A RELATIONAL APPROACH TO MARKET INNOVATION: A TRANSFORMATION FROM MANNED TO UNMANNED VESSELS AND AUTONOMOUS SHIPPING

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ABSTRACT

The literature on innovation is characterized by the dominance of technological aspects of innovation. Literature features linear models that describe innovation development as a technological challenge of subsequent stages whereas considerations on market aspects are more implicit and scattered. Consequently, the purpose of this article is to further understanding on the issue of how new needs and more widely new markets evolve and are created for the new technology. The study adopts the concept of market innovation in building a market-oriented, multi-level, and multi-actor analytical perspective on evolving needs, respectively evolving solutions and the emergence of markets. The market innovation is captured through theoretical development and a qualitative exploratory case study that focuses on the dawn of development in which autonomous shipping is to become reality in a global marine industry. The study conceptualizes the development of autonomous shipping as a market innovation and focuses on the related innovation drivers and barriers on micro, meso and macro levels of context. These generated insights comprise a basis for theorizing an integrative research framework on market innovation and critically assess and refine the suitability of the prevailing analytical concepts and perspectives on innovation to improve their capability to capture the market dimension of innovation.

Keywords: market innovation, multi-level approach, autonomous shipping

Competitive paper

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INTRODUCTION

Schumpeter was the first to introduce the concept of innovation in 1934. Since then, a massive and relatively diverse research endeavor on innovation has produced new knowledge, but also led to conceptual confusion regarding the term innovation (e.g., Gatignon, Tushman, Smith, & Anderson, 2002). Despite their diversity, however, newness and usefulness appear to be enduring common features, reflected in most definitions of innovation (see e.g., Baregheh, Rowley, & Sambrook, 2009; McDermott & O'Connor, 2002). This means that innovation not only concerns new technology or solutions, but also market needs (i.e., the usefulness) that it tackles: "What may be a startling breakthrough to the engineer, may be completely unremarkable as far as the user of the product is concerned." (Abernathy & Clark, 1985, 4; see also Nyström, 1990; Mowery & Rosenberg, 1979; Howells, 1997). However, the literature on innovation largely perceives innovation and innovation processes from the perspective of new technologies and solutions, whereas considerations on the emergence of respective needs and markets are more implicit and scattered.

The considerations on the market dimension of innovation reflect explicitly in conceptualizations such as, for example, market-based innovation, marketing innovation, and market innovation. Whereas the terms market-based innovation (e.g., Zhou, Yim, and Tse, 2005) and marketing innovation (e.g., Levitt, 1960; Naidoo, 2010) refer to company deliverables and marketing activities, the term market innovation has a broader scope. Market innovation does not concern simply the deliverables and marketing actions of a company, which alter its positioning with regard to the customer market and competitors. Rather, market innovation relates more widely to the strategic issue of how the company creates and realizes evolving market opportunities ranging from single customer needs and respective offerings to market-level reformations of supply and demand (Johne, 1999; Nyström, 1990; Nenonen & Storbacka, 2012).

In this study, we adopt the concept of market innovation to refer to the evolvement of needs and markets with respect to evolving new solutions and their supply. *The purpose is to further understanding on the early stages of the transformation process in which the prevailing market order is questioned and an alternative market order is emerging. Particular focus is set on the business actors and the interplay between their interpretations and actions and the emerging contextual contingencies on the different levels of context.* The purpose is achieved through conceptual development that builds on an empirical, exploratory case study in the maritime context. The case study focuses on the dawn of the transformation in which the manned vessels are gradually to be replaced by remote controlled or autonomous ones largely altering the global marine industry and respective fields..

This paper is organized as follows. First, in chapter 2, the theoretical background is reviewed, resulting in the definition of the units and levels of analysis of market innovation and depicting a research framework for the empirical study. The methodological approach of the study is described in chapter 3. With regard to the a priori research framework, the case analysis in chapter 4 depicts a dense empirical account of market innovation development in a real life context. The case analysis precedes sections in chapter 5 that discuss the results with regard to market innovation emergence in the focal case, and then theorizes the integrative research framework. Finally, conclusions are drawn in chapter 6, together with implications for theory and practice.

THEORETICAL BACKGROUND

The idea of market innovation

Explicit considerations on the term market innovation vary in their perspective to the link between organizational actions and the markets. For Nyström (1990), market innovation is a product's degree of uniqueness at its market introduction compared to existing competing products. In this respect, market innovation is the sum of the distinctive features of a product created by an innovator company within the product development process, and perceived and evaluated with reference to competing options by a customer. Johne (1999, 7) defines market innovation with regard to actions for "improving the mix of target markets and how chosen markets are best served. Its purpose is to identify better (new) potential markets; and better (new) ways to serve target markets." Also for Johne, the idea is that market innovation is attained through purposeful management activities; for example, through different kinds of segmentation or improving product features. Both approaches perceive market innovation as a phenomenon to be created and greatly controlled by the innovator company. Thus, they resemble the seminal work by Ansoff (1957) on the profit potential of alternative product-market strategies for a company and, more widely, the marketing management perspective (e.g., McCarthy, 1960; Kotler & Levy, 1969) in building on a linear stimulus-reaction assumption between an innovator's undertakings and resulting market outcomes.

However, a more recent consideration on market innovation, for example the study by Nenonen and Storbacka (2012), sets the other end of the range with regard to what constitutes a market innovation. In explicitly referring to a practice perspective on markets (Callon, 1998; Callon & Muniesa, 2005; Azimont & Araujo, 2007; Kjellberg & Helgesson, 2007; Araujo, Kjellberg, & Spencer, 2008), market innovation concerns focusing on where to compete, not how to compete, in the spirit that markets are what actors subjectively make them to be. For Nenonen and Storbacka (2012), activities underpinning market innovation are less rigid and clear-cut, but more relational and systemic.

The foci of these defined perspectives on market innovation are similar in addressing the idea of market innovation as *a realization of new market opportunities for the innovator*. This common idea between the perspectives is taken as a definition of market innovation in the focal study. However, the main difference between the perspectives lies in the emphasis and assumptions regarding the relationship between the innovator, the innovation, and the context. The focus seems to oscillate between the actions of an innovator to create new innovative offerings that comprise a solution to a customer need, and multi-actor and multi-level new market emergence processes. To sort out this dynamics, the following section draws on various streams of research to generate a research framework that provides analytical clarity for tackling these issues regarding market innovation.

The theoretical framework for the study of market innovation

The systems-oriented perspective on market innovation (Nenonen and Storbacka, 2012) links with approaches such as technological revolutions (Perez, 2002), technological transitions (Geels, 2002), and system innovation (Elzen et al., 2004). All these approaches refer to a collective process over which a particular socio-technical system alters from one form to another. For example, Geels (2005) has described transition processes from propeller–piston engine aircraft to turbojets, from sailing ships to steamships, and, regarding urban land transportation, from horse-drawn carriages to automobiles as examples of this type of process that represent composites of various actor's actions and parallel market evolvement.

Analytical tools have been defined to conceptualize and analyze transition processes at different levels of aggregation (see Liu & White, 2001; Bergek, Jacobsson, Carlsson, Lindmark, & Rickne, 2008). For example, an approach termed the multi-level framework has gained considerable attention and development efforts (e.g., Geels, 2005; Genus & Coles, 2008; Markard & Truffer, 2008). In explaining the transformation of socio-technical regimes, the multi-level framework distinguishes the nested hierarchical levels (i.e., micro-level niches, meso-level socio-technical regimes, and macro-level landscape), and the various interlinked actions and developmental pathways. The framework presented in Figure 1 adopts the idea of the multi-level framework (e.g., Geels, 2005; Genus & Coles, 2008) in describing market innovation as a multi-level conceptualization of *micro-*, *meso-*, *and macro-levels*. The framework describes these levels and those related actions and occurrences as interlinked and in conjuction with the socio-technical change. For the analytical purposes the socio-technical change is disaggregated into the components of *technical* and *social change* and those related *new solutions* and *new needs* that these change processes generate but also are initiated from in a cyclical and reciprocal manner.

