct on-site observations by visiting VP's Vara Plant, where block engines are received from VP's Skövde plant, prepared for assembly, assembled into complete engines, tested and then delivered to customers. The visit consisted in a tour of the facility and a power point presentation of the site. As well as 2 interviews with 2 VP employees working there. Information was recorded through handwritten notes. Moreover, pictures were taken. Appendix 1 provides a summary of interviewees and present people.

3.3 METHODS USED TO ANALYSE DATA

After collecting the data, analysis to process the information gathered was conducted. Initially, synthesis matrices were utilized to organize data on concepts related to CE, CBMs, Collaboration. As mentioned by Creswell (2018), for data analysis and interpretation, content analysis is used to identify themes in recorded communication, to determine the presence of certain terms, patterns, or concepts within some given qualitative data so content analysis was used for the purpose of this research to gather common themes. Moreover, the analytical framework highlighted in the literature review chapter was used both as a starting point to develop interview questions (thus making sure to map current circular strategies employed at VP) but also to analyse the interview transcripts. For that, the author has followed the 4 steps framework for qualitative content and thematic analysis as suggested by Vaismoradi et al. (2016), as summed up in fig 3-1.

First, initialization: the author read and carefully reread the interview transcripts and highlighted key recurring ideas related to the topic of research (e.g., different types of business models; collaboration), while writing reflective notes to gather the main key takeaways right after interviews.

Secondly, construction phase: the author classified recurring ideas into similar codes. Eventually, similar codes were grouped into bigger clusters that were then labelled in connection to relevant themes. Throughout the process, comparison among themes was applied to reveal the link between codes.

Thirdly, rectification phase: the author ensured some level of distancing to allow for self-criticism and discussions with other researchers involved in the REES Project. This approach allowed the opportunity to look at the phenomenon from a fresh angle. Labeled themes were related to established knowledge, acquired through literature analysis. Notwithstanding the comprehensive literature review conducted prior to data collection as a starting point to develop interview questions, additional academic sources were reviewed and supported the author in the development of step four.

Lastly, finalization: the author developed different storylines which were used as the base to develop analysis and interpretations of results for RQs.

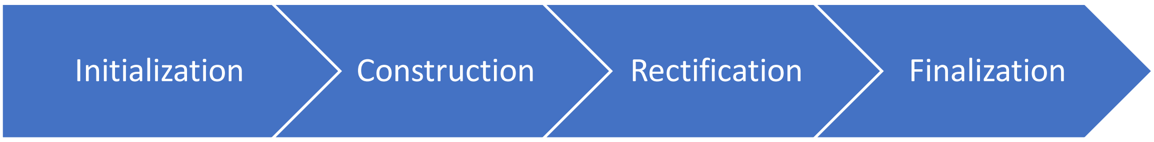

Figure 3-2. Steps for data analysis.

Source: Adapted from Vaismoradi et al. (2016)

A color coding has been used, with one color for each code. Appendix 2 shows coding for RQ1, RQ2 and RQ3 respectively. Manual coding proved appropriate for the small project and for avoiding the limitations of using a software in creating too many codes or becoming too mechanical, therefore lacking depth of analysis (Linneberg & Korsgaard, 2019). Moreover, because interviews were conducted internally (with VP employees), manual coding proved to be an efficient tool in reviewing the transcripts and connecting information to be then clarified in the next interviews. The author used coding as an early form of analysis as suggested by Linneberg & Korsgaard (2019). A combination of both inductive and deductive coding has been implemented as shown in figure 3-2.

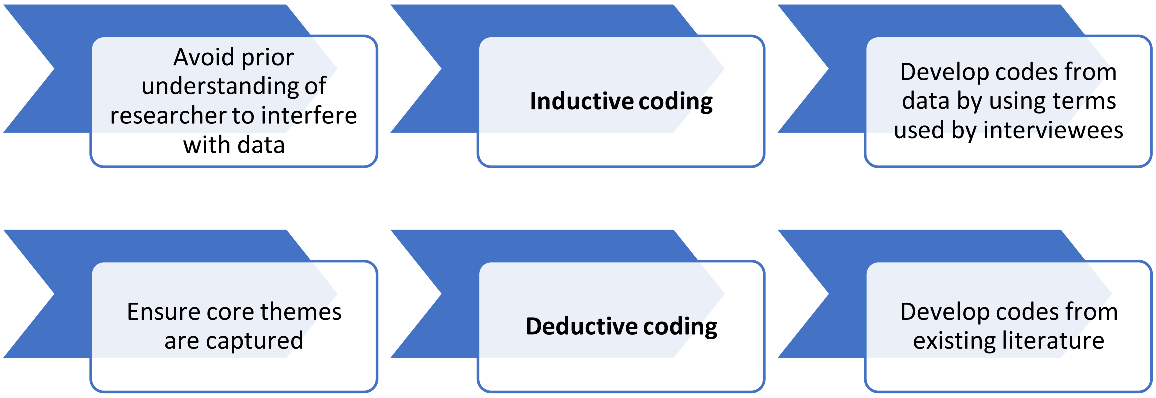

Figure 3-3. Inductive and deductive coding approaches.

Source: Author

4 FINDINGS & ANALYSIS

This section presents findings of research and analyses results for RQ1 in 4.1, RQ2 in section 4.2 & RQ3 in section 4.3, underlying patterns and themes emerged throughout the project.

4.1 FTS current status quo

Through interviews, on-site observations and constant interactions with employees at VP, it was possible for the author to gather a detailed understanding of this specific case study and suggest answers for RQ1: *"What are the central attributes of current traditional business models and the traditional value/supply chain of a First-tier Supplier in the marine leisure industry?"*. Section 4.1.1 will describe: the current BM set up with reference to Business Model Canvas by Ostelwalder & Pigneur as described in literature review. Section 4.1.2. will depict the current level of circular economy implementation at the company and current BM challenges.

4.1.1 Current BM set up

This section provides an overview on VP's Business Model Canvas (Table 4-1), before describing results and analysing every key element.

Table 4-1. Volvo Penta's Business Model Canvas

Value type	Key elements	Volvo Penta
Value creation	Offer and value proposition	Component manufacturer "Helm to prop" complete solutions Marine diesel engines Ease of installation and operation Customization Brand image, trust, credibility
	Customer segments	Boat builders/constructors/OEMs; dealers & private final end-users
	Customer relationships	Personal dedicated assistance through dealer network; online platforms
Value delivery	Key resources	Expertise in propulsion efficiency; technological skills; in-house product development; in-house testing facilities
	Key activities	Design, Production, delivery and sales related
	Key channels	Direct and indirect
	Key partners & suppliers	600 suppliers *For an overview on partners refer to Table 4-3

Source: Author

Value creation

i) Value proposition

VP is the world-leading supplier of power solutions to marine and industrial applications (VP website, 2022). Being a ***complete system supplier***, it creates value for its customers by providing "helm to prop" complete solutions: everything needed to maneuver and navigate the boat, produce power and transmission as well as steering. Even if VP has been part of the Volvo Group since 1935, it has been described as different from the rest of the group: in fact, differently from other divisions, such as the Volvo trucks, VP does not produce complete products but instead it could be described as a component manufacturer (Respondent 1; Respondent 6).

It has been highlighted by Respondent 4 that among the biggest strengths of VP, ease of installation and operation can be featured. When transitioning to CBMs, it will be relevant to understand how to ensure that both can be guaranteed. Respondent 1 mentioned that VP provides a ***high level of customization*** which represents one of the main factors that has given VP a good position in the market, since the number of combinations that can be produced is significant. "The boat builder that has maybe five different sizes of boats, for example, can have the same interfaces with the same supplier and just scale depending on what type of features they are looking for" (Respondent 1). At the same time, it has been highlighted by Respondent 1 that it is very relevant to ensure that the systems developed by VP are possible to ***scale*** and it must be very easy to ***configure*** all these different variants in software. "If we were to spend 100 hours on each unique installation with the customer, it will not be a profitable business" (Respondent 1).

In looking at CBMs, a high level of customization might be problematic, especially when considering circular strategies such as remanufacturing and reuse as well as product take back: indeed, a higher level of standardization could facilitate circular strategies. Moreover, VP provides a high degree of trust, credibility and brand image (Respondent 4) which must be maintained when transitioning to CBMs. Changing the existing blocks of the current BM towards a new way of doing things could impact these values, especially when certain types of CBMs are being tried for the first time.

As an FTS, VP ***manufactures and delivers an integrated propulsion system*** - cockpit, steering, control; gearbox and driveline; propeller/drive system -, directly or through dedicated dealers, to its customers boat manufacturers who then integrate them in boats and sell the whole boat themselves. As regards this thesis reference product, marine diesel engines for leisure segment, their production uses different types of materials, namely aluminium, copper, iron, steel, plastic (Respondent 11). The variety of materials raises concerns related to waste production and recycling possibilities but could also represent an opportunity for finding multiple rather than a limited amount of uses to reinsert these materials into the resources flow.

In terms of operational hours, it has been pointed out (Respondent 1) that over a lifetime, one boat would use two to three diesel engines which are typically able to perform thousands or tens of thousands of hours (e.g., in terms of testing its durability). However, the average marine leisure end users in Sweden use their boats a few tens of hours per year (Respondent 2). So, the necessity of changing some parts, at a certain point, will be driven by passing of time rather than by a heavy usage from the customer side. Indeed, private users will most likely not even be close to the technical limit of the engine but rather the engine will age due to calendar years (Respondent 1 – M2). Therefore, it could represent a win win strategy for both VP and for private customers to think about a renting model rather than a model where the boat is owned.

In terms of product development, throughout a product life cycle, smaller upgrades might be performed following the technological cycle or emissions regulations but developing a brand-new engine happens rarely, maybe once a decade (Respondent 1 – M2). VP is undergoing a transformation that will see electrification and electric engines as the main product offering. A brief section related to electrification will be discussed in Chapter 6.

ii) Customer segments

For the marine leisure segment of its business, VP offerings are targeted to **final end users being privates** who buy or charter a yatch. However, VP does not have a direct relationship with end-users: indeed, its direct customers are boat builders, also referred to as boat constructors and OEMs who purchase the boats components VP sells and then assemble the components into the final product - boats.

iii) Customer relationships

VP provides personal assistance to its customers and support through a geographically well-established network of dealers, based on a two-layered system: i) VP Centers (VPCs) as top tier dealers and ii) VP Services (VPSs) as smaller dealers. It has been outlined that there is a very good communication between VPCs and VPSs and the general impression is that the contact between dealers at all levels, is very good (Respondent 3) and daily communication is carried out. "Almost every day our sales personnel are communicating with them [VPSs]" (Respondent 10). Moreover, some online platforms handled by VP exist that ensure communication on general technical problems.

Additionally, some VPCs have created online platforms "to encourage discussions among mechanics, for example, this problem how can I solve it?" (Respondent 3). This underlines that, when considering the future network reconfiguration towards implementation of CBMs, since clear lines of communications have been already established, the same channels could support in circularity-related discussions among stakeholders in the ecosystem.

