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To lead or to follow:

Translating innovative technologies as a result of industrial fashion

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Abstract

As the technologies included in the concept of 'Industry 4.0' have been hailed as to be ushering in a fourth industrial revolution, corporations within the industrial sector strive to adopt innovative information technology (IT) systems in order to maintain a sustainable competitive advantage – or to avoid redundancy. In this article, we analyse how the idea of implementing an innovative technology managed to travel through time and space, from a German industrial exhibition to an educational department within a Swedish multinational corporation (MNC). Utilizing a framework based on Scandinavian institutionalism and actor network theory (ANT), we demonstrate how firms come to adopt technologies as a result of social networking processes and organizational fashion. Furthermore, we find that the successful implementation of an idea within a MNC involves active institutional entrepreneurship and careful navigation of the initial problematization phase. In doing so, we contribute to the literature of the translation of innovation and provide practical insight regarding how firms may approach innovation which spreads as a result of organizational fashion. Finally, we point out the importance of a successful knowledge management program for both successful and failed innovation projects.

Keywords

Actor network theory, translation, innovation, organizational fashion, problematization, Industry 4.0

Introduction

Despite the importance and documented benefits of implementing innovative IT systems, studies have shown that close to half of all IT-system implementations fail (Brynjolfsson & Hitt, 2000; Lyytinen & Hirschheim, 1987; Fortune & Peters, 2005). Managing technological change projects involve a great deal of ambiguity as defining clear plans or goals are difficult since the interaction between human beings and the technology is at the mercy of interpretative flexibility (Orlikowski, 1992), technology drift (Holmström, & Stalder (2001) and unintended consequences (Waring & Skoumpopoulou, 2013; Smyth, Kerr & Phillips, 2015). Nevertheless,

numerous projects are continuously undertaken by firms who seek to improve their product offerings or to streamline their operations by integrating new technologies, yielding an uncertain environment where organisations strive to develop a sustainable competitive advantage by innovating, while simultaneously wanting to remain in sync with existing industry practices, resulting in a strange interplay of conformism and innovation (Czarniawska and Sevón, 1996; Esposito, 2011). This is especially true for large national or multinational organisations who are seen as leaders of their fields. The operations of these organizations are not merely a result of (and judged by) industry practices, but of society as a whole (Czarniawska & Sevón, 1996).

As such, while organizations are independent entities, they are also part of institutional environments where there are socially legitimized norms regarding what constitutes a progressive or modern organization. These ideas are applicable to both management and IT systems/practices, where both management and information system are subject to 'hype', instilling a transitionary belief that a certain technique or technology will lead to rational management/process progress (Baskerville & Myers, 2009). Companies are also subject to a broader societal judgement of how well they comply with modern trends or standards, which adds to brand value and attractiveness (Czarniawska & Sevón, 1996). These aspects give further understanding to the reasoning underlying the dichotomy of chasing innovative technologies to maintain legitimacy, all the while adhering to established industry practices, adding to the complexity of successfully managing innovation.

The introduction of technological innovations within industrial practices is a cyclical process, and the standards that eventually become institutionalized within an industry undergo a lengthy procedure from inception to legitimization, and finally towards adoption. With the increasing capabilities of current technological innovations, the 'fashion' within production and information technology industries have been technologies that are included in the notion of *Industry 4.0* (Willmott, 2017; Geissbauer, Vedso & Schrauf, S 2016; Staahl, 2017). Industry 4.0 is generally defined as including technologies such as *autonomous robots, simulation, system integration, the internet of things*, *cybersecurity, cloud computing, additive manufacturing, augmented reality,* and *big data*. In the industrial world, the concept mainly revolves around the concept of 'smart factories', in which the physical processes of the machinery are monitored by cyber-physical systems, which in turn makes decentralized decisions based on data inputs. As such, the machinery itself communicates with other machines and humans simultaneously in real time. Despite the widespread acceptance regarding the importance of the technologies included in the concept Industry 4.0, few practical applications have become industrialized. This implies that the concept has come to be widespread and seen as a key strategic initiative, and that the term has already become institutionalized within the industrial sector, despite the lack of practical applications which gradually evolve into established industry practices.

In their survey of case studies of small and medium enterprises (SMEs) and their adoption of Industry 4.0 technologies Moeuf, Pellerin, Lamouri, Tamayo-Giraldo and Barbaray (2017) found that most of the technologies were under-utilised, if not ignored, and that the least revolutionary technologies (and the least resource-dependent) were those who were adopted. Adopting these processes were seen as possibilities to synchronize and to connect product flows with business partners, yet adoption strategies were unclear. On the other end of the

spectrum, the way in which MNCs, who have the ability to invest in more resource-dependent technologies, act when implementing the technologies tend to be opaque due to the innovative nature of the applications. Previous research on Industry 4.0 technology applications mainly involve literature reviews (Liao, Deschamps, Loures & Ramos, 2017; Xu, Xu, Eric & Ling, 2018), frameworks for underlying factors in successful adoption strategies (Lin, Lee, Lau & Yang, 2018) or detailed technical applications, and few case studies have been provided regarding how managers and agents attempt to implement one of the technologies within their context - especially within the context of professional competence development.

In this article, we study the case of a MNC attempting to adopt one of the technologies (augmented and virtual reality (AR/VR)) in the context of a specific department. The department is newly formed and revolves around educational practices for employees. As there have been a number of empirical accounts of the benefits of children's education, as well as for specific work groups by use of the technology (Lee, Wong and Fung, 2010; Rieber, 1996), the department has undertaken a project attempting to integrate the technology into their everyday practices. The project has, however, come to a standstill as stakeholders are uncertain of whether the introduction of the technology in their department, in this moment in time, provides value to the organization. As the technologies manage to allure organizational actors into adoption despite a clearly defined use case, our first aim with this article is to investigate how innovative technologies or concepts, such as Industry 4.0, come to carry such a 'hype' and fashionability - and how they retain the attention of MNCs. The attention and sense of urgency is also ambiguous as local adoption strategies or value generation may be unclear. This leads us to our second aim, relating to how or why ideas are adopted in local contexts, and what implications the first adoptions may have for the development of the technology within the local context. Our research contributes to the literature on Industry 4.0 and the adoption of technological innovation by providing a detailed empirical account of the dynamics involved when innovative technologies are translated by a MNC. In addition to theoretical contributions, practical implications for managers and organizations involve how they may approach technological innovations, as well as the importance of knowledge management of failed implementations.

This article is structured as follows: first off, previous research which tackles the introduction of innovative technologies are presented, followed by a theoretical overview of concepts within ANT and translation theory. Following the theoretical overview, a background of the case company is provided, as well as the methodology of how data was collected and analysed. The empirical findings are described in a chronological narrative, ranging from the conception of the idea to introduce the innovative technology within the context of the firm to the current iteration of the idea. Following the empirical account, our discussion analyses the outcomes through the lens of ANT and the travel of ideas-framework, as well as providing a reflection upon the factors and occurrences which had a defining impact on the development of the idea - and what implications this may hold for the future. Finally, suggestions for future research are provided.

Previous Research

As part of the information age, disruptive technological innovations continuously supersede established systems and contemporary media generously report on successful ventures who

become ingrained in society. In management literature, the process of innovation has generally been described through two schools of thought. The diffusion perspective, which is most commonly known through the technology 'S' curve (Rogers, 2003), illustrating innovation as a set pattern of behaviour which different actors follow (and can be retraced in all *successful* innovation processes), and that said behaviour is paramount in shaping how innovations travel or how organizational change unfolds. This perspective has, however, been criticized in its simplification of the dynamics of innovation - when describing a process, a stepwise model simply illustrates static instances in time, rather than the ongoing process of innovation (Czarniawska & Sevon, 2005).