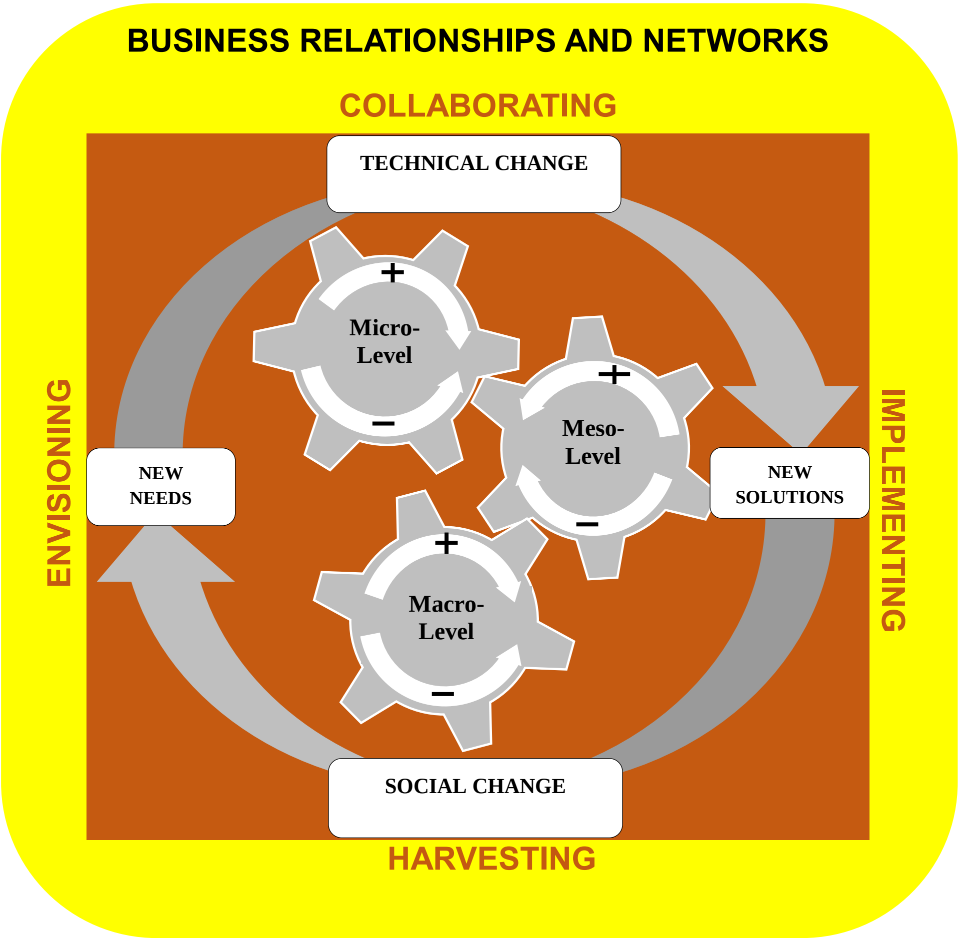

Figure 1 Theoretical framework for market innovation

The framework depicted in Figure 1 presents block arrows within the gears of micro-, meso-, and macro-levels. These arrows demonstrate *drivers* and *barriers* i.e. the activities and occurrences that have either accelerating (+) or inhibiting (-) effect on the socio-technical change. Despite, the multi-level framework represents a comprehensive model that explicitly considers both process and structural dimensions of socio-technical change, the managerial actions and intentions for change are only marginally considered in the multi-level framework. This is largely because of the idea of socio-technical change as being out of control of any single actor and thus managerial actions for inhibiting or facilitating the change may have only a marginal effect on the whole (see Rogers, 2003).

Instead of managerial actions, the framework described in Figure 1 describes steering activities of envisioning, collaborating, realizing and harvesting as a canvas (orange rectangle) that contextualize the (grey and white) elements in the middle of the framework (social and technological change, new needs and solutions, the contextual levels of micro, meso, and macro). These steering activities are modified from the study of transition management by Loorbach (2007) and are here described to steer the social and technical change and thus guide the transition comprising actions and events on the levels of micro, meso, and macro. *Envisioning* in the framework refers to identification and visualization of the elements and their interlinks related to the potential transition. *Collaborating* is about developing structures and processes for collaboration to initiate and facilitate transition. *Implementing* refers to actual undertakings for mobilizing resources for realizing the transition. *Harvesting* describes the collecting the benefits that result from the materialization of the transition. These steering activities are to be seen as composites that are not perhaps at hands of any single actor but emerge of various actions by different actors involved in the process through business relationships and network that comprise an overarching (yellow) backdrop in the framework. This kind of idea of less rigid idea of managerial actions resonates with the IMP perspective (see e.g., Anderson, Håkansson & Johansson, 1994; Håkansson & Snehota, 1995). The idea of managerial action as steering activities in a network are related particularly to the research on strategizing and interaction in multi-actor business networks (see Baraldi, Brennan, Harrison, Tunisini & Zolkiewski, 2007; Håkansson & Ford, 2002; Möller & Rajala, 2007; Gadde, Huemer & Håkansson, 2003; Abrahamsen, Henneberg, Huemer, Naudé, 2016).

The framework in Figure 1 comprises a sensitizing device that visualizes the key theoretical elements and thus provides guidance for the empirical, exploratory case study in the context of autonomous shipping. The articulation of the key concepts and their interlinks in the framework in Figure 1 facilitate us to define more specific research questions for the empirical study:

1. Who are the key actors, what are their resources and steering activities for developing the concept of autonomous shipping?
2. What are the drivers and barriers i.e. the activities and occurrences that have either accelerating or inhibiting effect on the socio-technical change from manned to autonomous shipping?

Thus the role of the empirical study is to produce knowledge on these themes and thus produce input for the theorizing purposes to reach more fine-grained perspective on market innovation.

THE EMPIRICAL STUDY OF AUTONOMOUS SHIPPING

Case description

Autonomous technologies have received a considerable amount of attention in various industries, and the marine sector is following suite. Autonomous shipping incorporates the systemic integration of a myriad of digital and physical components, and enables a profoundly new way of serving individuals, organisations and the society. Thus far, advances in digital technologies have enabled the development of automated applications aimed mainly at improving the maintenance and operational efficiency of ships, but the marine industry has recently begun to explore the vision of autonomous ships. In an autonomous shipping vision, ships can be remotely controlled from onshore as well as sail autonomously without any crew on board. Technologically the realisation of an autonomous ship requires the integration and convergence of a multitude of technologies including both hardware and software components, which are either existing or to be invented. This in turn necessitates extensive cooperation between various actors specialising in the necessary technologies. Thus, the marine industry has seen consortiums being formed in order to explore the potential of autonomous shipping (see for example the following projects: Advanced Autonomous Waterborne Applications (AAWA), Maritime Unmanned Navigation through Intelligence in Networks (MUNIN), and Mayflower Autonomous Research Ship (MARS).

While the technological invention of an autonomous ship would be a remarkable feat of engineering, its usefulness for the marine industry can, however, only be determined by the wider stakeholder community. The marine industry is not necessarily the easiest environment for introducing disruptive innovation. It is highly regulated, often characterized as conservative in terms of technological adoption, and heavily influenced by powerful seafarers' unions. Consequently, leaping into the business of autonomous shipping represents a high uncertainty investment for companies specializing in the needed technologies, as there is no guarantee that the industry will be able to reform its structures and practices that are grounded on ships being manually controlled on board. Similar projects involving autonomous technologies are being carried out in the automotive industry, where the technological and social development appear to be at a more advanced stage. Thus, insights from the automotive industry were also incorporated in this study.