Value delivery

iv) Key resources

Among the wide array of physical, human, financial and intellectual resources, some present themselves more pivotal than others. For example, producing extremely efficient products can be guaranteed just through a high level of expertise in propulsion efficiency. Moreover, several interviewees (Respondent 1; Respondent 9) have highlighted that ***technological development represents a key aspect for the current and future development of VP offerings*** and that VP benefits from in-house product development and testing facilities. When transitioning to CBMs, the presence of these resources acts as a good starting point for the capabilities needed for circular strategies, even if some will tend to be more CBM-specific.

It is relevant to highlight that there is a strong connection between VP and the rest of the Volvo Group: internally, there is a very deep collaboration within the different groups and group functions (Respondent 4), ***enabling strategy sharing and knowledge sharing***. "We are using a common platform with representatives from different divisions and we are trying to create a synergy within the Volvo group on that level" (Respondent 7). Such a synergy represents a very good starting point for internal CBMs development: for example, discussions related to discarded materials reused by other divisions could be initiated as will be highlighted in later sections.

v) Key activities

To make its business model work, VP carries out production related activities – including ***design, making and delivering*** of product components.

vi) Key Channels

In its current value chain structure for the marine leisure segment, the product currently flows from VP to dealers, to boat builders and then to end users as exemplified by Figure 4-1.

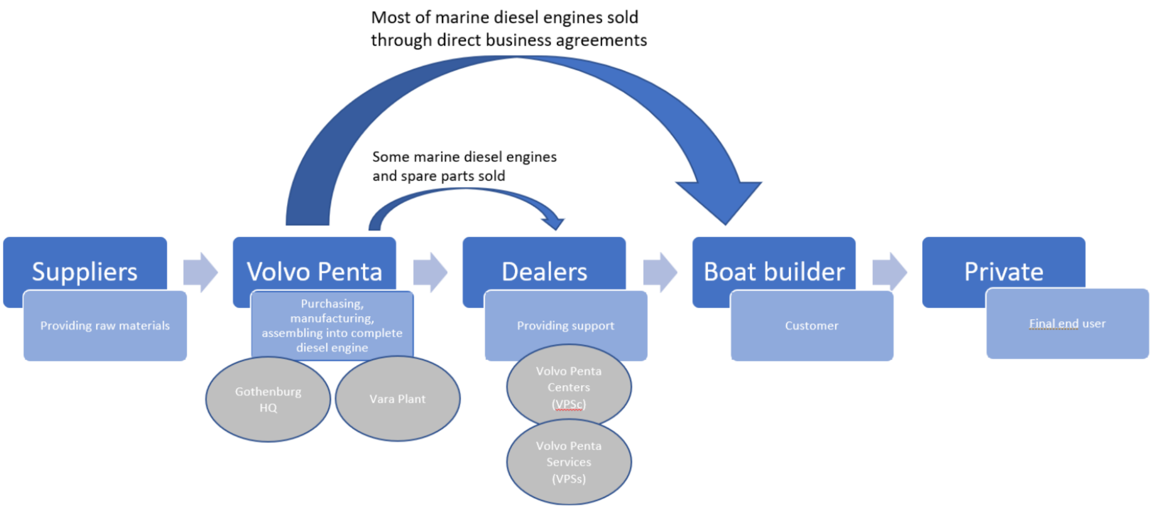

Figure 4-1. VP' supply and value chain

Source: Author

The settings are characterized by the double-agency role of VPCs and cascading requirements, training, monitoring and responsibilities. For the majority of boats, VP is not at all involved in the actual installation and commissioning (Respondent 3). For this reason, usually trainings are provided to dealers, consisting of a written manual, or YouTube instruction video. While for more complex and lengthy installations and software customization, at the beginning, the dealer receives a higher degree of support (Respondent 1 – M1; Respondent 3).

Additionally, dealers are authorized but independent, meaning that they are not exclusive to VP: they have a very high level of independence in setting their own contracts with the customers; VP supports simply in templates or ideas towards the dealer offerings they can provide (Respondent 1). On VP side, there is a high level of dependency on dealers (Respondent 3): it has very few dealers of its own and instead mostly work with independent dealers, which vary extensively: "from a one-person company to bigger companies with 30/40 employees." (Respondent 3). This implies that power dynamics need to be taken into consideration when thinking about future CBMs set up.

Moreover, some dealers are working only with leisure products and others only with commercial products but just a few are able to support both (Respondent 1; Respondent 3). It has been highlighted that it will be important to understand how to adapt the current network so that dealers can work with all products, especially now that VP is moving towards a high-tech specialized direction (Respondent 3).

What resulted clear from on-site observations at the Vara Plant is that, after assembly, engines are delivered directly to boat builders and constructors. In some cases, dealers buy spare parts or engines directly from the Vara Plant to ensure a local stock. Therefore, the VPC and VPS set up comes into play only when support is needed. This could point to the fact that there is a good possibility of establishing a direct and more interdependent relationship between VP and boat builders/constructors and therefore removing one layer of the supply chain. This is further supported by the fact that, in some cases, agreements are established directly centrally between VP and the OEM or a big boat builder. Consequently, some business models could be tested out by starting from here (e.g., pilot test for renting powertrain installation): "If you're a small boat builder and want to buy three engines, you would probably go to your local dealer but if you're a yacht builder and you want to sign up power trains for ten years or something, have a long-term strategic relationship with Volvo Penta, you would deal with the headquarters directly. Then the local dealer would get support hours (some uptime clauses or service contract), but the business agreement and the price negotiations are done directly between Penta and the customer" (Respondent 1 – M3).

vii) *Key* partners *& suppliers*

As regards the current status of partnerships, it plays a pivotal role at the moment at VP: the capacity to professionally form ecosystems and work with them in an efficient way has been depicted as a key to a successful company (Respondent 4).

Firstly, VP receives raw materials needed for developing its products offering from 330 active suppliers, out of the 600 suppliers VP interacts with, representing 98% of VP business (Respondent 5). Historically supply base requirements have been focused on quality, cost, delivery but going forward on the transformation journey, technology, sustainability and risks are the key aspects on the roadmap (Respondent 5).

Secondly, because of the complexity of its supply chain and its role as an FTS, partners have a very important role in VP business. When it comes to motives to collaborate, VP follows the trend in Volvo Group: developing and exploring new opportunities while learning from others have been described as some of the main motivations (Respondent 14). "A lot comes from within the organization, where we want to be like in five years, ten years, and what are we missing? Or what are we looking forward to speed up where we want to be?" (Respondent 7).

Among the factors that drive VP to establish partnerships, technological development has been highlighted as one of the most relevant areas where VP is actively trying to grow: the increasing future dependency on software makes it pivotal for VP to look at closer and more strictly interrelated partnerships (Respondent 1 – M2). However, when moving to new technologies, VP keeps in mind the strategy of independently growing technological skills as well.

Partners seem to prioritise market sharing competences and knowledge sharing, risk sharing (Respondent 7), highlighting that there is an alignment between VP and partner's motivations to establish collaborations. Moreover, trust, information exchange, openness, communication and transparency seem to be the most relevant aspects to take into account to achieve a prosperous culture of collaboration (Respondent 7). The process of establishing partnerships between VP and other stakeholders has been described as requiring persistence and patience, especiallly when high level of disagreements might arise (Respondent 7). Table 4-2 provides a summary of motivations for establishing collaboration by VP.

Table 4-2. Motivations for establishing collaborations at VP

Motivations for collaboration	VP Approach
Joint learning	Co-develop new knowledge, especially on softwares and technological development *"Sometimes we see the competencies that exist, so we would like to share those competencies or knowledge checks" (Respondent 7)*
Shared goals	Work towards achieving common set targets derived from aligning future strategy visions *"Ideas or future strategy, footprint in the market, and depends on win-win strategy, what they see in us and what we see when we look at them" (Respondent 7)* *"Many companies now they also want to partner with someone because you have the brand reputational risk. So, you want to partner with someone that has to share the right values, like diversity, inclusion and sustainability (Respondent 13)*
Resource sharing	Access to resources, assets, capabilities, skills across actors *"I think it's about finding partnerships that fulfills a very dedicated task or solving a very dedicated problem. And we can connect that so we can find the strength of each partner, what they provide in order for us to provide a complete solution." (Respondent 4)*
Finance alignment	Share costs, risks, benefits
Joint product development	Co-develop new offerings (product or service propositions) *"Everything from radar to music solutions to digital switching on to make it easy for the end user to have a good experience. I think that aspect of complements it is not only about the new tech, but also about bringing the bigger experience" (Respondent 4)* *In Gothenburg, working together for innovation and product development but "you could imagine similar in operations or purchasing or manufacturing as well" (Respondent 5)*

Source: Author

Even if, it has been pointed out that the first challenge encountered is mapping external collaborations and having an exhaustive overview of all the initiatives happening at the moment (Respondent 14), it can be underlined that most of the partnerships are established with equally sized companies but also suppliers, other companies, universities (Respondent 7) while VP has not been very active in partnerships with government agencies or local municipalities (Respondent 7). However, it has been pointed out that these types of collaborations with government agencies or local municipalities could be established, especially in a situation of VP being an early pioneer of a certain technology that maybe requires infrastructure changes (Respondent 1 – M3). Table 4-3 shows a tentative and not comprehensive mapping of current types of collaboration at VP, cross matching description and motivations.

Table 4-3. Examples of current collaboration types at VP

Collaboration Type and Subtype	Example	Motivations
Internal	*Exchange Business Council Remanufacturing* (covering all Business Areas within the Volvo Group)	Aligning strategies for remanufacturing, refurbishment and product development
External Vertical	*Suppliers*	Providing raw materials
	Independent dealers	Providing customer service support and assistance
External Horizontal	*Leading Swedish recycling company*	Recycling waste
	Third party manufacturers	Selling and remanufacturing injectors
	Technology company	Developing new displays solutions
	Manufacturer	Developing a "white book" on change management about lessons learnt
	University Partners	Researching

Source: Author. Information derived from interviews with VP employees and VP website

4.1.2 Circular Economy meaning for VP

To gather useful results, the author of this research has started from understanding what CE means for VP. Analysing the claims made by VP, it is clear that VP is aiming at achieving a CE by focusing on 2 aspects: climate and resources. In the path to zero emissions, VP is planning to emit zero GHG emissions throughout the entire supply chain - from raw materials to finished products - by 2050 (VP website, 2022), including plants and logistics, operations, products and transports.

Moreover, VP is envisioning a long-term plan where exchange, reuse and remanufacturing business are going to grow by 2025 (VP website, 2022). Additionally, the use of hazardous substances will be phased out and all main operation sites will be transformed in zero waste by 2030 (VP website, 2022). Nonetheless, as regards perspectives on the CE, VP did not set yet any overall CE Commitments: CE is on the agenda even if no quantified targets with respect to circularity have been set as of now (Respondent 1). As Respondent 13 mentioned, the approach VP takes to talk about sustainability relates to "speaking about the fact that we are having a vision, that we work on future solutions, but that we also have a history of or legacy of producing innovations and that we are also working on circular economy with the reman today".