Stemming from a proximal approach of organizations, in that they are *'mediating networks, as circuits of continuous contact and motion*' (Cooper and Law, 1995), Latour (1992), illustrates how innovations can be analysed through a structural perspective in the effect it had on society at large - but also that prior to its successful adoption, the innovation process was highly flexible and a result of continuous negotiation practices. Latour (1992) argues that the success of an innovation is reliant on he successful retaining of actants and navigation of competitors' 'anti-programs'. This reasoning formulated the basis for as actor-network theory (ANT), wherein Latour describes the establishment of an actor-network as a result of a successful formation and stabilizations of a networks of actors by means of translation, defined by Latour (1986) as *'the spread in time and space of anything – claims, orders, artefacts, goods – is in the hands of people; each of these people may act in many different ways, letting the token drop, or modifying it, or deflecting it, or betraying it, or adding to it, or appropriating it'*. Actor network theory also introduces the concept of generalized symmetry; of equal treatment of human and non-human actors. All of the entities involved in the network are described in the same terms, and eventual differences are generated in the network of relations (Callon, 1986).

As such, actor network theory can be aptly used in order to study the field of innovations, particularly in the case of technological innovations as it often involves the interaction between technology and human actors. Since *a priori* assumptions are minimized, the token is not seen as inherently 'good' or 'bad' in itself, and the establishment of a stabilized network surrounding the token is dependent on the fact that the involved actors deem it worthy of constructing and defending. Using an actor network theory-framework also acknowledges and illustrates the innovation as a process in all its grit, happenstance and social interactions.

Utilizing actor network theory, Latour (1996) illustrates the failed implementation of a Aramis, a new personal rapid transit system in Paris, through a quasi-mystery novel. In line with the concept of generalized symmetry, voices of both human actors and the system itself are heard in the text. The eventual failure of the Aramis project/technology is described not as a result of an individual actor, but that the network fails to dynamically adapt to changing situations. Through the use of the process of translation-framework to describe the spread of an innovative technological application within the field of telemedicine in northern rural Italy, Nicolini (2010) discusses that it loosely involves three different steps; the separation of the idea/technology from its original context, the idea becoming re-translated into a new context, and finally becoming standardized and institutionalized. In the report, he also states that translation is the result of active work of intermediaries and mediators which carry meaning and interest, as well as cementing relationships, and that translation, as the word

implies, signals a shift in meaning when objects travel through different contexts. As the process towards implementation is followed, it is made clear that the circulation and spread of medical innovation requires the building of alliances between various actors including individuals, groups, institutions, as well as machines. Based on his empirical findings, he concludes that translation is an inherently political process, as establishing ideas and practices involves pursuing specific interests and the management of different power relationships, which in turn produces reactions, resistance and novel interpretations. These thoughts are shared by Pohl, Styhre and Elmquist (2009) as they argue for a view of innovation processes where one of the main goals of the actors is to mobilise support and interest from other actors involved in the network. Sarker et.al (2006) and Akrich et.al (2002) describes the process of 'interessement' which was coined by (Callon, 1986) as a key to innovation. They describe it as a process where leading actors will negotiate and convince other actors that their idea also aligns with their interests, and that supporting the interests of the leading actor will, in turn, be to the benefit of the other actors in the network.

Contrasting the highly network-focused translation framework employed by ANT researchers are studies on innovation through the lens of institutional entrepreneurship, which has a more prominent emphasis on the influence of individual actors. As described by Hardy and Maguire (2008), some organisational members have the ability to change the institutions they operate with/within by understanding the processes which shape it and can use it to their advantage. Furthermore, the framework highlights that the actions within the environment in which specific actors operate has the ability to influence innovation and the creation of new ideas - and that actors within these environments who have the attention and understanding can perceive patterns which may constitute shifts in the institutional landscape, and how these changes may impact their local context. In doing so, and if acted upon, they can contribute to the prevalence of organizational change (Lamine et.al, 2017; Hardy and Maguire, 2008).

Theoretical framework

The travel of ideas - a process of translation

Czarniawska & Sevón (1996) refer to the travel of ideas as a framework to make sense of organizational change (such as innovation, or mimicking best practices), illustrated through a chronological narrative of how ideas turn into actions in new localities - and in doing so, answering the question of how local actions emerge, and institutionalization in a larger, global, context unfolds. Earlier streams of research on organizational change include the 'strategic choice' models and contingency-theory/institutional theory-approaches. The authors argue that these models are frequently contradicted by organizational practices, resulting in 'unintended consequences' and 'unexpected results, which often fail to be addressed. As such, they introduce the materialization of ideas, stating that '*out of the myriad of ideas introduced to an organization, certain ideas catch on and are subsequently translated into substance in a given organization, often barely touching the bureaucratic apparatus of planned change'* (ibid). - and that it is common that similar ideas materialize in organizations who are operating within the same type of fields at the same instances in time.

The concept of 'an idea' stems from the greek word *ἰδέα*, "to see", originally relating to forms or patterns. As such, it involves optical stimuli as well as mental analysis.

Czarniawska & Sevón (1996) utilize the working definition of ideas as *images who become known in the form of pictures or sounds*. Once an abstract form has been selected, the idea can be materialized into physical images, in writing, or in objects. Once an ide has become materialized, it can also travel from a local to a global time-space. By retracing the origins of the idea, one can analyse how, at a given moment, individuals or groups notice and apply the idea. More often than not, the idea has become dis- and re-embedded in a Gidden-esque fashion through a slew of localities. If the idea is seen as beneficial and spreads, it can become institutionalized; a well-established and structured pattern of behavior or of relationship that is accepted as a fundamental part of a culture.

To illustrate the travel of ideas, they utilize Latour's (1986) notion of translation, iterating that the spread of any token (idea, practice or goods) is at the mercy of people and their actions. Individuals can reiterate, modify or discard ideas - and as an idea is generated through optical and mental stimuli, different individuals can ascribe different meanings to the same phenomena - translating objects or quasi-objects differently, depending on their experiences, mental frameworks or contexts. Figure 1 illustrates the framework through the narrative of an idea originating in a local time and space A, can travel and reach a distant local time and space, B.

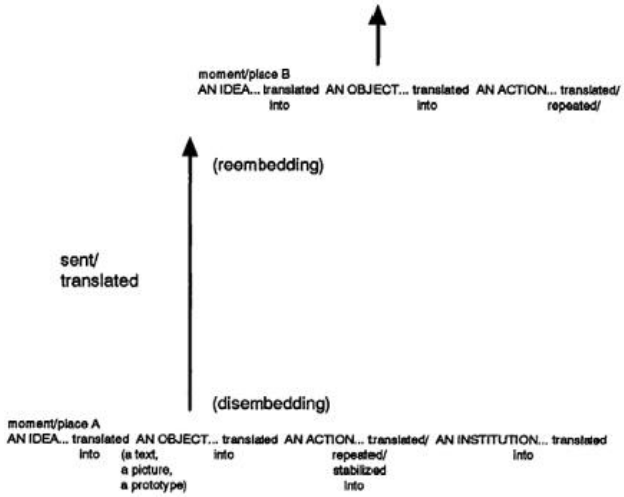

Figure 1: The process of translation (Czarniawska and Sevón, 1996 p.26).

The process starts with an idea which takes root in a local context. In order to further the idea in a way that it makes sense to others, it must be transformed, or translated, into a quasi-object or object. Once the idea has become objectified and other people are persuaded that the idea is beneficial, and the ideas manifests as actions within organizations. If these actions generate beneficial results and become locally validated, they can be translated into lasting institutions. Ideas who have been enacted and materialized can travel, yet local verification in the form of institutionalization often perpetuate that the idea is something worth defending - and increases the possibility of the idea-become-material to become noticed in a distant context. Once the idea has travelled and become noticed, it must once again subjected to a slew of translations in order to evolve from an idea to an object, from object to action, and possibly towards a lasting institution. As the spread of an idea relates to an individual's or a group's perception of it - not in the attributes of the idea itself - the spread is greatly reliant on how well proponents can

convince other actors that the idea is beneficial; a political process of negotiation and fashion waves.