Methods and data

Autonomous shipping is a novel real-life phenomenon characterized by high complexity. Thus, this study applies an exploratory single case study strategy as it allows us to generate in-depth understanding through the collection of rich data on multiple levels and from multiple actors involved. The merit of this type of qualitative data is its potential to capture the complexity of the topic in its natural setting (Miles & Huberman 1994). Furthermore, Yin (1981, 59) advocates the use of a case study strategy "when the boundaries between phenomenon and context are not clearly evident". In this case, autonomous shipping can be regarded as the phenomenon as well as the context in which the phenomenon takes place, as innovation in autonomous shipping is shaping the context of shipping as it is today. Eisenhardt (1989) argues that case study research is particularly appropriate in the early stages of research on a topic. Autonomous shipping thus makes an excellent topic for case study research, as it is still at its infancy. The novelty of autonomous shipping justifies the exploratory nature of the case study, as the study seeks to understand a new phenomenon without predictable outcomes. The exploratory nature allowed for flexibility to adjust the research process when necessary in the light of new or unexpected information. Being at the very early stages of innovation, autonomous shipping provides a particularly interesting context in which to study the emergent nature of innovation, as research can begin to observe the phenomenon in its infancy instead of having to look back far into the past.

As part of a research consortium we had unique access to rich multi-actor data. The empirical research was conducted by using multiple data collection methods to achieve triangulation (Woodside & Wilson 2003). Primary data was collected from semi-structured interviews of 18 informants, 4 consortium workshops, 5 industry seminars, and meeting observations. The interviewees were chosen so that each technology area of autonomous shipping was covered at least by one interviewee with relevant experience and expertise.

Interviewees represented expertise from the following areas recognised as relevant for understanding autonomous shipping: remote control center, communications, operation optimisation, remote controlled systems, situational awareness systems, and automotive. Overall 18 informants were interviewed between February 2015 and November 2015. Secondary data was collected through internet searches, newsletters and magazines of main media in the marine industry. The secondary data sources included 100 news and blogs, 17 company publications, 7 webinars and videos, 9 industry reports and white papers, and 7 magazine issues. Automotive and aviation industry articles were also included to gain a broader picture of autonomous systems development. The broad topics included autonomous shipping, autonomous driving, autonomous aviation, digitalisation, big data, internet of things, and robotics.

To allow for flexibility in data collection, oscillation between data collection and data analysis took place in this study for as long as saturation was achieved and the collected data was deemed to be sufficient to reach the research purpose. Thematic analysis was used to analyse the data as a whole. However, the data was first analysed separately in each data source to determine recurring themes, after which the results were compared between the different data sources to exploit the unique insights from each data collection type (Eisenhardt 1989). After the thematic analysis, a narrative approach to analysing data was utilised in reporting the findings in an integrated and multi-dimensional manner (Floersch et al. 2010). Floersch et al. (2010) attribute the narrative approach with the ability to add a plot to describing how the themes recognised in the thematic analysis come together to create understanding through a cohesive story. The narrative approach was particularly useful in portraying a credible interpretation of the dynamics of innovation emerging in networks on multiple levels (Makkonen, Aarikka-Stenroos & Olkkonen 2012). To ensure credibility, member checks (Lincoln & Guba 1985) were used twice during this study. The interviewees were first asked to comment on the initial reporting of the findings, which were then corrected according to their comments. The second member check was done when the final results were presented to the members of the research consortium.

THE KEY ACTORS IN THE CONCEPT DEVELOPMENT OF AN AUTONOMOUS SHIP

In the case of autonomous shipping, the realisation of an autonomous ship requires a plethora of technologies to be integrated systemically. This in turn requires cooperation between various actors who can master the different technological areas of remote controlled systems, communications, remote control centre, operation optimisation, and situational awareness systems. However, engaging in such innovative efforts must make a business case for the individual actors involved. Their businesses must remain viable as well as improve throughout the innovation process, meaning that benefits must be realised already in the short term before autonomous shipping can become the norm. Often this means new or improved offerings for the existing customer base, which can be realised with the new skills that actors learn during the cooperative innovation process.

"Taking the fruits of development to our existing big customers, and offering them as new services or products, that's where we see the meat of the hamburger is, so to speak."

As such, the business around autonomous shipping is built iteratively as a result of the continuous development of sub-systems (see Figure 2) that together comprise the concept of autonomous ship and the enabling technologies needed for its operation.

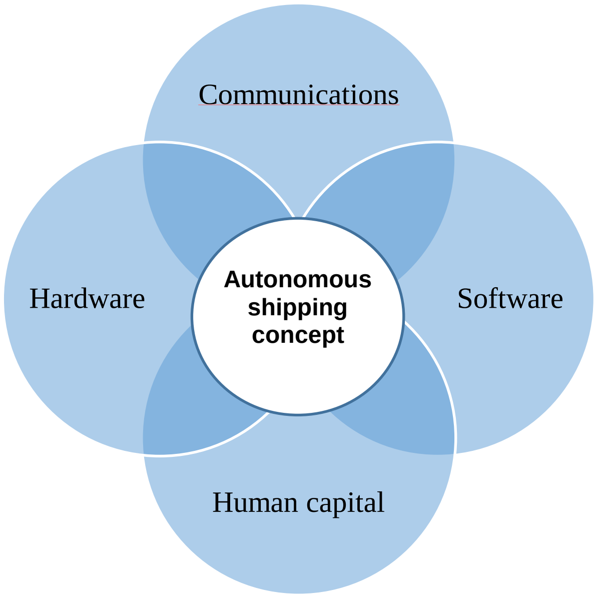

Figure 2 The key technology areas in the autonomous shipping concept

Innovators take existing technologies and combine them into new solutions that can be further matched with other solutions to create increasingly larger systemic entities. For example, video cameras have first been digitised and turned into digital cameras. This has made it possible for video technology suppliers to combine digital cameras with other types of sensors into integrated video solutions for the use of various industries. These integrated solutions can then become a part of a larger situational awareness solution, which is again combined with other technology areas that together comprise the autonomous shipping concept. This combinatorial evolution (Arthur 2009) happens as a result of intentional development activities between actors who seek to identify needed technologies within the marine industry and other relevant industries (e.g. automotive and aviation).

Some actors are perceived to have more to gain from autonomous shipping business than others. Thus, actors are not in equal positions to push the technological development forward.

"I do not think it will be in our interest to push this technology to the market. For the foreseeable future, we will also have business around the manned ship. We need to be able to cover both cases, however we do not see it as our job to push this. We do not have an interest in selling these technologies, and we do not have as much to gain from this as the [technology] suppliers. However, if they would like to push this, and that is our understanding, then we will take part in it in some way."

Furthermore, there are actors who specialise in technologies that the application of other actors' technologies depends on, e.g. satellite communications. Each actor must consider their position in the market relative to the other players, meaning that actors shape their business models accordingly, and form new alliances.

Autonomous shipping business is not only a matter of technological invention. The viability of the new business area requires support from actors whose input makes the operations possible. These include e.g. regulatory bodies, insurers, classification societies, ship managers, ship operators, ship owners, seafarers' unions, etc. Moreover, viable autonomous shipping business also requires certain norms to be broken, e.g. the marine industry needs to overcome its conservative nature if it is to benefit from new solutions, and the society needs to accept digital solutions as improving the quality of life instead of threatening it. In other words, to fully realise the potential of autonomous shipping, the developed technologies must be deemed valuable by the wider marine industry as well as the society as a whole. Here the autonomous systems development taking place in other industries comes into play.