The perception gathered from interview with Respondent 14, is that also on the broader Volvo Group, the level of familiarity within CE and CBMs is undergoing a deep and quick change. It is clear that ideas and discussions have been initiated but grasping the full picture still is presented as a relevant challenge (Respondent 6) with employees struggling to understand definitions and types of measurements to be employed. Nevertheless, discussions on CE and circular solutions have been carried out with respect to new key components for battery systems, since design stage (Respondent 1). Driven especially by upcoming CO2 emissions legislation: considering that currently, in the marine leisure industry, the scenario looks unregulated, but a different landscape arises when looking at a future based on electrification. Following the latest discussions on battery regulations at the European level, there is a general feeling that such a legislation will soon be expanded to regulate different industries: "if you produce a lithium-ion battery of a certain size, you will need to make sure there is a circular solution, irrespective of using a car or a boat or a truck" (Respondent 1).

Current General Challenges

Several general challenges have been highlighted by interviewees: it is relevant to discuss those since they could be an impediment for VP to implement new CBMs.

Starting from the ***seasonality of business*** from customer demand: during the busy summer season in the Nordics, most dealers are "150% booked while downtime over winter. So, if anything, I would say, out of the normal happens, it can be tough to find somebody who in one way or the other manages to squeeze it in" (Respondent 3).

Secondly, the ***difficulty for the dealers to hire more employees*** has been described as a barrier that is due to the need of keeping business running during the winter season which might not be as busy and therefore profitable as summer months (Respondent 3).

Third, the ***partial lack of expertise due to increasing complexity and diversity of skills needed*** (both mechanical and electrical engineering) to provide an adequate service represents a barrier in increasing the workforce (Respondent 3).

Fourth, the ***necessity of dealing with unauthorized repairers*** for high volume products: Respondent 1 – M2 has mentioned that many companies carry out repairs on VP systems, of which the company is not aware of or has not approved of. This presents VP with the additional challenge of implementing a fully circular solution. However, it could be interesting to discuss the untapped value provided by unauthorized repairers: if unauthorized repairers have good repair practices (design for repair, make spare parts available, provide trainings), then this would not represent an enourmous barrier. By sharing the right knowledge and supplies, the repair services provided by the unauthorized repairers could be as valuable as the ones provided by the official repairers.

In conclusions, VP is facing several challenges: the consideration of implementing CBMs presents itself as a valuable opportunity for VP to address these challenges, going beyond sustainability and circularity aspects. Section 4.2 explores this key aspect in more details while presenting and analysing findings for RQ2.

4.2 CBMs for FTS

The following section presents and analyses findings for RQ2 – "*Which circular strategies options and Circular Business Models is a First-tier Supplier in the marine leisure industry more likely to adopt?"*

4.2.1. Design stage: a transversal aspect within slowing and closing loops

A very relevant aspect that needs to be considered for both slowing and closing loops is the design stage. Even if circularity has been highlighted as an important topic to discuss since the very beginning of a product lifecycle (Respondent 11), materials circularity in product development seems not to be on the agenda of every project at VP.

In the design stage, one of the tasks to be respected is for products to pass an "environmental checklist": among the company's internal criteria to be respected, mixing of different materials in one component must be avoided to facilitate practices such as repair, recycling and remanufacturing (Respondent 11). ***Avoiding mixing of materials for easy separation*** and making sure the product is prepared for remanufacturing have been discussed as the most relevant factors in product development (Respondent 11). However, the ***uniqueness of products makes it more challenging to guarantee a high level of modularity and interchangeability*** of components (Respondent 11) which represents a challenge for transitioning to CBMs. Nevertheless, the need of having less variance in the warehouse has been highlighted as an important discussion point that VP has already undergone: "For that one project, we used to have quite a lot of different engine hardwares to get different power outputs but we now only have four cores" (Respondent 11), describing how the company is already taking a proactive approach to prepare for the implementation of CE strategies.

As part of the design stage, it is very relevant to consider product upgrades: usually, these follow the technological cycle and the legislative cycle (of emissions regulations) (Respondent 1 – M5; Respondent 11). At the moment, whenever an updated feature is added for product development, VP needs to "inform all our boat builders as well that they need to design differently for next year's engine" (Respondent 1 – M2). Therefore, this shows the current flow of information and level of communication between VP and its boat builders. Also, it is interesting to reflect on the fact that since VP is already covering a relevant position in power dynamics, it could be possible to imagine the company extending such agency over circularity-related discussions.

In addition, at the moment, VP is not using any product passports, i.e. "a set of information about components and materials that a product contains, and how they can be disassembled and recycled at the end of the product's useful life" (EU Commission, 2013) but a shift is foreseen for electrical offerings (Respondent 2) further pointing out the relevance of setting up such a structure imminently.

Furthermore, it has been highlighted that there is a high level of dependency on suppliers from VP side which can be taken into account as an important point to consider in the reconfiguration of the network. "Very difficult from purchasing department to go to a supplier and start talking "what can we do from that direction to create and support that CBM"?" (Respondent 5). It has been underlined that, in some cases, other stakeholders are involved in product development: customers proposing new features or some suppliers showing new products (Respondent 11). This shows that the interconnection between product development and other stakeholders, in terms of circularity, seems rather limited at the moment.

4.2.2 Slowing the loops

Access performance model

Rethink.

In theory, PSSs are a great way for ***companies to retain ownership of products***: however, in this specific discussion within the marine leisure industry, it is very important to reiterate a central point of this research and distinguish between two product levels here. As mentioned in previous sections, a marine diesel engine for middle size powerboats is the reference product of this thesis research while a middle size powerboat is the complete final product assembled and sold by boat builders and then used by final end-users over which VP has no direct contact. When a company manufactures the entire product – namely the final boat then used by a private user- and has a direct relationship with the final end-user, PSSs result as rather straightforward strategic business option. Nevertheless, when the company in question is an FTS that manufactures components – in this research case, marine diesel engine - not the complete product and it is therefore removed from the final end user step, implementing PSSs sounds more challenging.

Nevertheless, after having made these considerations, it might be argued that VP could assume responsibility for the development, design, manufacturing for a marine diesel engine, together with repair and maintenance services, throughout the entire lifetime of an engine type. In theory, PSS for marine diesel engines could be thought of as an opportunity to address some of the challenges VP is facing, namely: creating more value over time by retaining ownership or staying connected to the product over the lifecycle, thus staying closer to the customer.

Nonetheless, implementing a PSS comes with challenges, especially related to the relations with other stakeholders in the value chain. Being very removed from the final product, VP would have to find ways to set up more straightforward agreements with the stakeholders in the supply/value chain that are closer to the product. Collaboration is inherently connected to this type of BM: "we cannot sit by ourselves to define this; it is something that we need to do in combination" (Respondent 4). VP will have to ensure that the PSS set up is profitable and attractive also for the boat builder and the final end-user.

The need of establishing stronger collaboration with partners, could come with risks. For example, partners could decide to defect the network: nevertheless, incentives to stay in such a PSS set up would also reduce such risks. A PSS might not be the most appropriate solution to implement if the partners in the network are not on VP same page. This is probably, among all the different types of CBMs that could be implemented by VP, the one that has the most potential to solve the challenges VP as an FTS is facing but at the same time also the one that would require the most awareness on CBMs importance, as well as the most commitment from other stakeholders sides to ensure its successful implementation and functioning.

Moreover, some challenges are inherent to the type of PSS taken into account.

For product-oriented PSS: VP could sell the marine diesel engines and offer service agreements for providing maintenance and repair operations conducted by marine dealers. On a general level, service agreements could be a way for VP to control aftermarkets and keep contact with customers, enhancing the engagement of VP with circular sales. Nonetheless, it has been highlighted that service agreements for owned boats have been used in the past but have not proved successful (Respondent 3). Several interviewees shared the idea that this was due to an interest from the customer side of finding the cheapest option, through self service or independent (e.g. not authorized by VP) workshops, and postponing the purchase to a critically necessary situation (Respondent 3; 10). Nevertheless, it has been pointed out by Respondent 3 that even if the distrust would be overcome, challenges would result from i) diversity of applications not facilitating a unique service agreement and ii) necessity of a joint service agreement (valid to contact any dealers) to receive support worldwide. "You can be quite sure that there will not be two boats where you can apply the same service agreement. They will be different, all of them. Almost every installation is completely different from the others. And that is also why I think service agreements will never be the best seller for VP" (Respondent 3). Nonetheless, it is important, especially when looking at the future, to think that service agreements could present a successful idea. The possibility of integrating service agreements with use-based or result-based PSS could represent a new profitable business model, also an incentive for boat builders to agree to such a business set up.

For service/use-oriented, such as *sharing:* a possible idea could be for VP to be involved in a boat sharing scheme. For example, VP could provide the boat builder with the marine diesel engine but without having the boat builder purchase it and thus supporting the boat builder to set up a boat sharing scheme. The final end users would use the boat without having to buy it. Thus, VP would be involved in the sharing scheme and receive part of the profit from it. Boat builders could be incentivized to join such a system because such a ***boat sharing scheme could be very profitable in opening up a new customer segment***: infact, ***it would make it more accessible for everyone to get access to a boat***, targeting younger generations with a more environmentally friendly mindset and less affluent people wishing to join a boating experience.

Nevertheless, some challenges arise: for example, Respondent 1 pointed out that the number of customers willing to take a boat out in the seaside increases exponentially with very good weather conditions representing a challenge in such a sharing setting – namely an overload of demand and a necessity to provide adequate supply. Still, it is pivotal to bear in mind that rebound effects could arise: the product might be used more intensively and with less care because of lack of ownership and therefore responsibility. Also, if there is high demand, more boats might be built and then more boats would stay idle during the winter. So, it is relevant to make different considerations. Similarly for *renting*, the final end user could buy the boat from the boat builder but pay rent for the powertrain to VP: it will be necessary to predict cost for propulsion solution and a fixed rate over a specific period of time (Respondent 4). However, technology could support in developing such a model (the role of technology will be further elaborated in the next sections).

For result-oriented: for a subscription of engine power based on the end user paying for the amount of hours the engine is used, interviewees found it interesting but also somehow challenging to understand how to implement it (Respondent 4). Currently, VP is testing a pilot project, based on paying by the kilowatt-hour program but in the commercial segment (VP website, 2022) which however it is outside the scope of this thesis.

Nonetheless, these findings suggest that interviewees see a potential in PSS and have a positive outlook, yet do not have concrete experience with how to implement this, especially considering that the relevant aspects on how to deal with ownership of engine and ownership of the boat remains still unanswered. However, the fact that just recently few pilot projects have been introduced might provide answers in the future.

Extended product value

Remanufacture

Considering the position of VP within the Volvo Group and the extensive expertise of the Volvo Group in remanufacturing in the past 70 years, from several interviews, it is evident that remanufacturing is the main circular strategy employed at VP (Respondent 1, 11, 12, 13, 14) but also when looking at the bigger Volvo Group, it has been pointed out that ***extending the life of the product through repairs, refurbishment and remanufacturing is the regular stream of work*** (Respondent 14).