Organizational fashion

Czarniawska & Sevón (1996) describes fashion as a phenomenon in which people come to understand what is superior, and what can be imitated - and for managers, a way of introducing order and legitimacy in uncertain times with overwhelming possibilities. Furthermore, they describe the notion of fashion as an integral part of the spread or translation of an idea or technology, both in aesthetic and technical aspects, since fashion is a phenomenon that can explain how ideas and objects can travel in time and space. Furthermore, they elaborate that the social process of fashion requires different types of actors - most notably 'fashion leaders/setters' (those who pioneer the translation of innovative techniques into practice) and 'fashion followers' (those who engage in the discourse of legitimating the practices). As such, this is a dynamic relationship where those who create the fashion cannot necessarily legitimize them within an industry by themselves. Esposito (2011) also notices this trend, describing it it as 'originality through imitation'.

Hertwig (2012), in his study of the German automotive industry, describes the relationship as particularly ambiguous in the automotive industry, as many competing brands have shared ownership and are part of established networks with longstanding alliances. In the study, he debates the forces at play regarding the adoption of IT systems, ranging from market pressures that steer companies towards looking for ways to increase their efficiency, political processes within the automotive industry, as well as the companies being embedded in an institutional environment where normative expectations play a big role on technology adoption. He reinforces the notion of normative institutional pressures (DiMaggio & Powell, 1983) within the industry, and that individuals who receive similar training, or who are members of the same profession and trade associations tend to develop shared views of new technology or methods, which influence the industry as a whole. These ideas are often spread through gatherings of different kinds - exhibitions, workshops, or fairs. Blumer (1969) observed this phenomenon when studying the clothing industry, concluding that Paris fashions were created as a result of the interaction of a number of buyers at the annual fashion shows and exhibitions, who then jointly created the fashion through a social process. Hertwig (2012) further states that it is difficult for firms to 'protect' against these types of influences, as it is the result of the views of employees and managers - who in turn are influenced by other actors (consultants, trade associations, similar academic backgrounds, values, etc.) and society. As such, a general pattern can be found in that influential actors in the organizational field spread fashion, ideas and practices which are adopted by other actors seeking rationale and legitimacy - fashion 'leaders' and fashion 'followers'.

On problematization, interessement and obligatory passage points

Czarniawska & Sevón (1996) describe the notion of an idea whose 'time has come' as a result of which it has passed through a number of translations and passage points, the latter of which they define as '*a narrow passage that actors have to cross in order to get their wanted results'*. This notion of a passage point is also a key notion in Callon' (1986) work, in which he identifies four steps needed to create and maintain a stabilized network of actors; problematization,

interessement, enrolment and mobilization, where the actors linked to the network are in a constant flux of support, scepticism or dissidence towards the network, indicating that they are involved in a continuous process of negotiation.

Problematization, or how to become indispensable, is the first stage of creating a network. This is done by defining a problem, the solution of which would be beneficial to a number of different actors. In doing so, the interests of a number of actors are aligned, as they would all see mutual benefit in defending the network formed around the idea. If done successfully, the actors who defined the problem/idea will establish an obligatory passage point (OPP), which forms a central role in the network which the other actors depend upon for the progression of the idea. According to Sarker et.al (2006), the sort of negotiations and communication that is necessary to maintain the network is wholly dependent on the stage of translation that the actors are involved in. The main type of communication needed to accomplish the problematization goal is to understand who the main actors are and what their current interests and goals are. In that sense, the problematization stage is diagnostic in nature and focuses on other actors' wants and needs in order to convince them that their interests are aligned, requiring the understanding of multiple points of view (ibid).

The interessement stage refers to the stage where actors are locked into place in the network. This is done through a series of actions, where the leading actors impose and stabilize the identity of the other actors, defined though the problematization phase. In order to implement these actions, different interessement devices are used. The role of interessement has also been studied in terms of its relevance and importance in innovation. Understanding that innovation projects are social processes, a successful innovator would need to mobilise support as well as attract the interest of social groups and actors who can help the innovators cause (Pohl et.al, 2009). The importance of interessement and problematization in innovation projects is further emphasised by Latour (1996), in his book about the failed implementation of Aramis, a new technological solution for public transportation in France. In the book, the author describes the Aramis solution as a superior technology that the group trying to implement yet cannot gather the right amount of support for a successful implementation (Latour, 1996).

The local and translocal context

In order to illustrate how ideas are conceived, transformed into organizational fashion, and eventually manifest as concepts within MNCs, we studied how an innovative technology was translated into a concept within the Volvo Group, a MNC and a world leader within their field of manufacturing of buses, trucks and construction equipment (as well as providing solutions for financing and services). The organisation employs roughly 95 000 people and operates across 190 national markets. The core markets that Volvo Group operates in revolve around trucks, buses, industrial machines and other vehicles that operate in mostly professional settings. These are also markets where technological advancements are rapidly transforming the product and service offers that organisations create and deliver to their customers. The market as a whole is moving towards offering complete solutions and services instead of merely products (financing, continuous maintenance, etc.), autonomous driving technologies are transforming how consumers view transportation as a medium, and intricate technological advancements (such as additive manufacturing and the internet of things) are impacting

production processes, recruitment, and organizational design. These shifts create new demands from the organisations operating within the production- and service industries, as they need to be able to quickly adapt to technological advances and new customer demands. Furthermore, there is a general sense of optimism within the industry due to stable financial results and a market boom that has not been seen since prior to the large recession in 2009, leading to organisations leaning towards increased investment in their future operations.

A general consensus is also that the way that all industries operates are on the brink of many large changes as the transition towards Industry 4.0 has instilled a sense of urgency. The proponents of Industry 4.0 often describe this as a fourth industrial revolution, promising to transform entire industries and creating an exponentially more productive society. Any leading company that does not adapt and transform in accordance with these new technologies and processes are described as future "dinosaurs" who will be rendered obsolete by new market leaders. The technologies that are included in the concept of industry 4.0 are plenty in number, but a few of them are seen as being able to revolutionise all manufacturing organisations; cyber-physical systems, the internet of things, 5G, machine learning and other advanced technical solutions for creating connected production facilities. Two of the specific technical solutions included in the concept of industry 4.0 is Virtual and Augmented reality (VR/AR) which are used to create virtual manifestations or change the reality that we view through the use of technology. These technologies have begun to be tested in the production/manufacturing industry in general, as well as programmes aimed at the training of employees for physical work, maintenance and other tasks. There has been experiments in different areas of the Volvo Group organisation with VR and AR technologies; particularly in sales, after-sales, and marketing (such as the digital launch and sales of the new XC90-model). Being able to visualise and to experience the product you have bought or are about to buy are seen as great opportunities for the organisation to sway customers towards using their solutions. There is also a broader interest involving these technologies from the entertainment industry, which further saturates the exposure and maturity of the technology.

Volvo Group has long been one of the major forces in the Swedish industrial sector and one of the largest employers on the market. In order to maintain their market-leading position, Volvo Group have adopted a strategy of becoming a learning organisation, which they define as '*an organization that embraces employee growth and sees the learning process as much more than traditional learning'* (Internal Volvo IT system). The aim of this change is to help the company perform better over time, to be more agile towards change, and to maintain a sustainable competitive advantage by investing in their employees and to facilitate the possibility for them to grow and to perform. In lieu with these changes, Volvo Group University (VGU) was formed 2014, described as a 'game changer', as they provide training and development opportunities for all employees in all geographical locations, utilizing a consistent and quality-assured portfolio. The portfolio that VGU utilizes is based on established methods, integrating workshops, reading material and e-learning and videos to provide training for their employees. Operating within the broader Volvo Group, VGU is a key part of the overall vision of Volvo Group, to *be the most desired and successful transport solution provider in the world* (Volvo, 2018). Our research is specifically undertaken in collaboration with Volvo Group University. The University is divided into seven different academies, each responsible for specific business area, which consist of Project management, Operations, Engineering and

purchasing, Process and IT, Business administration, Volvo Group fundamentals as well as Leadership and management. Regarding their operations, VGU state that *'different formats are used to ensure the best learning experience – on-line, on-the-floor, on-stage and in-the-classroom training. Our training portfolio is well grounded in future business needs and designed to prepare you for what's around the corner'* (Volvo Group, 2018).