”If there wasn’t all this positive publicity and enthusiasm that you can see around Google car and stuff like that, I don’t think we would ever be able to get all the permissions.”

Autonomous shipping business is therefore not isolated. Digital applications and components developed in different industries are not contextually bound, but can serve as building blocks for autonomous technologies across industry borders. As digital innovation across industries advances, the society becomes more and more accustomed to autonomous technologies as part of life, gradually changing the institutional context governing digital innovation into one that embraces further development. Thus, actors in overlapping innovation ecosystems benefit from each other’s efforts. The involvement of actors in pursuing value from autonomous shipping is influenced by various innovation drivers and barriers that echo the wider context in which autonomous shipping business is to emerge and eventually become the norm. These drivers and barriers will be discussed next.

INNOVATION DRIVERS AND BARRIERS IN AUTONOMOUS SHIPPING EMERGENCE

Following the theoretical perspective on the multilayered and nested nature of market innovation, the innovation drivers and barriers as perceived by the interviewees were analysed on micro, meso, and macro levels of analysis. The innovation drivers and barriers are presented in table 1.

Table 1 Innovation drivers and barriers on micro, meso, and macro levels of context

	MICRO	MESO	MACRO
Innovation drivers	• Being among the first • Cooperation possibilities • Improving company resources for increased value creation potential • Developing existing offerings	• Support from governmental bodies • Technological readiness	• Supportive change in other industries • Changes in crew supply
Innovation barriers	• Prevailing business models • Investment uncertainty	• Low business volumes • Conservative nature of the industry	• Prevailing regulatory environment

Innovation drivers

Being among the first

Many of the interviewees brought up the desire to be among the first to be associated with the concept of autonomous shipping. Pushing the related technologies to market was seen to be in the interest of system suppliers, while for e.g. classification societies and ship designers the motivation comes from being prepared in order to be able to classify and design such ships, respectively, ahead of competition.

"If there's a lot of press etc, when it's covered by all industry publications, then of course ship owners will know that 'ah, company X did this, if I want something similar then I'll turn to company X."

"It brings us a lot of visibility and vision about where shipbuilding is going. Whether something comes out of this or not, is irrelevant, because what all these companies gain is an overview of a certain type of future."

For a system supplier, the strategic decision of being a thought leader in an area that has attracted much attention has driven the need to also develop and deliver a concrete solution so as to earn the position of a thought leader. Having a long-term strategy that focuses on being an innovative leader in the future is also likely to be positively received by shareholders as well as other company stakeholders. Investing in R&D among the first may also result in patents that block the way for competitors who attempt to follow later.

Cooperation possibilities

For a component or sub-system supplier the possibility of cooperating closely with other suppliers was seen as a driver to be involved in a development project, as the developed relationships could spur business opportunities in other areas in the future. Furthermore, the involvement of a large organization functions as a driver for others to be involved in the business of autonomous shipping, as e.g. a small video system supplier would lack the credibility to begin developing an operating system for an autonomous ship, whereas a larger system supplier would not. Being a part of a solution is what drives innovation.

"We would really like to be involved in something like this in the future. If it happens then it is business for someone. Of course we'd like to be involved, on the other hand we cannot create that market, but we'd be a subcontractor. We can't change the marine industry with our resources but if someone's interested then we have certain expertise, willingness and a motive to be a part of it and turn it into something big. We can do superb things but as a part of a whole."

Improving company resources for increased value creation potential

Moving towards increased levels of autonomy in shipping will require new types of capabilities from system suppliers, regarding digital services in particular:

"It's such a big change that in essence even all the big players are struggling with it, because if we take for example Rolls-Royce or Wärtsilä, or any other marine industry firm, they're basically industrial machine workshops. So what really will be demanded in the future is a whole different level of know-how. Telecommunications, cloud computing, automation, robotics etc. Let's say within the next 5-10 years."

For classification societies and ship designers, a deep understanding of the technologies involved was considered as a prerequisite for their core business if autonomous ships are to be the future of shipping.

Many of the interviewees recognised weaknesses in their operations that need to be addressed in order to be able to function in the business of autonomous shipping. They considered the involvement in cooperative networks a way to overcome those weaknesses. Indeed, improving internal capabilities through engaging in the development of autonomous applications can open doors for new business potential. For example, the electronics and automation personnel within organisations were considered to be the ones who will be the most affected by autonomous applications already in the short term, as it is their capabilities that need to grow accordingly. Through this learning e.g. ship design firms may be able to gain more design business in electronics and automation in newbuilding projects already in the short term.

On the other hand, the vision of autonomous shipping was also considered to support already existing organizational strengths:

"If we envision these to be high-tech ships, and they need better systems, then in practice it means that safety requirements will grow. This is good for us because we're more advanced precisely in demanding ships and high security levels."

Developing existing offerings

Interviewees expected returns in the short to medium term as well in the form of new or improved applications to already existing market offerings.

"You have small subsystems that assist the humans. So that's probably the most short-term benefit. For us in that case would be that, we want to be in a position where we're able to verify those subsystems, and to say if they are safe enough or if they are constructed in the right way to be able to do the task that they're made for."

Moreover, an autonomous ship was considered to be the natural next step from ongoing projects, e.g. around ship intelligence, as well as a vision that facilitated to wrap up, direct and communicate ongoing development projects.

"We're not doing these things because we believe we could build an autonomous ship, but it functions as a stimulator for what we should be aiming for."

Support from governmental bodies

Support from the Finnish Ministry of Transportation and Communications, as well as the Finnish Transport Safety Agency (Trafi) and the Finnish Funding Agency for Innovation (Tekes) was seen as a positive factor for engaging in the business of autonomous shipping. First, their support has made it possible for companies to organise around e.g. the AAWA project in Finland to take the concept development further. Second, governmental support was seen as an important factor for engaging in technological development towards autonomous solutions:

"It is very exciting that there is this kind of attention from the Finnish authorities. That is a good reason for us to want to participate in this. Because then you have backing from the authorities involved, which is very important."

Technological readiness

Overall, all interviewees agreed that the technologies required for the remote control or automation of ships already exist. It could be said that there is considerable faith among the interviewed system suppliers that their technologies are at a good enough level, and that technologically the matter is about making everything function together, i.e. develop the overall system architecture.

"We provide software, and if the user is not on a ship but onshore, for us there isn't much difference. For us it doesn't matter if the computer is sailing on the boat or if it's onshore, as long as the same information is available. I would even claim that we wouldn't have to change a thing. We could already bring all the functionality onshore."

Supportive change in other industries

The society was also seen to be evolving in a direction that is more supportive of technological change and accepting human errors as more dangerous than machine control.

"In aviation there's this philosophy brewing bit by bit, that planes don't fall because of technology, but they fall because the human is starting to be the weakest link in the loop. It will be interesting to see, of course it'll soon take ten years there too before anything happens, but if this kind of mental model becomes the norm, then it can significantly accelerate our thing. And also, Elon Musk [of Tesla Auto-motive] is already saying that in ten years human driving will be banned."

Autonomous advances in other industries such as aviation and automotive were seen to drive the societal change, influencing the regulatory environment of the marine industry positively towards autonomous shipping development.

"If there wasn't all this positive publicity and enthusiasm that you can see around Google car and stuff like that, I don't think we would ever be able to get all the permissions."

Changes in crew supply

The interviewees recognised a growing issue in the marine industry in terms of a decline in the supply of crew. The increasing demand for social connectivity in the society was seen to deter future generations from considering a career as a seafarer. In particular, a shortage of skilled workforce was considered to be likely in the future as the amount of intelligence on ships increases. Autonomous and remote controlled operations were seen as a solution to this issue. Ship management companies are already facing difficulties in recruiting qualified people onboard, thus requiring more support from shore-based personnel in today's operations.