As regards the current extent of remanufacturing activities, these are carried out for engines directly by VP; a remanufactured engine will reenter the value chain and be sold again, with the same characteristics of a new product (e.g., longevity and quality). All parts that do not fulfill VP's quality and performance criteria are changed: "Average is 20% of parts need to be new and 80% can be reused. So, it is possible that if you buy a reman engine, you get an engine with a reused engine block, but a new crankshaft" (Respondent 2).

Block engines that are sold at VP follow a so called "Upfront" business model which works as a deposit system: when a dealer purchases an engine, a core fee is included in the price. That core fee is given back to the dealer once the engine is brought back which makes it quite attractive for dealers. One of the advantages of such a well developed and long tested system, besides the extensive expertise, is the existence of an infrastructure and logistic chain that are already very well advanced. It has been agreed by Respondent 2 that the deposit system process could be enlarged to support other products: nonetheless, it will be relevant to consider trade offs in collecting and transporting the products – not only from a financial point of view but also from an environmental perspective, indeed collection and transportation might increase environmental emissions. There has been a successful example from Greenland: even if it has been stated that for some dealers it might be very expensive to send engine back and repair (Respondent 2), when the untapped value of the engines that could be sent back to the main hub to be remanufactured was disclosed, agreements between VP and local dealers to get back engines (otherwise left in backyard) and send them to VP remanufacturing facilities were established. "Eye opener for dealer network: we actually have a lot of money rustling in our backyard", as a profitable business opportunity (Respondent 3). This shows that there is a positive reception from the dealers' side, and it exemplifies the concrete opportunity of embarking the network into more products take back activities, when presenting economic advantages related to such activities. However, there is a need of understanding how to create more environmental awareness around the topic, besides the financial value.

In a few cases, remanufacturing is performed by third-party manufacturers: for example, VP purchases injectors from a company that also performs remanufacturing on them, which therefore is not under VP's responsibility (Respondent 2). Respondent 2 has pointed out that this approach could be applied to plenty of more components that VP gets from suppliers. It seems that partnerships could focus on everything that is not VP core competence, so everything that is not built by VP: "the general philosophy is that the one who built the part and design the part, they are the most suitable to do the remanufacturing of it. So, for everything we do not build ourselves, it is best if we can use the original supplier" (Respondent 2). A new BM could be remanufacturing even at suppliers as well: VP could send parts back to suppliers and they "can remanufacture subcomponents to us to be used in our primary production rather than just in the remanufacturing production" (Respondent 5).

Repair

It has been highlighted that there is a strong link between product development and the department taking care of the repairing of products to ensure a smooth and easy disassembly and repairing process for products that break (Respondent 11). In the leisure segment, considering the low level of average use of boats by a private end user and assuming that part of the repairs needed during summer could just as well be fixed during off-season but maybe end users do not notice them because they are not using the boat or the boat is kept in storage, service contracts could be interpreted as chance to spread out maintenance work more evenly throughout the year and generate more predictable business.

However, even if dealers have a high degree of freedom to set up service contracts, such a setting is not completely successful, mainly because of the nature of the business: "boats very often are moving around. Anybody can take care of a boat, for example" (Respondent 3). If customers are on vacation and the boat breaks down, there is a need of fixing it there where it is: this would require a joint service agreement. Nevertheless, since dealers are independent, so not owned by VP, one joint service agreement cannot be drafted (Respondent 3).

A possible solution to deal with this last challenge, therefore, could be to ***consider new collaborations with unauthorized repairers***: if the process of embarking an unauthorized repairer into becoming an official VP repairer becomes heavily bureaucratic, new businesses agreements could be considered. For example, rather than a dealer status, currently unauthorized repairers could be given a higher and more inclusive partner status. By establishing these new partnerships, VP would be able to provide the unauthorized repairer with the skills/knowledge needed for conducting repairs and would not have to suffer from any inaccurate type of repair that would damage the product and probably the brand value of the company.

Refurbish

Some refurbishing activities are currently carried out by VP, namely: refurbishing for some electrical components and refurbishing for specific components (diesel particles filters) (Respondent 2). VP interprets a refurbished product as one that does not fullfill esthetic criteria, but it functionally performs as good as a new one (Respondent 2). In a future, it has been confirmed that there is a possibility of expanding the refurbishing offering to all the products: if products cannot fulfill all VP remanufacturing criteria but they can still fulfill the function (Respondent 2). This represents a good aspect to consider when prioritizing CBMs development. However, it needs to be discussed how the customer will perceive the refurbished product: for example, customer might not be willing to purchase a refurbished product that does not look as good as a new one.

Repurpose

Repurposing has not been explored deeply so far at VP level. For displays, it might be possible to repurpose them; however, the technological cycle of electronics is very fast: "it is hard with electronics because it gets old very quickly. And modern softwares get bigger and bigger and more power consuming, so to say. So, to actually review then you need to assign to find another life for them with a different purpose and be able to create new software for them" (Respondent 9). However, Respondent 9 explained that when a customer buys/updates a new engine, in many cases electronics are changed as well (even if still functioning). This makes it pivotal to consider a system that allows to retrieve value from components that would still be functional.

Nevertheless, it would also be interesting to understand the feasibility of repurposing entire old boats engines which cannot be used anymore on boats or not able to pass a formal test or inspection. Of course, it is pivotal to consider also other not circularity related aspects such as CO2 emissions linked to repurposing old diesel engines. For such an activity, it might be necessary to ***involve new stakeholders and jointly find the most appropriate alternative use for these products which would be otherwise discarded***. In this sense, exploring new alternative uses could entail the involvement of researchers, academia and other companies (maybe in the same sector). Moreover, VP would need to get access to these old boat engines which might be difficult to achieve, since it does not have a direct contact with the final end users.

Reuse

The usual secondhand market in Sweden has been proven to be Blocket (Respondent 1). Nonetheless, in this discussion, it is important to consider that depending on the size and typology of products, different strategies could be applied. While engine and transmission are easier to reuse (as well as refurbish and repurpose), smaller electronical components (e.g., interface screens for navigation) are more difficult to reuse due to a fast technological cycle which would require updates with new softwares. In this light, it has been pointed out that it might be possible to reuse control levers and joysticks, but it has been highlighted that from VP side, it would not be financially interesting to do that (Respondent 9). As regards reuse of marine diesel engines, that happens at the end of the product lifecycle which makes it more complicated for VP to be involved in this strategy. However, it could be interesting to understand if end-users could be involved with a closer relationship to VP. Nonetheless, it is relevant to bear in mind that starting to work directly with end users can put the company in competition with its current customers. So, a careful consideration needs to be reflected upon to ensure a stable and balanced surrounding ecosystem.

4.2.3 Closing the loops

Extended resource value

Recycle

As regards products, end of life strategies differ depending on the product size: Respondent 1 underlined that if the product in question is a big engine (few hundred kg), then the customer faces the need to go to a yard or dealer to get support in removing it. If the product in question is a small engine: it can be removed by user and put in landfill or be recycled. Moreover, if the engines are changed also the controls are in many cases changed, although not in all cases. Boats with a lot of running hours per year might need to swap engines more often than controls. There is no structured recycling of the controls, the shipyard that makes the new installation might recycle according to local possibilities, meaning that most of the end of life is represented by the product ending up in landfill (Respondent 9). Thus, it is difficult for VP to control how recycling is carried out, especially for very old engines (Respondent 1 – M1).

However, if from a product perspective having an overview on products recycling results in a difficult activity, in terms of recycling materials from production processes in VP facilities, the situation at VP Vara Plant provides a clear example of the current status. VP has a partnership with a Swedish leading recycling company to ensure that everything is disposed of correctly – the agreement involves all VP plants in Sweden. It involves materials but also waste water produced in the plant from several manufacturing processes. In the first case, the recycling company collects and recycle the discarded materials, transforming them into new raw materials. In the second case, the wastewater is either treated by VP own cleaning system, reused for the painting phase and treated wastewater in excess is sent to the wastewater treatment plant. Otherwise, the recycling company takes care of cleaning the wastewater as well. In its current business relationship with VP, the recycling company recycles the waste and makes raw materials out of it. Once the waste is collected by the recycling company, that waste is under its ownership, but responsibility still falls under VP to make sure it monitors what happens to waste once getting out of their facility. Since the recycling company could potentially sell the recycled raw materials back to VP (e.g., copper), a possible suggestion could be to rearrange the agreement to facilitate buying back the materials to be then used as primary raw materials.

Following an interview with Respondent 14, it was highlighted that “something that we must start to look into - how can we create value of the wastes that are generated from various parts of our organization?”.

At the moment, from a product perspective, it seems like the closer access VP has to engines parts that could be recycled is in the remanufacturing process. Indeed, as regards the discarded parts from remanufacturing, pure iron parts are melted by VP to make new parts for engines while parts that are not good enough are sent to a recycling company (Respondent 2). Therefore, the value of the discarded parts is not fully exploited.

A possible suggestion could be to exploit the potential of discarded materials used by other departments of the Volvo Group, starting a sort of internal exchange of materials within the Volvo Group. So, for example, the materials that VP cannot reuse could be exchanged to another division of the Volvo Group, in an internal closed loop recycling. Nevertheless, on a company level, factors such as geographical locations can play an influential role: for example, if the waste or by products of one division could be used by another division as inputs but the two sites are not located in geographical proximity, then from an environmental perspective, it might not be beneficial to do so. Thus, it might be necessary to explore business lines for which it would be understandable to engage in such a CBM. Moreover, closing loops, in some cases might entail a higher production of energy for recycling: thus, that needs to be compared with the impact of using virgin raw materials instead of recycled ones.

Interesting to mention that other partners could be involved in recycling activities that go beyond VP products: for example, one interviewee mentioned that VP is considering, together with another company, to take out fishing nets from the seaside, recycle them and using them for producing new raw materials (Respondent 5). This could be a good starting point for VP to develop partnerships with non-traditional actors (such as no-profit organizations) which historically might seem more prone to circularity than others. Nevertheless, even if this initiative is interesting and it points out to the willingness of exploiting the residual value of other materials, even if not directly related to VP production (even different products than fishing nets, e.g., plastic PET bottles), it is not of utmost urgency so other CE strategies, inherently linked to VP products or production processes, might be prioritized instead.

Industrial Symbiosis

At the moment, it seems like VP is not involved in any activity of industrial symbiosis. However, the idea of developing such a strategy has been welcomed positively by several interviewees, who mentioned the interesting potential they see in it (Respondent 7; 14). As described by Salvioni et al. (2021), the involvement of industry partners could produce specific positive effects within the CE: among others, scale economies, profitable cost and risk sharing, advantages in logistics and better competitive positioning.

Nevertheless, this set up requires a very high level of interconnection among different stakeholders: therefore, it would be necessary to find the most appropriate partners, especially VP would need to identify which stakeholders would be most suitable for sharing such settings. Moreover, it involves the development of interconnected operational units built in the same area to facilitate transfer of outputs and inputs, which might involve a high level of financial and time resources; thus, in the short term, it is not a feasible option, but it might be when looking long term.