Methodology

Data access

In order to study how ideas reach, and are translated by MNCs, we would need to come into contact with a multinational corporation who were working with innovative ideas. Having looked through available research proposals for major Swedish firms, we approached Volvo Group through one of their outstanding applications for thesis projects. Having applied, a meeting was set up with a representative of the organization where the specific angle and contents of the research was discussed. The meeting resulted in the possibility for us to collaborate with Volvo Group University in their attempt to translate innovative technology to their given context. We were assigned a supervisor within the department, and given access to a number of facilities, industrial networks/connections as well as the internal Volvo system. Furthermore, we were given access to communicate with employees on a daily basis, as well as to observe the courses that the department offers to employees.

Data Collection

Case studies

Since the study aims to provide an in-depth example of how an idea reaches and is translated by an organization, detailed insight is required into the social network and practices present in the specific context. Since social sciences have not been able to produce general, context-independent theory, one has to rely on context-dependent knowledge, which Flyvberg (2006) argues is best delivered using case studies. Czarniawska (2014) describes two different temporal forms, historical or prospective case studies, of which this is the second case - placing the researchers 'within' the process of translation. This type of case study could pose some limitation in the difficulty of knowing which actors or ideas eventually manifest into more distinct forms, while also offering strengths in that actions taken within the network are observable in real time rather from subjective recollection. When it comes to conducting case studies on innovation processes in real-time, Hoholm and Araujo (2011) illustrates the difficulty of conducting a longitudinal study as one easily runs into time constraints, or that projects often become delayed. Furthermore, they elaborate on the problem of choosing which innovation processes to follow, since there are often several simultaneous processes that shape the outcome of a given idea or concept. The researcher is limited in time and space and cannot appear at several geographic locations at the same time – and as such, many of the events that unfold that turn out to be critical to the innovation process happen in places the researcher did not visit or had not visited in a long time.

Empirically, the 'application' of ideas take place through repeated acts of communication. Tracing repeated communication (such as meetings, emails, presentations, images, etc.), we can ask how and where ideas travel, and although this question is formulated in spatial terms, the movement of ideas involves both time and space.

Interviews

In order to capture the flow of abstract ideas, practices, and objects throughout the organization, we conducted semi-structured interviews, observations, participation in meetings and document analysis. All of the actors (human and non-human) included in the research was found through a 'snowballing' approach, where initial interactions through our supervisor lead us to finding new targets. Both authors were engaged in the fieldwork, which was undertaken between January-June of 2018.

The interviews were undertaken in accordance with what Bryman and Bell (2011) label as a 'semi-structured' interviews. Furthermore, it allows for follow-up questions and can provide rich, detailed answers. By utilizing semi-structured interviews, the respondents are able to talk freely about their thoughts and experiences – and by conversing with a range of employees, a broader picture of their current practices and needs is enabled, facilitating an agnostic approach which negates *a priori* assumptions regarding best practices to specific operations.

Prior to conducting the interviews, the respondents were provided with adequate information regarding the research, in accordance with the principles of informed consent and deception, and all participation are kept confidential in order to minimize invasion of privacy or harm to participants. This is key to producing quality dialogues and to negate the power asymmetry between the researchers and participants. Since interviews were also conducted with industry specialists, it is also key to establish an interview setting in where the interviewees are not falsely seen as experts (Kvale, 2006).

The interviews were, with consent, recorded through an audio recording software, enabling the interviewees to highlight specific time intervals in which key notions are discussed. Once the interviews were completed, they were transcribed verbatim in order to capture necessary concepts and to analyse specific themes. As most interviews were conducted in Swedish, quotes provided in this study are subject to the authors' translation. As such, despite our best efforts, there is a potential for distortion as meaning may be lost in translation.

In total, interviews were held with 17 individual respondents. A majority of the respondents had some type of interest or thoughts about the technology and how it could be implemented in the given department, while the rest had no specific connection to the department, instead representing external expertise or projects run in the Volvo group, utilizing similar technology or having undergone a similar process. The topics discussed ranged from general discussions about the technology, the industry as well as the specific case discussed in this paper. The interviews conducted with employees of VGU where held in their offices, whereas the interviews with experts and other industry affiliates were held at their respective offices. The interviews lasted at average between 30-75 minutes, mostly depending on the level of insight the interviewee had within the given subjects and process.

Representing the specific department, respondents ranged from top management/head of academies to pedagogy experts and business managers. Attaining a range of different recollections and views of the origins and actions of the project is critical in limiting individual bias and/or retrospective altering of events. The table below illustrates the different recipients as well as the means by which they will be referenced to.

Respondent	Reference ID
Learning Expert Manager	LEM1 - LEM7
Business/Media/Operations Manager	MAN1 - MAN3
Industry/Academia Experts	EXP1 - EXP4
Volvo Group Employees	VE1 - VE3

Table 1:Interview Respondents

Observations and meetings

In addition to the interviews, roughly 10 ongoing meeting arrangements/ongoing conversations were held with different stakeholders and industry affiliates. For these interactions, key aspects were documented in order to be re-visited and analysed retrospectively. Furthermore, 5 full-day observations were made in order to illustrate everyday practices and to get an idea of how proponents and dissidents of the technology viewed its place, or lack thereof, within the department. his is in line with Watson's (2011) call for ethnographers to engage in participant observations in order to understand everyday practices of the actors they study.

Observations were done both through interactive meetings as well as by shadowing. The shadowing included passive observation of educational practices, while simultaneously taking notes of the setting, actors and actions. This process spanned a period of roughly two weeks, where specific classes in the portfolio were followed. These classes generally include an educator and roughly 10-20 participants. Once the observations were completed, the notes were coded and analysed by use of grounded theory. Czarniawska (2014) mentions several different strengths of shadowing in ANT research, as it aids in illuminating how actants move through the network and the discovery of many other actants which may otherwise be hidden. The shadowing of individuals reveals additional information about the actions and network, and the possibility to follow objects adheres to the notion of viewing non-human actants as being of equal importance.

Data analysis

As a result of the first interactions, such as the preliminary interview, certain phrases and explanations used (as to why the work was important to the firm) lead us to abductively (Schurz, 2008) select theoretical frameworks to analyse the phenomena. For instance, the adaptation of an idea to a specific context, the progression of implementing an idea - and how to illustrate its benefits to other actors within the department all lead us to instinctively consider a translation perspective as a framework that could effectively illustrate the process of how an idea is conceived, may travel from a specific context - and how it is attempted to be applied in a separate context.

As the representative of Volvo right away discussed the importance of the Industry 4.0 concept and how all major firms were working towards increased digitization, we concluded that some form of mimesis was apparent, and that some actor within the institutional environment had orchestrated a change - a change which would then be followed by other actors within the same environment, as they attempted to sculpt the technologies into a good fit within their context. Such a change also illustrates a potential change to established practices - that 'hyped' ideas or technologies could replace practices that had been institutionalized over the years. This cyclical behaviour, wherein one actor leads a change, and a number of actors

eventually follow, be explained through the notion of fashion - and in an organizational and managerial perspective, through organizational and management fashions. Combining these aspects with a translation perspective, Czarniawska & Sevón's (1996) framework of the Travel of ideas effectively illustrates how ideas progress from their conception in a given time and place, and through a number of translations are transformed from an idea to an object, from an object into action, and eventually into institutionalization - after which they are primed to 'travel' to another time and place. In doing so, the framework also provides valuable depth in how fashion leaders and organizational fashion may arise, as well as the impact it has on which ideas are translated by fashion followers. An abductive reasoning also lead us to complement the travel of ideas framework with notions from institutional entrepreneurship, as the notion of how an innovative idea reaches and becomes adopted by an organization is not the result of a one-way flow or 'push' of ideas, but the active search and conceptualization of how ideas can be translated by members of the firm. The addition of institutional entrepreneurship to the concept of the travel of ideas causes little friction, as the framework developed by Czarniawska & Sevón is based on Scandinavian institutionalism, in where many of the phenomena discussed are relayed throughout both perspectives.