"In a digitally connected world, the remote monitoring of what is happening onboard the ship, will allow you to have a different skill set onboard. Or less skilled people onboard, to a certain extent, in the sense that you may have more conductors rather than skilled operators, i.e. drivers rather than managers onboard. And having more support from shore, on all concerning the actual running of the ship in terms of maintenance and control."

Innovation barriers

Prevailing business models

To date, equipment manufacturers seem to hold a strong position in the maintenance of ships; due to liability, insurance and classification societies' rules, ship owners are in principle obliged to rely on the recommendations given by equipment manufacturers regarding the maintenance needs of their critical machinery. Therefore, for equipment manufacturers whose revenue stream consists of selling spare parts after the initial delivery of a piece of machinery, the development of condition based maintenance systems may not be a lucrative business:

"For [equipment manufacturers] it's obviously much better to sell spare parts at 12,000 hours, fixed as per general recommendation, than when it's actually due as per condition monitoring. That can be 10,000 hours but it can be 18,000 hours. So on the condition based maintenance, if the machinery is working, this can double up."

Furthermore, actively pushing autonomous technologies to market was not deemed to be in the interest of marine players whose service offerings are currently built around a manned ship, e.g. classification societies and ship managers.

Investment uncertainty

The initial investment required to engage in innovation around autonomous shipping appeared to be a barrier for a number of interviewees. There was also speculation that most ship owners will be following the trend rather than being the first ones to invest in autonomous shipping due to high initial costs and fear of resistance from seafarers' unions. Indeed, the lack of a buying customer and therefore uncertainty for gaining enough return on investment (ROI) was seen as an obstacle for sub-component suppliers in particular. As one interviewee explained it,

"If we're being realistic about life, if we're in this business and a customer orders something from us, they pay us now, but if we take part in this [autonomous shipping] we'd have to invest without any guarantee that we'd get any money back. So it's not hard to guess which we'd choose to do."

Sub-component suppliers were seen to be more likely to join the business when challenges in the autonomous shipping scenario have been solved conceptually, and demonstrated successfully in practice.

Low business volumes

Concern was expressed for the potentially low business volumes for autonomous shipping. The shipping industry is seen to be divided between few large operators and several smaller operators, especially bulk carrier operators, which represent a large volume of the ships in the industry. Only large corporations are seen to afford upfront investment in remote controlled and autonomous solutions where ROI is reached only after some years, whereas the volume for such solutions would be found in small tanker or bulk carrier operators.

Furthermore, engaging in the development of autonomous solutions may be more lucrative in other industries than marine, as the volumes of newbuilding projects have fallen and are significantly smaller in comparison:

"If you think about the volumes in the marine industry, that newbuildings are made on average about 2000-3000 a year in the world. Then compare that to cars where hundreds of millions or at least tens of millions are made every year. So developing some technology is reasonably more preferable elsewhere than here [the marine industry]."

As a result, the marine industry could be considered to be competing for knowledgeable suppliers against other industries, which are also perhaps more advanced in their steps towards autonomy and thus, commercialisation.

Conservative nature of the industry

The conservative nature of the industry in terms of adapting new technologies was also often mentioned as a barrier for new players to engage in innovation:

"It's difficult to enter the industry as a new player because it requires a lot of investment to get all the equipment approved to be able to bring them on a ship. It's a very conservative industry, so before you have established a name and trust on the customer side, it takes a long time."

A prevailing "one ship" mentality in the marine industry also came up during the interviews as a problem for technology suppliers, as it does not allow solutions to be scaled for a larger number of vessels, which further complicates maintenance services.

"They're always swearing at Wärtsilä that if the same D6 machine is ordered from them, the ship is never the same. On the shore side [power management] if they deliver it, they can deliver 100 units of the same machine. For shipping if they deliver it for 100 ships they can be happy if two of them are the same. All of them have some small change in them, and this is the problem in the marine industry."

If the same one-ship mentality carries on to the autonomous ship market, the problem was deemed to manifest itself as operational issues for the end customer.

"If you have this remote control center, and then you have a Rolls-Royce ship, and a Wärtsilä ship, and any other third party ship, then how can one control center operate all of them? Then when there are multiple types of ships, if all the big ones Rolls, Wärtsilä, ABB, Siemens, want their own ship ecosystem, and you have a customer who has one Siemens and one Rolls [ship], how do you bring them together? So if you have remote conrolled ships from multiple different suppliers, how do you handle all of them? It's like having an IT department and they have to be able to handle all the Androids, Nokias and Apples."

Prevailing regulatory environment

The current regulatory environment was seen as an obstacle for developing new solutions in particular around remote control. While remote control was recognised as an area with high potential for rethinking operations without much competition, the reason for low levels of competition in this area came down to regulations, e.g. the Safety of Life at Sea regulating the watchkeeping practices that could otherwise be automated.
Furthermore, issues with liability in the event of an accident were brought up many times during the interviews. From a commercial point of view, suppliers expressed worry over the possible insurance costs of an autonomous ship:

"It's just a question of what the price of insurance will be, and this is one possible thing that can bring down the whole interest in this. So if we have to take out an insurance worth a million for a sale that's worth a million, then the price for the customer will be two million."

Therefore, leaping into the business of autonomous shipping would require certainty of the insurers' willingness to cooperate, which was seen as a major problem for commercialisation.

"The insurance business, marine insurance, isn't regulated by any national or international law, but it's the insurance company's own terms and conditions. It's the perfect obstacle for

commercialisation. An insurance company could just come and say, we're not going to give you insurance unless you do this or this."

DISCUSSION

Relationships and networks of market innovation for autonomous shipping

The purpose of this study was to further understanding on the issue of how new needs and more widely new markets evolve and are created for the new technology. This section conceptualizes the key findings into an integrative framework that provides guidelines for further research. The interviews revealed that from a business perspective the innovation drivers of actors varied from opportunities for new applications in the short term to occupying a central role in the autonomous shipping ecosystem in the long term. Thus, autonomous shipping can be considered as an umbrella concept comprising various levels. Respectively, autonomous shipping business emerges as a result of innovation on different contextual levels: *1. strategic relationships for new solutions, 2. new local networks for technology platforms, and 3. global networks for new markets.* Figure 3 describes these levels in the form of circular block arrows that comprise a mutually feeding loop between the marine ecosystem and other relevant ecosystems exploring autonomous systems development (e.g. automotive and aviation). Altogether these ecosystems comprise an innovation ecosystem for autonomous technologies; a set of actors, resources and activities that feed the autonomous solutions and business, particularly in this case autonomous shipping, to emerge. Another dimension in the framework is comprised of the horizontal dimension of time in term of past, present and future. The grey rotating arrows in the framework demonstrate the interconnectedness between the past, present and future. In other words, the past shapes the present, the present shapes the future, the future – in terms of expectations – shapes the present, and the present shapes how we perceive and interpret the past (cf. Giddens, 1984). This non-linear perception of time is captured by the circular form of the framework, in which the circular notion of time penetrates and holds sway over the contextual levels.