LBMs to CBMs transition

The role of technology – Easy Connect App for Boating

VP has recently (2018) introduced the Easy Connect App for Boating through which operators, fleet owners and service dealers can access data on boat usage and performance - average fuel consumption, distance to empty, speed and travel distance - from multiple devices via a cloud-based service (VP website, 2022). It can be a good transversal starting point, as confirmed also by Respondent 9, to be part of and support service agreements, thus strengthening maintenance and repair activities. However, due to the novelty of this tool (first launch occurred in 2018), it has not shown results in terms of tracking changes in maintenance and repair (e.g., need of less intense maintenance). Besides improving uptime, in the future, under monitoring, it could represent a valuable tool to ***extend lifetime of products*** (if a serious breakdown can be avoided by doing a repair early enough). "So, if we can read those patterns, and predict failure and fix it before it happens, that I think, though is still some time to go before we can do it, but it technically, it should be possible" (Respondent 9).

Moreover, reuse and secondhand selling could be incentivized through one of the last features of the Easy Connect App for boating. In the near future, service records from the installation will be included in the tracked data: this means that "when you're selling your boats on the auto market to show this service was performed according to plan by authorized service dealer. That brings higher value to your boat." (Respondent 9).

Moreover, in thinking about the development of a PSS, based on a pay per service fee model, such as a subscription of engine power, it will be necessary to predict cost for propulsion solution and a fixed rate over a specific period of time (Respondent 4). Thus, once more the Easy Connect App for boating could be used as a supporting tool to define a fee for subscription of engine power based on customer's average fuel consumption or average time traveled, features tracked by the app. However, this app has been installed and downloaded but the use by end users has proved rather limited so, from the perspective of a service dealer, it is challenging to understand the benefits related to it (Respondent 10) which shows the necessity of a more integrated communication with customers.

As highlighted by Respondent 14: "I think we should work with these two - old and new business models - in parallel in the group to explore what can we do with new business models but also to explore what can we do with the business models that is already there. Everything will not change overnight. Everything is about timing what will happen when and how fast will this go? And I think we will need to start up some pilots maybe or real cases where we look into this deeper step by step". Even if VP follows the logic of trying and reusing as much as possible from the rest of the group, it has been highlighted that "requirements especially in marine leisure are quite different from trucks and buses" so VP is "actively looking for partnerships or other ways of inorganic growth. More active in speaking to startups and looking at m&a options now than in the past" (Respondent 1 – M2). Therefore, before understanding which CBMs, as highlighted by BMI, are more likely to be adopted, it is important to understand what role collaboration will play in the transition from LBMs to CBMs, as described in the next section.

4.3 Role of collaboration in the transition from LBMs to CBMs

The following section provides and analyses results for RQ3 - "*Which role does collaboration play for a First-tier Supplier in the marine leisure industry when implementing circular strategies options and transitioning from Linear Business Models to Circular Business Models?*"

4.3.1 External collaboration

From previous sections, it has been highlighted how relevant collaboration for VP is. Several interviewees, both in the research field and practitioner field, have pointed out that in a CE, cooperation is very important: even if, few companies do things together, they need to work in combination with other stakeholders to achieve valuable results (Respondent 4; Respondent 17).

An interesting point to highlight is related to VP's *network interest towards circularity*, which can give insights to the readiness of partners to transition towards CBMs. It is evident that CBMs seem not to be on top of the network's agenda even if sustainability is on top of agenda for a lot of customers: "each and every tier in this value chain is working on how to address the sustainability question from the best perspective and I think we are all in agreement to have a 0-emission solution. The question is: is it feasible today and how to get there in the shortest period of time? And what kind of different solutions are available in order to reduce the footprint from today?" (Respondent 4). This scenario is peculiar to the commercial segment: the discussion from the end-users side seem to be less mature in the leisure segment. However, it has been pointed out that the discussion on CBMs at the dealers' level is in its infancy (Respondent 3), which shows the necessity of making sure that an uptake on such a discussion can be guaranteed, possibly with VP taking a leading role on raising awareness and supporting in developing required capabilities.

In addition, it has been made clear that local legislation will speed up the process of needing suppliers to fulfill certain requirements: however, suppliers seem not to be ready for the technology shift or the sustainability requirements that are going to be necessary in the near future (Respondent 5) and VP will have to undergo a significant restructuration of the network.

Nevertheless, the approach that VP is taking, rather than getting rid of suppliers that do not fulfill VP responsibility or do not meet VP demands is training them (Respondent 5). Therefore, since a strategy to train suppliers is already in place, additional training sessions, more related to circularity could be developed as well, perhaps not representing an extra cost or an extra burden from VP side. "We do not, at the moment, have any specific requirements or demands on our supply base that they have to have a circular business model or account. It has never been on the agenda. But it is of course in our roadmap now" (Respondent 5).

Besides workshops and trainings, a low level of bureaucracy and economic advantages have been described as the most attractive factors for stakeholders to engage in circularity (Respondent 3), pointing to the fact that these aspects should be prioritized.

It has been emphasised that one of the main challenges VP is facing at the moment is to position itself to stay competitive for the next decade: a possible way to achieve this has been pointed out to be accelerating work with partnerships in different aspects to move up and focus on "how we as a supplier can just simplify but also support our customers" (Respondent 4).

Potentially, VP could think of *building up a constellation of partners implementing CBMs*, through a tiered system where they do not have to pay the upfront cost of buying the full boat but get a circular offering. In fact, dealers are very diverse: while some are very big and probably would have the financial muscle to implement CBMs themselves, many are also smaller companies that have supported their local harbors for generations and could encounter enormous challenges in financing CBMs implementation (Respondent 1). It is interesting noticing that some dealers are developing a business model in terms of having an OEM dealership and trying to have a rental dealership or starting to form local boat clubs in their communities (Respondent 4) which highlights the existence of a starting infrastructure.

Moreover, there is no distinction between different dealers in terms of performance: "we are not really there that if a dealer has passed the dealer operating standard, then it means that if two dealers have passed them, it does not necessarily mean that they both are at the same level. And yeah, actually, there is quite a bit of work ongoing now to create a new dealer operating standard. Which should be more objective and more just to use." (Respondent 3). Since the

Dealer Operating Standard is already undergoing revision, it would be relevant to add incentives and disincentives to encourage dealers to move towards circularity. However, the need to adapt and increase a dealer standard does not help dealers provide better service, maybe VP might need to be involved more closely, through more vertical integration and closer collaboration. Also, as a way to push new circular models more effectively if it is more engaged directly, that involvement could provide a closer source of data.

4.3.2 Internal collaboration

Because of the peculiar environment VP is embedded in, it is important to consider also internal collaboration, namely within the overarching umbrella of the Volvo Group. The business rationale for VP is to exploit skills and capabilities internal to the bigger Volvo Group: being part of Volvo Group has been described as a toolbox where VP can pick the things within the group that it would not be able to develop itself (Respondent 4). For example, making use of the technology that has been developed for the trucks and buses and construction equipment and where possible, sell that to other applications as well (Respondent 1). This is a very interesting aspect which points to the opportunity for VP to exploit the capabilities, skills, resources already present in the company. Indeed, the structures and tools that have been set up could be applied to circularity related communication and trainings to create broader awareness on CBMs as well (Respondent 1).

The next tables provide a visual representation of the results of the analysis, highlighting i) the current status of each investigated CE strategy and the identified particularities faced by VP, representing enablers or barriers to the adoption of that particular CE strategy; ii) insights on the role of collaboration needed to support the adoption of these CE strategies.

Table 4-4. Slowing loops: access and performance model. Overview of analysis on CE strategies and collaboration

SLOWING LOOPS				
ACCESS PERFORMANCE MODEL				
Type of CE strategy	**Current status**	**Enablers**	**Barriers**	**Collaboration actors**
Rethink – Product Oriented PSS	Service agreements for providing maintenance and repair operations by dealers tried in the past but proved not successful	Low level of average use of boats by average marine leisure end user (Sweden) Technology as a supporting tool	Customer interested in cheapest option Diversity of application not facilitating a unique service agreement Necessity of joint service agreement but independence of dealers does not allow for it	DEALER Strengthen relationships with dealers for them to provide service agreements, fostering maintenance and repair
Rethink - Service/Use Oriented PSS ***Sharing & renting*** ***&*** ***Rethink - Result Oriented PSS***	Strong potential and positive outlook, no concrete experience with how to implement it. Pilot project to test the idea of renting a hybrid powertrain to a customer (but in the commercial segment)	Technology as a supporting tool	Rebound effects: product used more intensively and with less care Relations with other stakeholders in supply/value chain: necessity of developing a profitable and attractive set up for boat builders and end users	BOAT BUILDERS/ CONSTRUCTORS Support boat builders/constructors in setting up their own CBM configuration and thus surround VP by a constellation of stakeholders performing circular related strategies

Source: Author

Table 4-5. Slowing loops: extended product value. Overview of analysis on CE strategies and collaboration

SLOWING LOOPS				
EXTENDED PRODUCT VALUE				
Type of CE strategy	**Current status**	**Enablers**	**Barriers**	**Collaboration actors**
Remanufacture	Main CE strategy employed at VP For marine diesel engines: performed internally by VP	Existing infrastructure and logistic chain of the upfront deposit system 70+ years of remanufacturing expertise in Volvo Group	Tradeoffs for collection and transportation (both environmental and financial levels) of product take back activities Raise awareness with dealers' network about environmental value besides financial value (e.g., successful example in Greenland)	DEALERS Strengthen relationship with dealers for extending remanufacturing on other product lines BOAT BUILDERS/CONSTRUCTORS Strengthen relationships with boat constructors to extend remanufacturing on other product lines
	For injectors: performed by third-party manufacturers	Use the original manufacturer which builds and designs the parts to perform remanufacturing (specific expertise)	Tradeoffs for collection and transportation (both environmental and financial levels) of product take back activities	THIRD-PARTY MANUFACTURERS Strengthen relationship with current third-party manufacturers or involve new third-party manufacturers to extend remanufacturing on other product lines
				SUPPLIERS Involve suppliers in remanufacturing subcomponents for VP to use them in primary production rather than just remanufacturing production

Repair	Strong link with product development department to ensure smooth and easy disassembly and repairing process	Diagnostics and technology as a valuable supporting tool Low level of average use of boats by average marine leisure end user (Sweden) Dealers with high degree of freedom in setting up service agreement	Customer interested in cheapest option Diversity of application not facilitating a unique service agreement Necessity of joint service agreement but independence of dealers does not allow for it	DEALERS Set up service agreements: control aftermarkets, keep contact with customers, tailor to specific needs of customer segments UNAUTHORIZED REPAIRERS Involve unauthorized repairers, providing them with skills and knowledge needed for conducting repairs
Refurbish	For some electrical components and for specific components (e.g., diesel filter particles): performed by VP	Existing internal skills	Customer reception of a refurbished product ("not as good as a new one" aesthetically)	INTERNAL DEPARTMENT Extend refurbishing to new product lines for products that do not fulfill remanufacturing criteria but still function
Repurpose	Not explored deeply at VP	Retrieve value from still functional components	For electrical components, technological cycle is very fast Consider trade offs: e.g., CO_2 emissions linked to repurpose process	INTERNAL DEPARTMENTS Strengthen relationships to receive components back for repurposing BOAT BUILDERS/CONSTRUCTORS Explore possibilities to receive components back RESEARCHERS, OTHER COMPANIES Find alternative uses for marine diesel engines from old boats which cannot be used anymore (not able to pass a formal test or inspection). However, getting access not easy