In order to analyse how an idea is adopted and stabilized within organizations, the travel of ideas framework was further complemented by the first step of the sociology of translation (Callon, 1986), in order to illustrate how actors problematize the idea in order to mobilize a network of support. Aspects of Callon's framework, such as problematization and obligatory passage points, are also discussed within the travel of ideas framework - and as such, integrating the two perspectives causes little friction. Utilizing an ANT perspective, and specifically the travel of ideas and sociology of translation, is beneficial in illustrating the social processes that underlie the progression of an idea - as well as the importance of the non-human actor the entire concept revolves around. The frameworks selected provide elaborate insight into how ideas travel, how they come under the attention of firms, and the dynamic process of adoption once they attempt to be translated. As previously discussed, earlier studies on innovation processes have acknowledged that an ANT perspective is well apt at analysing innovation processes, effectively illustrating the range of interests, politics, and actions that constitute the process of innovation.

Findings

In this section, the journey that the idea/technology has taken from the first point of contact to the current situation is described. After a brief preface, describing the introduction we had to the case study, the origins of the idea and how we initiated our research, a retrospective is illustrated, chronologically illustrating how the idea has travelled from a specific context and reached the context of VGU through three main acts; *Genesis - a shaky start, A new hope - the idea revisited, and Coming to a crossroads - to lead or to follow.*

Preface

Operating within the broader Volvo Group, VGU is a key part of the overall vision of Volvo Group, to *be the most desired and successful transport solution provider in the world* (Volvo, 2018). Innovation and technology is described as a means of moving forward, enabling a constant progression and improvement, and that employees are to utilize creative and

innovative thinking as well as evolutionary and revolutionary problem solving in order to reach the vision. This notion is further echoed by current employees, as exemplified by (VE2):

"Volvo as a company would not be where they are today without a clear focus on innovation. Even though the automotive industry may move slowly, it is one of the largest industries in the world." - VE2

As the authors had an active part in the progression of the idea, we were also given a background to the project prior to its initiation. Through a meeting with VE3, he introduced us to the concept of Industry 4.0 and the technologies it encompassed. Giving a short background of its conception at the Hannover fair in 2011, he explained how a group of German researchers had introduced the concept as guidelines for a move towards a fourth industrial revolution. According to VE3, the technologies included in the concept were all of importance to the fight, and there were guidelines 'from above' to work towards becoming a more digitized firm.

Prior to conducting any interviews or observations, we conducted a short research phase on the background of Industry 4.0, the technologies involved in it, and more specifically, the technology they wanted to implement - augmented and virtual reality. Through our research, we found that the term 'Industry 4.0' had originated from a group of influential German researchers, who presented their ideas at a trade exhibition in 2011. As a result of their presentation of during the exhibition, the group of researchers was tasked by the German state to develop a strategic plan for the technologies in order to promote computerization of manufacturing. Their recommendation, *Recommendations for implementing the strategic initiative INDUSTRIE 4.0* (Kagermann, Wahlster and Helbig, 2013) eventually became a state-sponsored strategic directive dubbed I40 (Industrie 4.0). As the concept became entrenched in the German community, it also spread throughout the international industrial community - of which Volvo is a key actor. Once the research phase concluded, we began to map how the idea had travelled from its initial introduction at a German trade fair to the local context of Volvo Group University in Gothenburg. The story, narrated in the section below, spans a number of years and is influenced by politics, economic recession, as well as individual perceptions and goals.

Genesis - a shaky start

In early 2013, an employee VE3 within the department (who had past experience as a management consultant, working with artificial intelligence and web-based learning), introduced the idea of investigating VR/AR technologies in educational practices (LEM1). At the time, the technology was innovative and carried a huge 'buzz' around it. Word of the technology had reached him from an industry event where he conversed with a representative of a large organisation working with solutions for organisational improvement (LEM1; LEM2). Through their interaction, he established a vision regarding the application of the technology within the organization, which was in line with contemporary innovation trends within educational practices, such as roleplaying and gamification. Stating that there are 8 documented ways in which different individuals learn things most effectively, he envisioned applications where the technology could be used for scenarios ranging from onboarding, marketing and sales campaigns to programmes that could aid in overcoming phenomena such as stage fright (VE3). Having established a vision and a few potential use cases, he describes how the progression of the project would unfold:

"I think that a key flaw that many people do is to try to implement an idea that isn't fleshed out fully. You need to identify drivers - people or goals that have an agenda that can benefit from the idea, after which the idea will progress naturally. That also means that you need to find those people or goals, and to engage them in conversation. The best-case scenario is when you find a number of interdisciplinary contacts that all see a potential value in the idea." - VE3

As the year shifted to 2014, he felt that he wanted to investigate the technology and possible applications further and felt ready to spread the idea. Unfortunately, before he was able to scout for different parties that might have an interest in the technology, the entire concept was shut down, as he was appointed with new work assignments (VE3; LEM2). The relatively newly appointed CEO of Volvo had begun to embark on his previously stated mission of reducing operating costs in order to achieve a better profit margin. The employee reflects on the experience:

"*These projects are about politics on all levels. As such, whether the idea is superb or not can only take you so far - it can be discontinued due to external influences regardless."* -*VE3*

He further describes the environment and industry interest in the technology as having gone through a clear peak in the early 2013-2014, after which it had fallen off greatly. With new hardware programmes and increased accessibility, interest and market saturation began to speed up, even for regular consumers. This lead the employee to once again, after a 3-year hiatus, re-evaluate the technology (VE3). He illustrated this behaviour through the Gartner hype curve (Figure 2). As such, the idea was shelved and remained dormant. As ownership of the Volvo Group changed, and a new CEO was appointed, the automotive industry eventually fell on better times [VE3]:

"The cycles in the global economy really shapes operating procedures - if the firm is doing well, they want to sell more and are willing to invest resources in ideas that can improve production processes and business operations, and if the firm is doing worse, they minimize costs. It's a cyclical process."

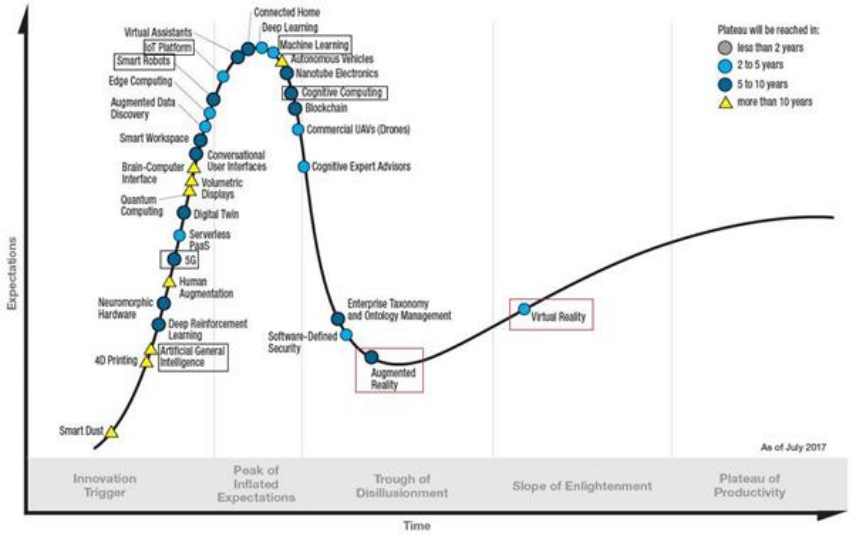

Figure 2: Gartner hype curve for innovative technologies (Gartner, 2018).