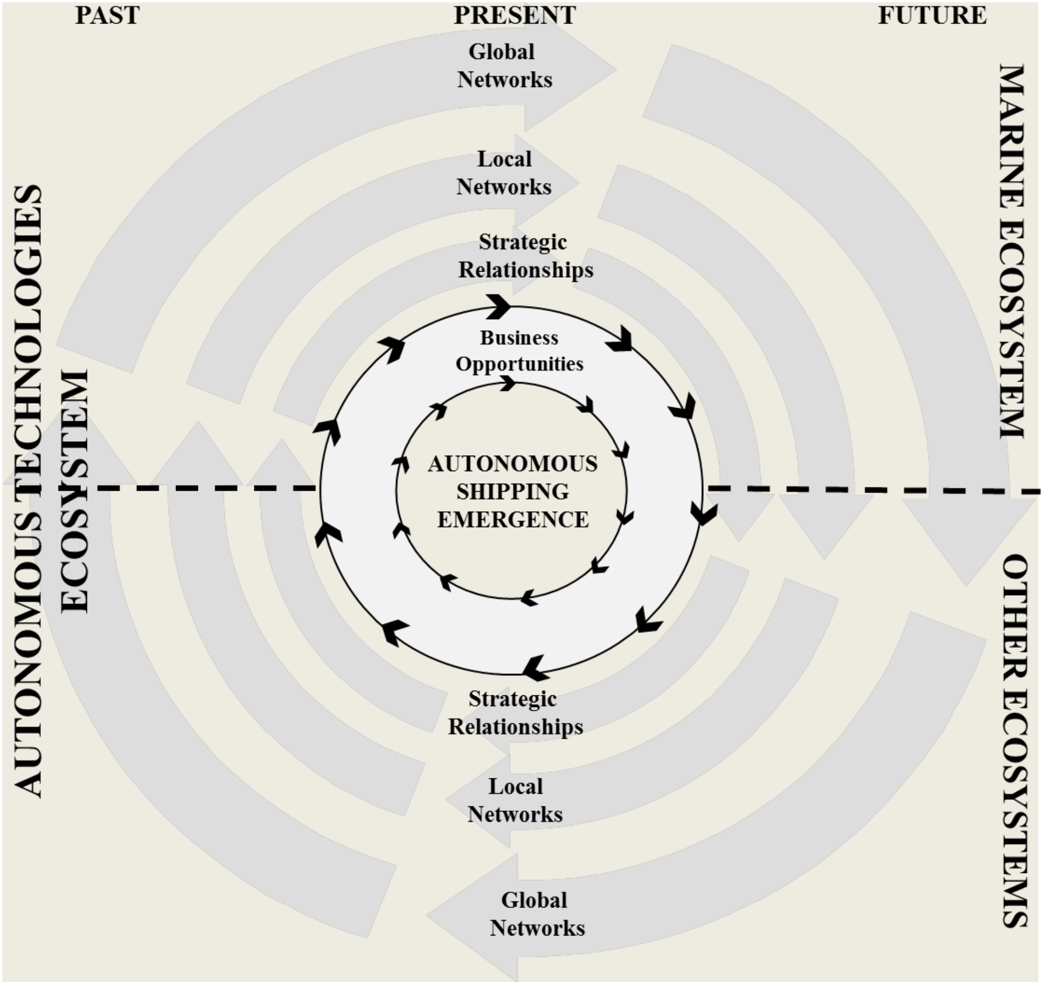

Figure 3 Autonomous shipping business as a multi-level phenomenon

Currently, the development of suitable technologies for autonomous shipping takes place largely in *strategic relationships*. In other words, business actors develop *solutions* to serve their current business in their key relationships within the current socio-technical regime. This is exemplified by a satellite communications firm working with current suppliers and customers to achieve safer communication links, and a video technology firm working with algorithm specialists to develop the computational power of video cameras. The development of these solutions may or may not be driven by the concept of autonomous shipping, but they nevertheless propose value to some actors in the ecosystem. Moreover, this type of development features building blocks into the concept of autonomous shipping.

Secondly, *local networks* exist in which actors collaborate to intentionally build the concept of autonomous shipping, as exemplified by development networks AAWA, MUNIN and MARS. These local networks have truly begun to question the current socio-technical regime and the institutionalized solution around which the industry players have organized themselves, in this case a manned ship i.e. a ship being controlled onboard. Before engaging in systemic innovation within local networks, the actors have been involved in maintaining the institutionalised solution, and are now involved in disrupting it. These local networks aim at developing the new dominant form, a *technology platform*, on which future development can take place. While the actors in a local network may have expectations for short-term returns, autonomous shipping truly becomes a driving force for innovation in local networks. It is for this reason that local networks need to give careful thought to the value propositions of the concept of autonomous shipping to actors outside of the local network. It is only when other actors in the ecosystem accept those propositions that the development of autonomous shipping becomes a matter of increased value instead of a feat of engineering.

Finally, it is likely that the local networks, i.e. hot spots of autonomous shipping, gradually gain momentum and scale to generate *global networks* engaged in the development and operation of autonomous shipping as a *new market*. It is in these global networks that autonomous shipping eventually evolves into the new dominant form (Lusch et al. 2010), i.e. market innovation occurs. Furthermore, as global networks emerge, more and more actors engage in the socio-technical transition efforts reconfiguring the ecosystem. This implies that actors on different levels of context are accepting the value propositions that autonomous shipping represents within the ecosystem: on the micro level, seafarers believe that their working conditions are improved, on the meso level, marine industry players see cost, efficiency and safety gains, and on the macro level, the society benefits from lowered emissions. For a dominant form to take place, it must deliver on these value propositions.

Similar development is identifiable in other relevant industries. For example, the automotive industry has for a long time developed technologies (e.g. cameras, radar, ultra-sonic sensors), that form the basis for intentional activities to develop and launch autonomous driving platforms, such as those of Google and Tesla. These currently represent local networks but are transforming towards global networks not only comprising development, but also production and use of commercially viable applications. It should be recognised that as global networks expand, more actors will be able to bring their resources to the table. That is, even after the design and production of a self-driving car or an autonomous ship, new capabilities can be added to them due to their digital nature. In this sense, the once produced tools are never really complete, showcasing the emergent nature of market innovation. Furthermore, in addition to the available technologies directly relevant for autonomous shipping, new technologies develop and technological potential materialises in applications that serve the emergence of autonomous shipping, as demonstrated by e.g. the development of drone aircraft and semiconductors. Vice versa, innovation taking place under the umbrella of autonomous shipping also feeds further innovation in other technology areas, such as simulators for crew education. This showcases the overlapping nature of different ecosystems (Vargo & Lusch 2015).

The model in Figure 3 exhibits how the technologies of autonomous shipping interplay with the business of autonomous shipping: the technological innovations and the dawn of the new concept of autonomous shipping motivates the actors to develop new business models and further, new business models with intentional activities to generate commercially viable applications feed the technologies to develop. For local networks to evolve, the key point in development would be creating credibility through successful implementation to attract potential technology suppliers to generate technologies with which to benefit from this rising business area and harvest its potential in economic terms. It is imperative to realise that as the technologies take new forms and functions, businesses cannot assume that business models could remain static during this change. Respectively, business models should reflect the new roles and responsibilities that actors wish to occupy in the transforming socio-technical regime.

The notion of need-solution coupling for the study of market innovation of autonomous shipping

To conceptualize an analytical perspective on innovation process that corresponds with the defined levels and an idea of market innovation as an emergent entity, we conceptualize innovation as a match between needs and solutions (see e.g. Nyström, 1990; Mowery & Rosenberg, 1979; Howells, 1997; Lynn et al., 1996), and perceive the market innovation process as an emergent coupling process between the two. The model depicted in Figure 4 describes the coupling process and the three levels of innovation as its results.