Reuse	Not explored deeply at VP For entire boats, Blocket as main secondhand market (in Sweden)	Retrieve value from still functional components	Smaller components (electrical) more difficult to reuse due to fast technological cycle	BOAT BUILDERS/CONSTRUCTORS Strengthen relationships to receive components back to be reused END USER Develop direct relationship with final end users

Source: Author

Table 4-6. Closing the loops: extended resource value. Overview of analysis on CE strategies and collaboration

CLOSING LOOPS				
EXTENDED RESOURCE VALUE				
Type of CE strategy	**Current status**	**Enablers**	**Barriers**	**Collaboration actors**
Recycling	Materials from production processes in VP facilities: well-developed through agreement with a Swedish leading recycling company	Internal well-developed system and established agreements for recycling Internal synergy within Volvo Group	Geographical locations Environmentally, a higher production of energy for recycling: thus, that needs to be compared with the impact of using virgin raw materials instead of recycled ones.	EXISTING RECYCLING COMPANIES Strengthen relationships with recycling companies for recycling materials from production processes. Rearrange the agreement to facilitate buying back recycled raw materials OTHER DEPARTMENTS OF VOLVO GROUP Consider internal exchange of materials within the Volvo Group
	Products: old diesel engines. If big engine, dealer provides support for removing it. If small engine, removed by customers and put in landfill/recycling	Possibility of exploiting otherwise untapped value of discarded materials as a good reasoning for stakeholders to embark on a collaboration	Difficult to have an overview of how this is carried out since it happens at EoL/end user level	DEALER Facilitate dealer supporting customer to remove big engine BOAT BUILDERS/CONSTRUCTORS Understand how to create incentives for customers to remove small engine and recycle

	Not VP production related: possibility of looking into a project to recycle fishing nets for producing raw materials	Partnerships facilitated by Volvo Penta brand value as a company driving innovation Continuing flow of work with current project (WWF Climate Savers Program, Clean Seas Campaign by UNEP)	Might not be the best option when thinking about prioritizing	NON-TRADITIONAL ACTORS Involve nontraditional actors (e. g NGOs) in exploiting the residual value of other materials, even if not directly related to VP production. Consider embarking on such projects also for other products (e.g., plastic PET bottles)
Industrial symbiosis				
	Not established	Possibility of exploting otherwise untapped value of discarded materials as a good reasoning for stakeholders to embark on a collaboration	High level of interconnection among stakeholders in developing interconnected operational units	OTHER INDUSTRY PARTNERS Involve other industry partners interested in sharing waste outputs and by products OTHER DEPARTMENTS OF THE VOLVO GROUP Exchange on an internal level, exploiting synergy among different departments

Source: Author

Moreover, even if design has not been considered a CE strategy per se', for the purpose of this research, it is a very relevant stage which transversally affects both slowing and closing loops for a CE. Therefore, table 4-7 provides a summary of considerations for design.

Table 4-7. Design. Overview of analysis on CE strategies and collaboration

DESIGN STAGE				
Current status	**Enablers**	**Barriers**	**Collaboration actor**	**General considerations**
Design for circularity not extremely developed now Products passing "environmental checklist"	In-house product development and testing facilities Synergy within the Volvo Group – knowledge and strategy sharing VP proactive approach: discussions around need of less variance in the warehouse	Uniqueness of products and customization vs modularity and interchangeability of components Product upgrades communicated to boat builders/constructors No product passport providing information on disassembly and recycling of components and materials Upgrades following technological cycle or legislative cycle	SUPPLIERS Strengthen involvement of suppliers to provide raw materials that can support circularity BOAT BUILDERS/CONSTRUCTORS Strengthen relationship with boat builders for product updates	Most important stage to facilitate all the other CE strategies VP directly controlling this stage

Source: Author

5 DISCUSSION

Section 5.1 of this chapter provides an interpretation and description of the results of this research, in light of what was already known in the literature about the research problem being investigated and explains new understandings about the problem while section 5.2 concludes by summarizing limitations of this research.

5.1 STATUS QUO, CBMS AND COLLABORATION: OPPORTUNITIES FOR AN FTS

As regards the central attributes of current traditional business models of an FTS in the marine leisure industry, it can be mentioned that VP current status quo is mostly based on LBMs, which is in line with what highlighted by Gusmerotti et al. (2019) and Linder & Williander (2017) during literature review: a typical approach in most manufacturing industries. Overall, this exemplifies what found in literature analysis: even if CE has been around since the 1970s, albeit under different terminologies, and many companies in Sweden embraced some concepts – resource efficiency, pollution prevention, cleaner production - already in the 1990s, it is an emergent topic from a practitioner's perspective. However, it is showing an increasing interest and following uptake from several firms as Staaf & Sundstrom (2021) have pointed out. Nonetheless, while mapping out the current status of circular strategies implemented at the company level, findings confirm what Bocken et al. (2019) underlines: CBMs uptake seems not very widespread in business practice.

Besides the more peculiar challenges to VP case itself, some of the challenges that VP encounters in its business set up are connected to FTS in general, such as the lack of ownership on product throughout its lifecycle. In theory, these can be mitigated by the adoption of certain circular strategies and CBMs. For example, when considering the Access Performance Model, this is probably, among the different archetypes of CBMs that could be implemented by VP, the one that has the most potential to solve the challenges VP as FTS is facing (lack of ownership on the final product, staying closer to customer), considering current literature on CBMs. Indeed, as found during literature review, Rosa et al. (2019) describe PSS (especially use-oriented) as a popular activity conducted by leading manufacturing firms, that is especially the case when the firm produces the whole product, and it is not a component manufacturer.

These findings show that the usual focus in academia is on PSS as conceived and implemented by end-user facing companies: in the case of an FTS, it might be more challenging and not the best solution to implement a PSS. In fact, it is also the one that would require the need of establishing the strongest collaboration with partners, which could come with risks. For example, partners could decide to defect the network. Thus, it is pivotal to ensure that PSSs set up is attractive for both boat builders and end user to avoid risks, through incentives and profitable offerings. Also, making sure that the network is made aware about the environmental importance of circular offerings, as to further strengthen stakeholders' commitment and ensure CBM successful implementation and functioning. Thus, there is potential in PSS but yet, at VP level, the company lacks the concrete experience with how to implement this. Further practical research through pilot projects is needed.

Nevertheless, even though CE seems to be a recent topic, VP has a long tradition of applying some CE strategies, namely remanufacturing activities, partly confirming what found in the literature review, as being one of the most common CBMs (Rosa et al., 2019). It has the potential to be enlarged to other products as well, by strengthening relationships with dealers, third party manufacturer and to some extent suppliers. Other circular strategies classified under the extended product value model – repair, refurbish, repurpose – show interesting possibility to be strengthened and enlarged to other products as well. Even if, because of product take back, which involves collection and transportation, financial and environmental costs need to be taken into account. It is interesting to notice that for the repair strategy, new partners, historically considered outside the ecosystem – namely, unauthorized repairers – could be included in the value chain to exploit new opportunities.

Furthermore, because of the nature of today's businesses, VP is embedded in a traditionally complex value and supply chain with many different stakeholders involved in the business. However, VP has a direct contact to the closest steps of the chain (upstream: suppliers; downstream: dealers and boat builders) but it is further away from the final end-user as typically any FTS would. This confirms that, to facilitate CBMs uptake, VP as an FTS should prioritise the CBMs where the closest steps of the supply and value chains are involved (dealers, boat builders/constructors).

When looking at possible ways for FTS to close the loops, this seems the most interesting aspect from a practitioner perspective in understanding how to get the value out of waste and residuals. Rosa et al. (2019) talk about recycling as one of the most common circular strategies discussed in the literature. However, this shows that when discussing about FTS implementing circular strategies, there is the need of making a distinction between two levels: as mentioned in previous sections, a marine diesel engine for middle size powerboats is the reference product of this thesis research while a middle size powerboat is the complete final product assembled and sold by boat builders and then used by final end-users over which VP has no direct contact. When the company in question is an FTS that manufactures components – in this research case, marine diesel engine - not the complete product and it is therefore removed from the final end user step, implementing the most common CBMs as envisioned by academics sound more challenging. For example, recycling marine diesel engines is out of VP control, since that would happen at the end of life of the product. However, recycling of materials during the production process is carried out and can be enhanced. Especially, by reconfiguring the partnership with the leading recycling company to find a way to buy back the recycled raw materials.

Moreover, industrial symbiosis was welcomed with a high level of interest from several interviewees. However, it requires a high level of interconnection among different stakeholders to identify the most suitable partners and the development of interconnected operational units. Thus, as highlighted by Bocken et al. (2016), collaborative strategies are particularly important for a successful implementation of industrial symbiosis.

Lastly, design confirms itself as one of the most important stages to implement CE strategies and a transversal aspect within closing and slowing loops as highlighted by the literature (Bocken et al., 2016). Therefore, since FTS are usually the one manufacturing the components, they have higher control on this aspect: however, this necessitates closer relationship with suppliers (which need to provide raw materials that can facilitate circularity) so might be more difficult to implement. However, developing a set up where fewer suppliers are involved can lead to more stable relationships.

When considering which circular strategies options and CBMs an FTS in the marine leisure industry is more likely to adopt, it is pivotal to look at the role that collaboration will play in this context. Currently, both internal and external collaborations are established at VP level, although it cannot be assumed if one is more popular than the other since that would require a more comprehensive overview of the current collaboration strategies in place which the author of this research has been able to capture just partially. What can be guaranteed is that circular flows could be enabled by both vertical and horizontal collaboration as found out in literature review (Vlaji & Hsiao, 2018). Most of the partnerships are established with equally sized companies but also other companies and universities while not much activity has been seen in establishing partnerships with government agencies and local municipalities. The most relevant aspects VP considers when establishing partnerships are related to all the motivations listed by the literature (Staaf & Sundstrom, 2021; Brown et al., 2019; Frey et al., 2006), namely co-developing new knowledge (especially about technology), sharing resources, aligning strategic visions and co-development of new offerings.

Especially when looking at the external value chain relations, there is high potential to support CBMs implementation and network reconfiguration, especially on i) the communication level by exploiting the same channels to support circularity-related discussions among stakeholders in the ecosystem; ii) the interdependence with the stakeholders being a risk but also an opportunity.

There is a good possibility of establishing a direct and more interdependent relationship with different stakeholders in the supply/value chain. The two layered dealer system comprising VPCs and VPSs is of pivotal importance: it shows a high level of dependence from VP side and a high level of freedom from the dealers' side (e.g., setting up their own contracts and service agreements, working with other companies since they are not exclusive to VP). However, dealers also need to learn how to work with all products: this is a leverage point that can be further explored in power dynamics. As regards the reconfiguration of the network, as highlighted by literature review, it is important to make sure that other actors are also interested or willing to transition towards circularity to develop a long-term stakeholder relationship (Salvador et al., 2020; Salvioni & Almici, 2020). Possibly, surrounding VP with a constellation of partners with CBMs: providing training, financial support, economic advantages and low level of bureaucracy.