A new hope - the idea revisited

On a cold day in February 2017, one of the learning managers at VGU was approached by a colleague during a brief coffee break. As the conversation progressed, the informal subjects eventually turned into more work-related concepts, where the colleague [VE3] pondered whether it would be a good idea for them to look at AR/VR technology in a learning environment (LEM1). Having a clear vision of the technology being an asset in regard to creating an interactive environment for educational practices, which was in line with the learning principles the organization had established, he [VE3] managed to garner the interest of his colleague:

"He was convinced that it was an effective way to learn. He thought that it would be something which could aid us as suppliers of education, without being bound to a specific geographic classroom and that the technology could help us in a number of instances. - LEM1

Considering the opportunities that the new technologies would deliver was, however, not the most compelling aspect of the idea introduced by [VE3], as the technology itself was what compelled [LEM1] to start working with the idea:

"Honestly, I didn't listen to those ideas too much, I think that I latched on to the idea mostly due to the technology, instead of the specific applications." - LEM1

Having no physical experience with the technology, the two discussed eventual concepts and researched further regarding the technology itself (LEM1). Through their research, they also discovered that other contemporary projects regarding the new technology were also being undertaken within the organization and the broader industry (VE1). The two colleagues worked independently for a while, choosing not to involve managers and co-workers, explaining that their previous experiences of doing so had a tendency to halter projects as they would require the systemization of work - presenting budgets, business cases, implementation strategies, etc., hampering the creative freedom of the project and how it could take shape (LEM1). The two co-workers spent weeks conversing and meeting with experts, looking at demonstrations and researching different hardware solutions. Part of their research connected them with an employee [VE1] in a separate department within the Volvo Group, who had conducted a thesis project regarding maintenance work in a virtual environment (VE3). He was now a full-time employee, working on possible solutions to implement a VR solution in the organization, aimed at showcasing how they could work with service and service solutions without being at the same geographical location (VE1). For the two colleagues, this project illustrated how important physical objects were to employees working in production, and that a key to understanding their challenges and needs was to be put in that very environment. Additionally, non-production workers could gain a realistic insight in how production processes could unfold, all through a medium that required no geographic proximity to the de-facto location (VE3; LEM1). Through their interactions with other actors working with the technology, the possibilities they envisioned by utilizing the technology instilled a hopeful prospect:

"I think this is a must for us in the future. I think this could also be an important step for us here at VGU and how we can shorten the time to market for specific users or products. We have spoken a lot about our training of operators for new production processes, which often spans a year and a half. [...] That time needs to shorten in the future."

Already at this time the two colleagues had ideas of how the technology could be utilized in the organisation to shorten the time needed for products or employees before they could generate value for the company (LEM1). Further LEM1 explained that the time available for new products across platforms are shortening and the time to market is shortening, the prospect of training employees in virtual applications ahead of changes in their physical environment and their idea could have a great impact on the organisation:

"The changes will be radical! I would think that time period could be shortened by half a year, at least. Such a change will be very important for us in the future. Actually… it's important now!" - LEM1

As a more concrete concept grew forth, the two colleagues decided to progress with a formal project, and in June 2017 they approached their manager to make a RFI (Request of Investigation). As the RFI was accepted, the number of parties associated with the idea grew, as another colleague was recruited to work full-time with the project, as well as their manager providing general supervision and aid. The newly recruited colleague describes the process:

"Well, VE3 is a very charismatic and enthusiastic character. He is very ambitious, and basically instructed us that 'this is something we need to do', after which we started evaluating different forms of implementation and started connecting with different people who work with it within Volvo."

The beginning of the project was to a large extent a project where VE3 led the groups work through the use of his vision of how the technology could be used. The enrolment of LEM2 was primarily due to the leadership of VE3; the way he made things happen, negotiating and connecting different people within the organisation (LEM2):

"It was largely due to his passion and initiative that made it happen, it helped a lot. He pointed out people to talk to and so forth. He had a very leading role for the first months until he thought he had contributed with his knowledge and then he gave it over to us." - LEM2

As the group prepared to move forward with the project, they suffered an untimely setback. The colleague who initiated the idea had to take several months off work due to private matters, leading to the departure of a key proponent of the project (LEM2). Despite the departure, the remaining colleagues proceeded with the development of the concept, drawing on the insights of education through roleplaying and gamification. The group aimed to capture a solution that offered something for a cross-functional set of employees, in order for it to be able to reach the broadest possible target group within the organization. The first idea materialized into a concept of a game called *Waste Hunter*, where 'players' would operate in a virtual environment in which they would, through a fun and competitive experience, learn to identify 'waste' (in accordance with LEAN/Toyota Production System principles, adopted locally by Volvo as VPS - Volvo Production System).

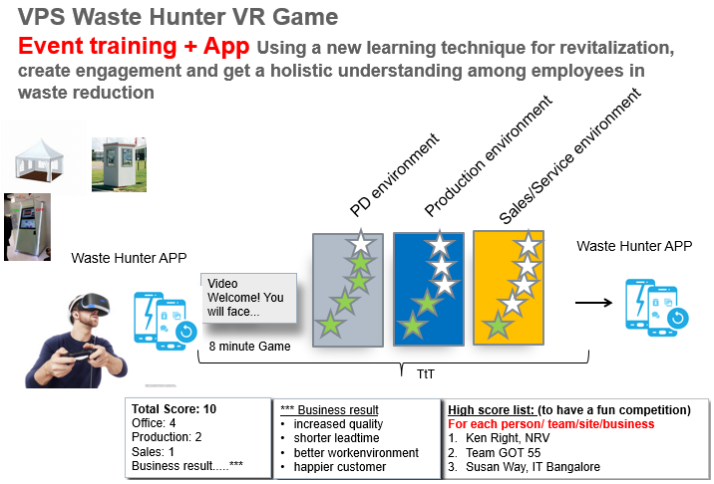

Figure 3: The idea behind the 'Waste Hunter' game. Source: Internal Volvo documents.

With this concept in mind, they contacted four different suppliers of educational practices as well as game developers (LEM2). Once the group started to evaluate the resources that might be required, and the idea became more concrete, the group also exposed themselves to the business end of the department, for whom they had to legitimize the idea in order to proceed (LEM1). Since the idea was still an abstract entity, the two parties had varying views, as a member of the group stated:

"We, to some degree, ran faster with the idea than the rest could keep up with, and you should probably not do that, you should instead invite and involve more people and create a concrete idea in order to make them understand without giving them a solution. [...] Only talking about AR/VR is not concrete enough, we should have gone to the business side and involved them because they have only just started to understand what we want to do and therefore we are not moving as fast as we could." - *LEM2*

While the manager on the business-end stated:

"You have to maybe try it in a few areas to see where it actually works and breaks through, where it creates value. I think we are still in a stage where we don't have good understanding of where it can create the most value for us." - *MAN2*

As the business-end of the department didn't fully share the hopefulness of the group, stating that they did not see a clear case for value creation within the organisation (MAN2). Attempts were made to alter the project in a manner that would be more appealing to financiers. As the department is governed by the overarching Operations group, appealing to their interests were of great importance (LEM2). Conversing with managers for the Operations group, the focus on waste management came into question - they were under the impression that they had worked with lean principles for a long time, and had the competence required. For them, an increased focused on safety would be more desirable, as increasing the safety of employees and their competence in maintaining a safer work environment held a greater value proposition (LEM4). For the project group, this became a problematic proposition - as they aimed to create a platform that could be used in a cross-functional setting, the safety principles that the Operations team requested would not be applicable in an office setting. Nevertheless, the financial influence could not be neglected, and the group started working towards integrating safety principles as part of the concept (LEM2).