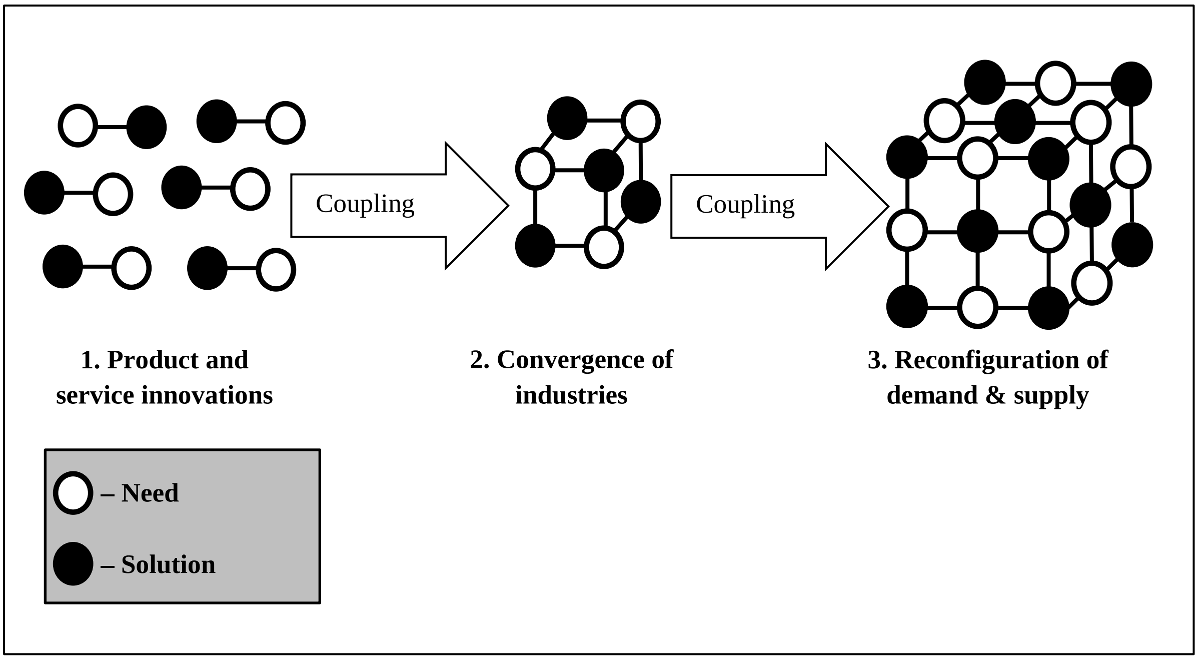

Figure 4. Market innovation process as need-solution coupling

The three levels of innovation are described in terms of needs and the related solutions. On the level of product and service innovation, products and services represent solutions to needs. The need-solution couplings on the left side of the model feature solutions that tackle respective needs. The center and the right side of the model describe interlinked need-solution couplings. The idea here is that single need-solution couplings couple into larger entities representing convergence of industries as well as reconfiguration of demand and supply. For example, if a shoe company believes its shoes are suitable for walking on the moon and aims for a mass market regarding space tourism, it is likely that the realization of this market innovation requires various other needs and technologies (representing variant industries) to match and form a mass space tourism market. Similarly, a broad diffusion of electric cars requires the development of a dense network of charging stations and maintenance services for this type of car. Both these examples represent the convergence of industries as well as reconfiguration of demand and supply.

An integrative framework of market innovation of autonomous shipping

This article describes autonomous shipping as an emergent phenomenon of market innovation. In this context the managerial activities are less rigid and clear-cut activities of steering, but feature reflexive actions to facilitate the development in this relational and systemic context of various levels and actors of variant type. The model depicted in Figure 5 adopts this mindset of management in synthesizing the results of this article. The idea here is that the concept of autonomous shipping and its related business develops gradually in phases from simpler towards more complex entities. The innovation funnel in the center of the model describes this development.

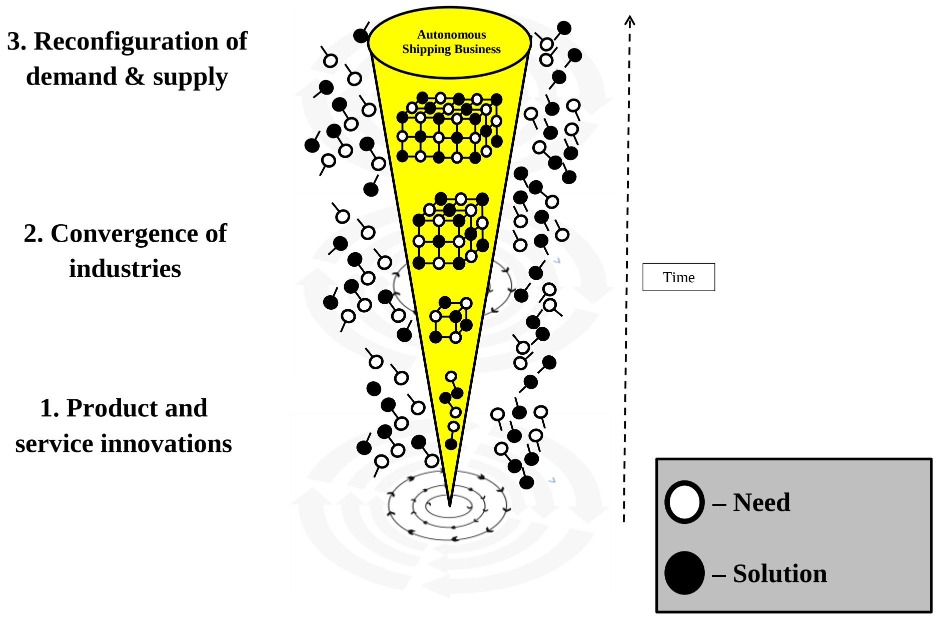

Figure 5. An integrative framework of autonomous shipping as a market innovation

Currently, the development of the concept is largely based on existing solutions that are identified and tested whether they meet the needs of the developing concept. Thus to some extent the autonomous shipping as a market innovation locates on the bottom of the innovation funnel at the moment. Gradually the solutions are to be integrated towards more systemic entities of interlinked need-solution couplings described in the funnel. This happens as a result of intentional development activities and identification of relevant technologies within the marine industry and other relevant industries (automotive, aviation). It is likely that as a result of the development and achievements made in maritime and other relevant industries, the general awareness of autonomous shipping rises and attracts potential technologies and technology suppliers to join the development.

CONCLUSIONS

Autonomous shipping is at its infancy. This study has shed light on the early steps of market innovation that are being taken towards autonomous shipping becoming a reality, and suggests how market innovation is likely to evolve within ecosystems as innovation in autonomous technologies continues. The presented case brings forward a number of interesting avenues for future research. First, the case illustrates how the knowledge of increasingly heterogeneous actors are needed in market innovation to be able to develop offerings that are truly valuable for a number of system actors. This creates complexity in the innovation context, which bears a number of risks, not least due to the involvement of digital technologies. As one of the interviewed automotive representatives noted, the involvement of software is likely to cause more errors in the functioning of a car than the hardware. Due to the number of participating actors, these errors can potentially scale to systemic failures. Moreover, risks are also related to the way humans may rely too heavily on autonomous systems. These types of situations are only likely to increase as people become more and more accustomed to digital technologies, not understanding their possible shortcomings. Actors engaged in digital innovation are also likely to face risks regarding intellectual property rights and brand equity, in particular when it comes to local networks. Actors within local networks face a situation where balance is needed between trust and control. To what extent can and will partners open their intellectual assets for mutual benefit? Future research could explore how actors share and manage these new forms of risk in market innovation.

Second, the findings indicate that actors involved in digital innovation are having to reconsider the roles that they will possess in the transforming socio-technical regime, and will need to adjust their business models accordingly. Thus, research would benefit from empirical knowledge derived from longitudinal studies observing the business model transitions and their alignment between multiple actors involved in a specific socio-technical regime. Researchers could utilise participative methods such as ethnography or action research to truly capture reality as it occurs, and be able to illustrate how the business models of multiple actors inter-twine and shape a fully functioning socio-technical regime where overall benefit is reached and sustained. In the same stream, it would be particularly interesting to shed light on situations where changes occur in the relative power positions between actors in a socio-technical regime, and how this influences the relationships between the actors. As digital innovation and the possibly resulting market innovation increasingly necessitates deep cooperation, the business landscape may see more powerful consortiums, rather than powerful individual organisations.