VP suffers from a low level of awareness from the network perspective: it seems that the interest towards circularity is not very widespread. Therefore, it will be necessary to find incentives when applying network reconfiguration and CBMs. The entire circular system risks to collapse if just one partner defects, especially for BMs to close loops and product life extension. Moreover, the risk of defection can be minimized by exploiting internal skills, capabilities and tools, which is extremely possible for VP since it is embedded in the bigger Volvo Group.

What is clear from the findings is that all these CBMs can be supported by technology which represents the biggest enabler. Developing and identifying new circular flows within VP and possibly the Volvo Group is a journey and a stepwise approach is needed to embrace the challenge – a gradual process is necessary. From findings, it seems like the most likely scenario would be to diversify the current business models. Although, when applied in practice, the boundaries among the different types seem a bit vague bearing in mind that an FTS could operate under different BMs. Additionally, more substantial changes to BM, such as retaining ownership through PSS are not so frequent but should be explored further.

In developing new CBMs, VP can exploit the current competences and resources (e.g., technological skills, in-house product development, testing facilities) but it will have to establish partnerships to strengthen these competences and to fill the gaps of what it is missing (also, exploiting current tools and channels in place – such as trainings, workshops). Indeed, as Frishammar & Parida (2019) mention, new types of partnerships can help firms to launch CBMs, by complementing lack of internal capability. Engaging in collaboration requires to take into account trade offs such as costs, time, effort and risk sharing (Dyer, 1997). Therefore, exploiting the internal synergy, if present, could lead to a lower level of risk involved. In testing out pilot projects, it could be crucial to start from the closer relationship between VP and boat builders/constructors who, already nowadays, have some direct business agreements.

As regards the research findings placed in the context of existing research, they provide new contributions that advance the existing literature on CBMs and collaboration for FTS. Namely, due to the complexity of VP business model (several different suppliers, dealers and complex steps in its supply/value chain), when implementing circular strategies and CBMs, it is pivotal to understand how to collaborate with the surrounding network of partners and stakeholders to redefine, improve and restructure links with end-users as literature underlined. Therefore, this particular case study and the findings of this research can advance the theory by providing an overview of the most suited circular strategies and CBMs for FTS, considering its business set up and supply/value chain peculiarities, and how collaboration supports FTS in transitioning from LBMs to CBMs uptake. Moreover, it shows that the usual results in academia, discussing most common CBMs in firms might not apply to an FTS context, calling for further research on the topic. However, some limitations to the generalizability of the findings are present as will be discussed in the next paragraph.

5.2 REFLECTING ON METHODOLOGICAL CHOICES AND LIMITATIONS

This paragraph provides reflections on the methodological choices conducted by the author, as well as the legitimacy and generalizability of the findings of this study. Indeed, although this research has provided many valuable insights, some aspects might have affected the obtained results. As regards the method chosen, the decision to focus on one single case study was realized to gather an in-depth understanding of the studied phenomenon.

On the one hand, this has a positive outcome, because it allows to get closer to a real context scenario: it brings the author closer to real-life situations and test views on phenomena as they reveal in practice (Flyvbjerg, 2006).

On the other hand, findings might not be totally transferrable. Nevertheless, particularity rather than generalizability is the hallmark of good qualitative research. Rigor in the structure and the choice of methods to be employed has been ensured. Triangulation was guaranteed by using different types of collection methods (interviews, documents and on-site observations) and being embedded in a context where other researchers were involved as well. Exchange of understanding and reflections was conducted on a regular basis, avoiding research bias as well.

Results might be more generalized for other FTS, in marine leisure industry but to an extent also the broader manufacturing sector: the situation described by RQ1 is a common set up of FTS (especially in the manufacturing sector) and the results of RQ3 about possibilities that collaboration plays within the transition to CBMs could also be extended to other FTS. For RQ2, as Reim et al. (2019) points out, often, the conception of CBMs is based on the logic of a "one-size-fits-all solutions", which disregards product-specific criteria and firm's capabilities. Therefore, for valuable results, if considering this perspective, it becomes difficult to generalize findings but rather it is important to conduct more research on different sectors and industries, and even products.

VP is based in Sweden, a country that has adopted relatively progressive environmental policies so VP situation – especially with regards to the level of CE awareness - might slightly differ from FTS based in other countries. Nevertheless, the stakeholders involved in the supply/value chain are distributed worldwide but interviews were conducted with interviewees based in Sweden. More empirical research addressing various industries is required to provide a generalization of findings. However, some general patterns that other FTS can relate to have been highlighted in previous sections.

As regards the method for data collection, even if interviews conducted with employees at VP have proven useful for gathering relevant data, other interviews with other stakeholders involved in the supply and value chain could complement data collection as an interesting future follow-up study. It is pivotal to map the entire supply chain to understand which actors are involved from a relational perspective (Köhler et al., 2022). Interacting with actors from every part of the supply chain (both upstream and downstream) to have a holistic view of the case studied and understand also stakeholders' perspective could be fruitful. Table 5.1 provides a suggestion of additional interviewees as well as motivations for data collection.

Table 5-1. Additional interviewees to be contacted for future research

Additional interviewee	Motivation for data collection
Legal team	Understand concerns with LBM to CBM transition (e.g., liability concerns; ownership of softwares) Understand difficulty/impossibility of retaining ownership of an engine etc. in a 'service offering'
Sales team	Understand development and current status of Hurtigruten Svalbard pilot project (e-mobility service based on pay-per-hour)
Boat builders/constructors	Understand operations conducted by boat constructors and challenges faced from their perspectives
End users	Understand wishes and challenges faced in relation to circularity
Suppliers	Understand challenges faced about implementing sustainability activities and CBMs

Source: Author

Therefore, this thesis contributes to the existing research by offering empirical evidence that the interviews with an FTS in the marine leisure industry provided. The empirical material particularly pertains to how such a company can shift to CBMs and which collaborative processes are helpful for the LBM to CBM transition, supporting CBMs implementation. As a firm, VP can be considered as exemplary for FTS in the manufacturing sector (marine leisure industry) in Sweden due to its dominant role. In this peculiar case, it is also relevant to bear in mind that VP is embedded in a bigger context – Volvo Group – which provides important tools such as knowledge sharing and strategy sharing. Moreover, VP is characterized by a heritage of driving innovation in the marine space and therefore by having an influential position to start the LBMs to CBMs discussion on a broader level.

Moreover, for the purpose of this study, the research has been delimited to one reference product, namely marine diesel engines. Even if, the recommendations are more generic and the reference product was used by the author to understand some technical aspects, focusing on other products might provide slightly different results.

Moreover, additional research on financial viability and technical feasibility of the suggested CBMs will be needed. Indeed, in order to fully understand the practical applications of certain circular strategies, it could be relevant to analyse the financial flows but also the technical aspects that might hinder or facilitate such application. Moreover, the focus market has been the leisure segment, as highlighted in previous sections: the structure and the nature of this market by default might pose more problems and challenges for the discussed findings than other segments (like the commercial one) where certain solutions could be more feasible or more applicable.

6 CONCLUSIONS

It is clear that the "take-make-dispose" logic of the current industrial economic system which has caused severe environmental related problems can be transformed into one based on circular economy principles. Firms play a key role in this transformation by adopting CE strategies and CBMs. However, while much of the research on CBMs implementation has a focus on companies who have a direct contact with end users, research on impactful actors such as FTS, who are not end-user facing companies, is underdeveloped. Therefore, this thesis has tried to understand how non-end-user facing manufacturers, namely FTS, can uptake CBMs.

The results contribute to the overall thesis aim of understanding the possibilities an FTS has to implement a transition from an LBM to a CBM, by exploring suitable circular strategies options best suited to its specific situation.

For RQ1, indeed, the results have shown that an FTS business set up is primarily based on a linear thinking, with a complex supply and value chain, removed from final end-users. Moreover, even if interest towards CE is present, the current status of circular strategies is quite low and thus there is a rather low uptake of CBMs in business practice.

For RQ2, findings suggest that an FTS could start from the current CE strategies in place (e.g., remanufacturing in the case of VP) and diversify its business model by adding additional product lines. Moreover, what is clear from the results is that the usual common circular strategies suggested by current literature might not be totally transferrable to an FTS situation: infact, the case of VP has proven that PSS-based CBMs and recycling strategies might be more challenging to implement than how it is perceived by current literature. However, some will need more time and a different degree of collaboration strategies. This thesis contributes, through insights and discussions gathered about key strategies of importance, priorities, feasibilities to understand how the landscape should develop.

Indeed, in the transition from LBMs, because of the peculiar nature of the business set up, a pivotal role is played by actors in the ecosystem. Thus, this research has tried to explore which role collaboration plays in such a transition. It seems clear that FTS should prioritise the CBMs where the closest steps of the supply and value chains are involved (dealers, boat builders/constructors). Simultaneoulsy, it should strengthen current partnerships with existing partners (third-party manufacturers; suppliers; researchers and other companies in the same or other industries). Potentially, it could also involve new actors (unauthorized repairers; non-traditional actors). What proves important is to start from existing infrastructures and internal departments. Moreover, because different types of CE strategies and CBMs will entail network reconfigurations: to ensure a smooth CBMs uptake, it will be necessary to provide partners with the rights incentives, both environmentally and financially.

Therefore, this study contributes to findings by exploring a specific sector (manufacturing sector), a specific industry (marine leisure industry), in a specific company setting (Volvo Penta). Moreover, this study's importance lies in the ability to contribute to fill existing gaps in the field: namely understanding which circular strategies companies further upstream in the value chain, namely FTS, can adopt, adding to the current research on CBMs in business practice (where instead is mostly focused on end-user-facing firms). In providing these results, the research looks at the role that collaborative strategies have in supporting FTS in the uptake of CBMs.

6.1 PRACTICAL IMPLICATIONS AND RECOMMENDATIONS NON-ACADEMIC AUDIENCES

The findings bear implications for managers: the current research does not take into account discussions on finance and costs; instead, it serves as a preliminary understanding of possible circular strategies to look into and test. The author recommends VP management group to explore the financial related aspects of these models to understand their commercial competitivity.

Additional research on the technical feasibility of the suggested CBMs will be needed as well, to understand, from an engineering perspective, if certain strategies can be feasible to apply.

Moreover, other CE strategies for different product lines – besides marine diesel engines – could be identified. Indeed, while oftentimes, conception of CBMs is based on the logic of a "one-size-fits-all solutions", it is pivotal to understand which circular strategies are more appropriate based on product specific criteria. Additionally, it would be relevant to analyse also the industrial commercial segment to understand how certain types of CBMs might be uptaken more easily.

Furthermore, in parallel with identifying the circular strategies, it would be relevant to develop Key Performance Indicators (KPIs) to measure the impact and progress of these strategies.