Coming to a crossroads - to lead or to follow

As the progression of the concept hit a snag, and the group had to adapt to an increasingly broader goal and a wider set of stakeholders, the uncertainty regarding the future of the project increased. The general consensus among stakeholders was that the technology was both interesting and important, but that it was hard to define a clear use case;

"I think a lot of people see the potential, and the constant flow of information/hype regarding what Industry 4.0 will contribute to the industry. I also think that it is seen as fun - which generates interest. However, other technologies (i.e. scanners) are often developed after a wider industry standard. This technology has not really reached that point yet." - MAN1

The wider set of stakeholders also exposed the group to new experiences with the technology, including past potential use cases as well as how many of the ideas that had been presented were at the mercy of the technology itself (in terms of processing power, physical design characteristics, graphics engines, etc.), as well as business and strategic aspects that were beyond their control:

"One of the first things we wanted was to integrate Skype with wearable glasses. We discussed this with Microsoft. However, they parted ways with Skype and are working on their own platform, which further complicates things on a political level." - MAN3

As the correct timing and use case for implementation became increasingly difficult for the group to pinpoint, and since the group members also had other responsibilities, a choice was made to enlist two external consultants, two students [the authors], who would specifically look at possible use cases for the technology, while one of the core members proceeded to develop the waste- and safety management project (LEM5). In doing so, the group hoped to link up-to-date academic insight and a broader industry understanding to a practical use case (LEM4; LEM5). The recruitment of the consultants linked another independent, set of actors to the project, whose insights were seen as key to the future of the project. This link also further bridged a connection with a wider social network, involving both academic experts and business innovators that the group had been unable to contact previously, primarily due to time restrictions. As both experts within academia and business innovators who offer a technological solution had a genuine interest in applying the technology in a Multinational corporation (MNC), or merely following its progression as a practical use case, their alignment of interests were natural. Technology/Industry experts saw great future prospects;

"The technology has caught up somewhat - the hardware progression can be illustrated by the analogy of the difference between the first generation of an iPhone compared to the possibilities of the iPhone X. In the coming 5-10 years I am certain that it will be exponentially accessible." - EXP2

The experts within the field of the technology see the rapid development of hardware as somewhat of a hindrance to implementation as timing becomes an issue (EXP4). The use cases that are applicable today might be obsolete within the foreseeable future, making the decision between implementing now and waiting harder for managers. This is further emphasised by other actors within the field:

"For instance, the regular reading glasses that I am wearing right now could be equipped with AR/VR technology, linked to cloud services, connected through a 5G network. Things are moving so quickly that developers are

already working on the third generation of a VR/AR product before they have even released the second generation!" - EXP3

Despite this, when discussing the possible use cases within the department, the task was described as daunting by all involved parties, as one of the Volvo managers describes;

"In order to generate the best result, the technology needs to be connected to the wider Volvo system, following updates, etc. This is a bit tricky – we utilize a range of different systems, some very old and some very modern. Connecting all of them is difficult. In general, most projects are often relegated to proof of concept-status and very few reach industrial status. In many cases there is something missing – the hardware isn't up to spec, the product data might be missing, or the time might just not be right."- MAN1

This is further elaborated by a technology expert:

"A big challenge with innovative technologies like these are issues that arise when new generations of software and hardware come around. For instance, the choice of development engine is crucial, as all engines don't offer portability over different physical hardware/products - which of course is a big problem for a firm that wants to standardise operations." - EXP2

There was also a general hesitation among objective actors regarding the value generated in applying a waste- and safety project in an office setting (LEM2). All of the actors saw great value in using the technology in the day-to-date operations and education of production workers, whereas defining a clear use case for office workers was troublesome (VE2). A few of the experts within academia suggested that the technology possibly could be used as a part of 'onboarding' processes, where it could reduce the training and introduction needed for new employees, as well as reducing the 'time-to-market' of their practices. One of the researchers, being born and raised in London, drew the analogy to how new cab drivers had a mandatory three years of studying to do in order to learn the streets, routes and areas of the city - as the GPS technology became accessible, this period could be shortened drastically, or be made redundant and reduced to a mere ritual (EXP1). These sentiments were also shared by some of the technological experts, who stated that the initial phase of anything was extremely important - be it the introduction of a technology or the first week of work - as it will shape future perception of the workplace (EXP2).

Despite the possible idea being altered once again by industry and academic experts, further complicating the process of narrowing down a more concrete application format for the specific organization, both group members and indirect associates are hopeful regarding the application of the technology in a way that can provide value for office workers, as an employee in the IT department illustrates the importance of cross-functional training solutions for the different departments within Volvo:

"There is an issue at a large company such as Volvo where everyone works in their silos, working on different 'islands'. Perhaps one could develop a solution where employees get a better understanding of other departments and their operations." - VE1

This sentiment is echoed by one of the group members, illustrating how the technology could improve teamwork over large distances through the use of virtual meetings:

"I believe our cross-functional work will be easier. I have seen a concept where they had a virtual meeting in a real room with virtual people and real people at the same time - and they looked at a virtual object, they worked together in a room without having to travel... I think it will be a big help" - LEM2

The experts that have been interviewed in many cases are in agreement of that the implementation of these technologies can have great impact on educational practices due to the technologies capabilities. As stated by EXP2 “finding the right application area for the VR-technologies will make education more efficient” and EXP3 stating: “look at what Walmart did with their VR-project, it increased their efficiency in onboarding with great results”.

Ever since the initial inception of the idea, roughly 5 years ago, the project has encountered obstacles, resistance, and uncertainty - the most influential actor in the project group leaving and the fact that the department has had difficulties financing an innovation project are great obstacles for the continuation of the idea. There has been resistance towards the idea from multiple sources, including the finance department in their inability to see the business case, as well as the technology proving to be harder to master than the project group had anticipated. Furthermore, there has been uncertainty surrounding the idea of using VR and AR due to the fact that there are several areas of potential implementation, making a decision of where and how to use it (and which projects that should receive resources) complex. Despite the fact that a clear use case remains unfinished, and that the project currently remains as a non-material idea, employees remain hopeful of the technology, illustrating sweeping changes within the organization:

“There is a group within the wider automotive industry, GAAG [Global Automotive Advisory Group], where we meet and discuss standards and projects within the industry. I think that just by saying that we are working with Industry 4.0 practices, having an agenda, we will generate a lot of ‘buzz’ and interest. I believe that the technologies will take us from GTO 1.0 to GTO 2.0 [GTO - Group Truck Operations*].”* - LEM5

The work towards using these technologies is still described by the employees with enthusiasm and characterized by hope for future uses, even though many of the justifications for using the technology is drifting away from educational practices, and employees’ focus more on the overarching impacts that the technology can have on their processes:

“When it comes to AR and mixed reality, I think we are going to experience a revolution – I don’t think we have seen the bigger, final incarnation of it. I say this because I know that we have – and will continue to have for a while […] I don’t think we will build many prototypes in the future – there will be no need for it. We will put them together virtually long before the physical unit will roll out from the shop. We will have done it hundreds of times already.” - LEM1

The organisation as a whole remains invested in the ideas and concepts of Industry 4.0, as other parts of the Volvo Group continuously conduct projects to evaluate the technologies’ effectiveness and application areas. The hype and interest is also maintained within VGU as presentations, infographics and other visual means are present in the public space of the office. This in turn means that all employees that enter the office spaces will come into contact with the information that the Volvo Group wishes to mediate surrounding these ideas. The observations of these visual sources included both general information about the technologies and concepts, as well as practical examples of how it could be implemented in an industrial setting (authors observations). The report that we as consultants were tasked with conducting for VGU is mainly exploratory in its nature and revolves around the strengths of augmented and virtual reality innovations and how an implementation would impact the organisation as a whole in terms of their processes and practices. The formulation of the thesis work and its aim indicate to us that the organisation and the proponents of the idea have the understanding that

an implementation of the technologies is imminent, and that the right preparations has to be made in order to facilitate the new technologies, as exemplified through one quote from the thesis descriptive: "*Study what opportunities it will generate for a large global company to integrate AR/VR in the design and delivery of on the job learning solutions".* During the course of the fieldwork done, one of the tasks was also to identify other organisations working with and providing services connected to learning through the use of the new technologies so that a transition towards using the new technologies could be initiated easily.