Third, building on the holistic framework in figure 5, and following Geels and Schot (2007), researchers could systematically map the regulative, normative and cognitive institutions that enable and hinder resource integration between actors in strategic relationships, local networks and global networks related to market innovation. Using both qualitative and quantitative methods would allow for deeper understanding of the relative power of the different types of institutions influencing market innovation and the related socio-technical changes on different levels of interaction. This type of research would benefit from multi-disciplinary perspectives incorporating views from e.g. economics, law, sociology and political science, and would require a wide sample of stakeholders.

REFERENCES

Abernathy, W. J. & Clark, K. B. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy,* 14(1), 3-22.

Abrahamsen, M. H., Henneberg, S. C., Huemer, L., & Naudé, P. (2016) Network picturing: An action research study of strategizing in business networks. Industrial Marketing Management. In press: doi:http://dx.doi.org/10.1016/j.indmarman.2016.02.006

Anderson, J. C., Håkansson, H., & Johanson, J. (1994) Dyadic business relationships within a busi-ness network context. Journal of Marketing, 58(1), 1–15.

Ansoff, I. (1957). *Strategies for diversification*. Harvard Business Review, 35(5), 113-124.

Araujo, L., Kjellberg, H., & Spencer, R. (2008). Market practices and forms: introduction to the special issue. *Marketing Theory*, 8(1), 5-14.

Arthur, W.B. (2009) *The Nature of Technology: What It Is and How It Evolves*, New York: Free Press.

Azimont, F., & Araujo, L. (2007). Category reviews as market shaping events. *Industrial Marketing Management*, 36(7), 849-860.

Baraldi, E., Brennan, R., Harrison, D., Tunisini, A., & Zolkiewski, J. (2007). Strategic thinking and the IMP approach: A comparative analysis. Industrial Marketing Management, 36(7), 879-894.

Baraldi, E., Brennan, R., Harrison, D., Tunisini, A., Zolkiewski, J. (2007) Strategic thinking and the IMP approach: A comparative analysis. Industrial Marketing Management, 36(7), 879-894.

Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision*, 47(8), 1323-1339.

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., & Rickne, A. (2008). Analyzing the functional dynamics of technological innovation systems: a scheme of analysis. *Research Policy*, 37, 407-429.

Callon, M. (1998). Introduction: The embeddedness of economic markets in economics. In M. Callon (Eds.), *The laws of the markets* (pp. 1-57) Oxford: Sociological Review and Blackwell Publishers.

Callon, M., & Muniesa, F. (2005). Economic markets as calculative collective devices. *Organization Studies*, 26(8), 1229-1250.

Eisenhardt, K.M. (1989) Building Theories from Case Study Research. *Academy of Management Review*, Vol. 14 (4), 532-550.

Elzen, B., Geels, F.W., & Green, K. (Eds.) (2004). *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*. Edward Elgar: Cheltenham.

Floersch, J., Longhofer, J.L., Kranke, D., Townsend, L. (2010) Integrating Thematic, Grounded Theory and Narrative Analysis. A Case Study of Adolescent Psychotropic Treatment. *Qualitative Social Work*, Vol. 9 (3), 407-425.

Gadde, L.-E., Huemer, L., & Håkansson, H. (2003). Strategizing in industrial networks. Industrial Marketing Management, 32(5), 357-365.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: construct development of innovation locus, type, and characteristics. *Management Science*, 48(9), 1103-1122.

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy,* 31(8/9), 1257-1274.

Geels, F.W. & Schot (2007) Typology of sociotechnical transition pathways. Research Policy, 36 (3), 399-417.

Geels, F.W. (2005). The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management,* 17(4), 445-476.

Genus, A., & Coles, A. M. (2008). Rethinking the multi-level perspective of technological transitions. *Research Policy*, 37, 1436-1445.

Giddens, A. (1984) *The constitution of society. Outline of the theory of structuration*. Polity Press, Cambridge.

Håkansson, H. & Ford. D. (2002) How should companies interact in business networks? Journal of Business Research, 55(2), 133-139

Håkansson, H., & Snehota, I. (1995) Developing business relationships. London: Routledge.

Howells, J. (1997). Rethinking the market-technology relationship for innovation. *Research Policy,* 25(8), 1209-1219.

Johne, A. (1999). Successful market innovation. *European Journal of Innovation Management*, 2(1), 6-11.

Kjellberg, H., & Helgesson, C-F. (2007). The mode of exchange and shaping of markets: distributor influence on the Swedish post-war food industry. *Industrial Marketing Management*, 36(7), 861-878.

Kotler, P., & Levy, S. J. (1969). Broadening the concept of marketing. *Journal of Marketing,* 33(1), 10-15.

Levitt, T. (1960). Growth and profits through planned marketing innovation. *Journal of Marketing*, 24(4), 1-8.

Lincoln, Y.S. & Guba, E.G. (1985) *Naturalistic Inquiry*. Sage Publications: Beverly Hills, California.

Liu, X., & White, S. (2001). Comparing innovation systems: a framework and application to China’s transitional context. *Research Policy,* 30(7), 1091-1114.

Loorbach, D. (2007). Transition Management - New mode of governance for sustainable development. (Doctoral Dissertation, Erasmus Universiteit Rotterdam)

Lynn, G. S., Morone, J. G., & Paulson, A. S. (1996). Marketing and discontinuous innovation: the probe and learn process. California Management Review, 38(3).

Makkonen, H., Aarikka-Stenroos, L., Olkkonen, R. (2012) Narrative approach in business network process research – Implications for theory and methodology. *Industrial Marketing Management*, Vol. 41 (2), 287-299.

Markard, J., & Truffer, B. (2008). Technological innovation systems and the multi-level perspective: Towards an integrated framework. *Research Policy*, 37, 596-615.

McCarthy, E. J. (1960). *Basic Marketing*. Irwin: Homewood, IL.

McDermott, C. M., & O’Connor, G. C. (2002). Managing radical innovation: an overview of emergent strategy issues. *Journal of product innovation management*. 19(6), 424-438.

Miles, M. B. & Huberman, A. M. (1994) *Qualitative Data Analysis: An Expanded Sourcebook*. 2nd ed. Sage publications, Thousand Oaks, CA.

Möller, K. & Rajala, A. (2007) Rise of strategic nets — New modes of value creation. Industrial Marketing Management, 36(7), 895-908

Mowery, D., & Rosenberg, N. (1979). The influence of market demand upon innovation: a critical review of some recent empirical studies. *Research Policy,* 8(2), 102-153.

Naidoo, V. (2010). Firm survival through a crisis: The influence of market orientation, marketing innovation and business strategy. *Industrial Marketing Management,* 39, 1311-1320.

Nenonen, S., & Storbacka, K. (2012). Competitive arena mapping: market innovation using morphological analysis. *Journal of business-to-business marketing*, 19(3), 183-215.

Nyström, H. (1990). *Technological and market innovation. Strategies for product and company development.* Chichester: John Wiley & Sons.

Perez, C., (2002). *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Edward Elgar: Cheltenham.
Woodside, A.G. & Wilson, E.J. (2003) Case study research methods for theory building. *Journal of Business and Industrial Marketing,* Vol. 16 (6/7), 493-508.
Yin, R.K. (1981) The Case Study Crisis: Some Answers. *Administrative Science Quarterly*, Vol. 26 (1), 8-66.
Zhou, K. Z., Yim, C. K., & Tse, D. K. (2005). The effects of strategic orientations on technology- and market-based breakthrough innovations. *Journal of Marketing*, 69, 42-60.