As regards the CBMs, it is pivotal to consider that the choices suggested are simplified versions but there are many types of business model specific sub-models that should be investigated further. When prioritizing which model to test out, it will be essential to take into account the resource and environmental savings provided by each type of CBM. For example, when looking at PSS, if more boats need to be offered as service/rental/pay per use solutions by 3rd parties or dealers, this would imply for VP to be able to offer/sold/provide more of its products to make business sense. Also, the boats will be used more intensively by non-owners, leading to more wear and tear and thus to a shorter life. Consequently, research on the environmental rationale would be needed during the pilot tests.

Furthermore, this research provides information on collaboration types based on several collaboration examples as identified through interviews: it will be relevant to map in a more comprehensive way all the existing partners, to better understand where most appropriate leverage points exist for establishing strong partnerships.

Moving towards electrification

The focus of this thesis has been on CBMs for current marine diesel engines: the aim is to experiment with different CBMs, understanding what could work, what could not work while building experience and skills. However, the author has researched the topic bearing in mind the electrification journey VP is undertaking. Indeed, this research represents a starting point to i) trial business models that ensure value creation and competitiveness in the future; ii) help build a foundation for an inevitable transition to electrification, iii) in preparing for the future, supporting the company in dealing with risk reduction. Therefore, the author would like to draw on the insights gathered on CBMs for the existing diesel engines and provide some reflections on how findings could be transferred to the electric offerings later on.

As regards CBMs, having the product as a service has been described as one of the mitigating factors in order to speed up adoption and as one of the requirements coming from the different stakeholders (Respondent 4).

The idea of developing a sharing platform – such as a boat sharing scheme - could be considered as a good new CBMs. VP is actively looking at boat clubs and boats sharing schemes for electric boats, since boat club culture seems to be growing (especially in the USA). There are many startups in the landscape which are encouraging boat sharing and connecting private users. Therefore, it could be important for VP to start thinking about collaboration with these types of competitors. In providing PSS, the network reconfiguration might see new partnerships with local governments: for example, in a boat sharing scheme, implementing a system for which every harbour would have stations where customers could swap batteries or recharge them might imply changes in municipal infrastructures. Nonetheless, this could be the case assuming that such a public space like a municipal harbour could be dedicated to an exclusive service (charging) that does not benefit all possible users of that space. It will depend on local and national laws for regulation of public spaces.

In disassembly for remanufacturing, it was highlighted that "the tricky part will be with electrification because now we are going to work with something we have never worked before. Electronic parts are not designed for remanufacturing, for example because they are involving lots of glue" (Respondent 2). Therefore, there will be the need of strengthening the current remanufacturing processes: disassembly activities will increase with the development of battery electric vehicles (BEV), source of many precious metals. From a regulatory perspective related to Right to Repair and Extended Producer Responsibility (EPR), it will be "important to develop special selling models to make sure battery can come back" (Respondent 6). In a future "there will be requirements on more carbon footprint, information to be shared [e.g., Right to Repair] and sustainability passports for products" and "extended producer responsibilities" (Respondent 6) besides regulations on safety and emissions as well as materials and substances (e.g., REACH and ROSS Regulations).

Moreover, value chain relationships are also going to change in terms of competencies: probably, there will be a bigger focus on safety response and support than with current offerings (Respondent 3). The cascading requirements might get through a shift when implementing electrification, other aspects of electric safety and more care needed during the commissioning of the high voltage system would require VP to be more present, hands on for installations, at least in the beginning of the products (Respondent 1).

Future set up is foreseen to involve bigger but fewer dealers, with a huge impact on VP's dealers' network: old dealers are likely to acquire new competencies and new dealers with new needed competencies are likely to join the network (Respondent 3). In the long run, when looking at electrification, it is evident from findings that VP will need to learn how to deal with new competitors entering the market: "We see many more competitors with different backgrounds now than we do on the combustion engine side. And on the marine, most of the competition is actually startups building dedicated electric boats" (Respondent 1).

Furthermore, when moving towards electric propulsions, faster technological cycles will lead product development which implies the necessity of establishing closer relations with dealers anyways, following the need of informing them of updates in design as it is currently happening right now. Moreover, with increasing automation, it will be more and more difficult to get the product back and particular attention has to be paid to batteries handling which would represent a more costly expense.

The most widespread opinion clearly sees every employee aware that VP is undergoing a big transformation (Respondent 1; 4; 7; 8) but with difficulties related to how to manage this change (Respondent 8). It has been pointed out that "Electromobility is great, but it might not work for all applications. Maybe you cannot rely on because you need to go very high speed all of a sudden (e.g., with coast guard). So, combustion engines should be still around as a support" (Respondent 11).

Since the thesis focus was on CBMs for marine diesel engines, this section on electric offerings is not comprehensive but serves as a reflection on insights gathered during the interviews. Therefore, the author recommends conducting further research on this aspect: right after that, it will be possible to anticipate how well particular CBM aspects are going to be transferrable to the electric offerings as well.

6.2 RECOMMENDATIONS FOR FUTURE RESEARCH

Even if the RQs have been answered, the author suggests scholars to conduct further research with other case studies with other FTS in different industries, to compare results with this research's findings. Moreover, it could be interesting to understand, besides the role played by collaboration with actors in the supply and value chain, which role internal organizational structures play in the transition from LBMs to CBMs for FTS. Furthermore, after understanding which circular strategies and CBMs are most suited for FTS, the author recommends looking into the ways FTS could be supported in the transition, through the lens of change management literature. CE is not an end point and learning how to manage a CE process would support a company's sustainability journey.

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APPENDIX 1: List of interviews

List of interviews conducted with VP' employees, external business consultants/researchers and on-site observations

List of Volvo Penta interviewees				
Reference number used in the text	**Position**	**Date**	**Time**	**Reasons for interviewee' selection**
Pilot study interview	Director Electromobility (contact person)	02.02.2022	25 minutes	Understand his perspective on the project
1		11.02.2022	45 minutes	
M1		21.02.2022 Regular meeting 1	25 minutes	
M2		07.03.2022 Regular meeting 2	20 minutes	
M3		21.03.2022 Regular meeting 3	25 minutes	
M4		19.04.2022 Regular meeting 4	15 minutes	
2	Global Parts and Services department's Product manager & Director	28.02.2022 Follow up (with Product Manager) 03.03.2022	45 minutes 15 minutes	Understand technical side of marine engines and propulsion systems Understand how the reverse logistics process looks like
3	Business development manager in the Nordics	28.02.2022 Follow up 07.03.2022	45 minutes 25 minutes	Understand Supply Chain relationships (especially with dealers)
4	Business Development Director in Marine Business Unit	03.03.2022	45 minutes	Understand VP current BM status and operations in VP marine unit Understand VP services/offerings/settings in the leisure segment Understand role of spare parts or other

				remanufacturing etc. offerings
5	Purchasing Manager	04.03.2022	40 minutes	Get to know VP sustainability strategy, related leverage points and challenges Understand Supply Chain relationships – raw materials, component manufacturing purchasing
6	Regulatory Affairs Manager	08.03.2022	40 minutes	Get to know VP sustainability strategy, related leverage points and challenges Understand Supply Chain relationships – raw materials, component manufacturing purchasing
7	Business partnership developer in purchasing department	09.03.2022	40 minutes	Understand current status of partnerships and opportunities in developing new partnerships for circularity
8	Change and transformation Manager	23.03.2022	40 minutes	Understand organizational behaviours, structures, and routines at VP
9	Engineering Product manager for marine electronics platform	29.03.2022	35 minutes	Understand the potential future role of connectivity and this type of customer and interfaces to others with respect to circularity. Example: Easy Connect App for boating
10	CEO of Marine Dealer	30.03.2022	25 minutes	Understand the operations conducted by VPC marine dealers and collaboration/sustainability-related challenges faced from their perspective
11	Engineer Project Manager	26.04.2022	40 minutes	Understand the current status of manufacturing, the circularity of components & related challenges from the design stage

				Understand how it changes with electrification
12	Responsible for Internal Communication	26.04.2022	25 minutes	Understand how internal communication can help the uptake of LBM to CBM transition in the company
13	Vice President Brand, Communication and Marketing	26.04.2022	25 minutes	
14	Director Volvo Group circularity development	02.05.2022	40 minutes	Understand wishes and challenges faced concerning circularity at the Volvo Group level

On-site observations – Vara Plant				
Reference number used in the text	**Position**	**Date**	**Time**	**Reasons for interviewee' selection**
15	Logistic engineer	27.04.2022	1.5 hour	Understand assembly phase Understand the technical side of marine engines and/or propulsion systems
16	Environmental coordinator	27.04.2022	3 hours	Understand environmental aspects related to Volvo Penta's facilities
*VP Electromobility Director and one Researcher from the REES Project were also present				

List of external interviewees				
Reference number used in the text	**Position**	**Date**	**Time**	**Reasons for interviewee' selection**
17	Project Manager at Merikartta, working on CE in the marine industry	22.03.2022	30 minutes	Understand CE issues in the marine industry
18	Consultant at Circulab	11.04.2022	30 minutes	Understand CE/CBMs related challenges faced by companies

APPENDIX 2: Coding categories

Overarching Category	*Associated terms*
	RQ1
Offer and value proposition	- Marine leisure industry - Customization - Engine lifetime/Product lifecycle - Metals - Cross functionality; cross-functional community - Technological development
Key channels	- Suppliers; supply base - Reverse Supply Chain - Multilayered system - VPC; VPS - Cascading effects - Freedom; independent - Traditional Communication; communication process. - Dependency; interdependency - Training chain
Relationship with value chain partners; Partnerships; ecosystem	- Shared responsibility - Trust - Information exchange - Openness - Communication - Transparency - Brand reputational risk - Shared values - Develop - Explore - Learn - New opportunities - Challenge of mapping all initiatives
Circular Economy	- Future solutions - Innovations - Remanufacturing - Circular flows - Circular sales
Business set up challenges	- Lack of expertise; increasing complexity; skills diversity - Business seasonality - Nature of the business - Unauthorized dealers - Costs - Scattered information - Organization size - Dependency

Overarching categories	**Associated terms**

RQ2	
Product as a Service	- Product Oriented - Service Oriented - Accessibility - Aftermarkets control - Customer contacts
Reuse	- Secondhand market - Blocket
Repair	- Mix; variance - Dismounting - Extending product lifetime
Remanufacturing	- Circular thing - Closed loop - Deposit system - Upfront - Core assessment criteria - Third-party manufacturer - Knowledge sharing
Recycle	- Wastewater - Hazardous waste - Chemicals
Product development	- Design - Regulations - Customers - Suppliers - Start of the project
Technology	- Diagnostics - Technological cycle - upgrades
Service agreement	- Diversity of applications - Joint service agreement - Self-service; independent workshop; unauthorized repairers

Overarching categories	**Associated terms**
RQ3	
Business rationale	- Internal support - Piggyback - Umbrella - Shared targets and values - Synergy
Competitors	- Startups - Unauthorized repairers
Partnership; ecosystem	- Joint challenge - Product development - Technology - Inorganic growth - M&A - Network's interest/willingness towards circularity - Role of connectivity

Challenges for shift towards circularity	- Awareness (especially in product design) - learning journey - internal communication - Bureaucracy - Profitability; economic advantage - Regulations; legislation - Attractiveness for network
Transformation; Journey; Shift; transition	- Newness - Design issues - Competencies