As the case study was finalized, the idea was still in the form of quasi-objects (the 'Waste Hunter' project and the consultant's report), having yet to stabilize the network surrounding the idea and to materialize the idea into organizational action or practices. The core actors maintain a strong belief that the technology will, in some way, be implemented within the department in the future, yet the scepticism of the business end remains.

During the time the authors spent at the offices and work areas within the Volvo Group, other observations supporting the push for innovations has also been noticed, e.g. posters and video screens inviting employees to partake in an "innovation-day", organized by the company at one of their production facilities illustrate the 'smart' technologies involved in the Industry 4.0 concept. Furthermore, the group has launched Volvo Group talks, a spin on Ted talks, where presentations are held regarding innovative technologies and methods to develop mindsets aimed at adapting to the future of industrialization. Having invested resources into ensuring that employees are made aware of the coming technologies suggests that the organisation wants their employees to contemplate possibilities of changes in the workplace, and to instil their culture and vision of being an innovative company (authors observations).

Discussion

Alluring technologies and dormant ideas

By retracing the origins of implementing the technology within Volvo Group University, the story goes to show that the idea 'arrived' at the department as a result of social interaction – and that the idea surfaced simultaneously in different departments within the wider Volvo Group. Utilizing the simple model described by Czarniawska & Sevón (1996), the process by which the idea became dis-embedded from its original context, travelled through time and space, and eventually became re-embedded in the local context of Volvo Group University, can be described.

The main idea originated from three German engineers and researchers, who presented their idea at the Hannover Trade fair in 2011 under the umbrella-term 'Industrie 4.0'. By labelling their idea as a specific concept they stimulated potential repetition and use by recipients, minimizing potential distortion due to displacement effects (Czarniawska, 1988). This was further enforced through the objectification of the idea by graphical means as images/slides and a strategic paper, as the idea was presented to the actors within the industry. The choice of forum in which they presented the idea - a place where members of the same institutional field interact, exchange information, and generate a 'field consciousness' (Czarniawska & Sevón, 1996) - is a key aspect in the transformation of an idea towards institutionalization. Czarniawska & Sevón (1996) describes the process of materialization of an idea as being dependent on an act of will, rather than the inherent properties of the idea -

this involves the idea instilling positive expectations of the process and outcome. This notion was observable as a result of the 2013 trade fair, wherein a task force was ordered by the German government the following year to develop a set of recommendations for Industry 4.0 implementation, yet again transforming the idea from object into organizational action. Their work resulted in the report *Recommendations for implementing the strategic initiative INDUSTRIE 4.0* (Kagermann, Wahlster and Helbig, 2013).

Once their ideas had been objectified in writing, they were subsequently materialized and institutionalized by the German government through the Platform I40, a national strategic initiative through the Ministry of Education and Research as well as the Ministry for Economic Affairs and Energy (Klitou, Conrads & Rasmusen, 2017), aiming to drive digital manufacturing forward by increasing digitalization and the interconnection of industries, value chains and research. In addition to being materialized through governmental policy, the concept of 'Industrie 4.0' evolved into a meme (Rogers, 2018), a concept coined by Richard Dawkins (1989), based on the Greek *mimema* (imitated), used to describe an idea, behaviour, or style that spreads from person to person within a culture - often with the aim of conveying a particular phenomenon, theme, or meaning represented by the meme), which became widely used within trade fairs through the following years, as well as being the main subject of discussion during the 2016 World Economic Forum in Davos (Klitou, Conrads & Rasmusen, 2017). Pfeiffer (2017) argues that trade exhibitions enable exchange networks to continuously pass on black-boxed representations of ideas, and that the strategic papers and ideas presented at the 2011 exhibition held no de-facto instructions regarding how to generate value through the use of the technologies. Nevertheless, the concept became widespread, and firms raced towards adopting them to keep up with the competition. In retrospect, a manager explains the behaviour:

"If you look at the Industry 4.0 concept, nobody had really finalized a working industrial practice with these technologies. All of the firms focused on working with applications to become more efficient – so this, in the grand scheme of things, is no different to previous efforts to maintain their position. Remember a decade ago, hybrid vehicles were the talk of the town – not so much anymore..." – MAN1

Furthermore, Pfeiffer (2017) denotes the success of the institutionalization of 'Industrie 4.0' as being more dependent on social processes than the idea itself, as one of the founders of the concept also acted as the president of the German National Academy of Science and engineering, taking an active role in the promotion of the concept through a network of leading managers, politicians, business organizations and trade unions. As these actors embraced the idea, it was legitimized among the wider community, which in turn contributes to the emergence of organizational fashion - enabling external environments to recognize the idea, verify that it has been locally tested and validated, and attempt to adapt it to their environment.

As such, the idea behind Industry 4.0 underwent a slew of translations; from idea to object, from object to action, and eventually towards an institution. However, as there were still no organisations who had successfully materialized the ideas to such a degree that it constituted a standard within the industry, the primary carriers were different actors within the German government and the researchers who came up with the term 'Industrie 4.0'.

As the idea became institutionalized in German society and the wider industrial sector, it was also primed for travel to external local contexts. Figure 5 illustrates a headline in

the British magazine *The Times* shortly after the Industry 4.0 concept had become institutionalized in Germany, where voices were raised of the dangers of not being up to date with the latest ideas within the industry - and the concept was used as a linguistic artefact with the purpose of instilling a sense of urgency, as well as to suggest governmental action in acknowledging that the ideas were also relevant in their local context. This entails that the idea-become-material had been dis-embedded from its original context and travelled, through social interaction, eventually becoming re-embedded in a new context. Czarniawska & Sevón (1996) state that the spread of ideas between specific contexts often rely on professional consultants or industry organizations, who translate objects into a framework for local adoption, acting as mediators of the original idea (Latour, 2005; Brunsson & Sahlin, 2000), which was also the case for Volvo Group University (through the interaction between VE3 and a member of his professional network, acting as a carrier of ideas between the primary and secondary context)

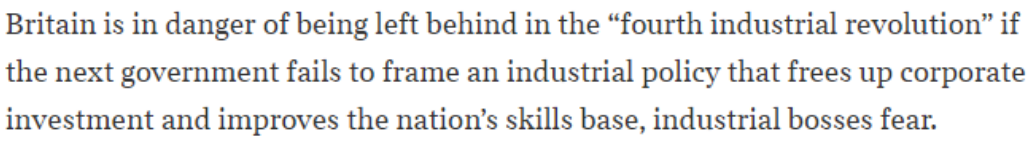
Britain is in danger of being left behind in the "fourth industrial revolution" if the next government fails to frame an industrial policy that frees up corporate investment and improves the nation's skills base, industrial bosses fear.

FIGURE 5: Headline from The Times, February 2015

DiMaggio & Powell (1983) exemplify that professional associations and trade exhibitions are breeding grounds for institutional mimesis: "*the greater the participation of organizational managers in trade and professional associations, the more likely the organization will be, or will become, like other organizations in its field".* Although Czarniawska and Joerges's (1996) framework somewhat departs from the of neo-institutionalist perspective, they state that there are four general elements in which organizational fields are imperative in the process towards institutionalization - an increased interaction among organizations of the given field, the emergence of interorganizational structures and coalitions, an increase in information exchange between the organizations, and the development of an awareness among organizations that they are interlinked. The story of how the idea travelled are ripe with these phenomena, as interview participants describe the tight linkages within the automotive industry, influential governing agencies, increasing communication and collaboration, as well as the establishment of a general consensus that the technologies are the key to future success (LEM5). As such, our findings corroborate that there are indeed underlying structures or gatherings, such as industry exhibitions, within the production sector that have a defining role in enabling the possibility of ideas to travel from a local context to another - or for carriers of ideas to interact with other actors. These interactions between individuals and organisations, operational within same field, play a key role in the initial rate and scope of which ideas can travel - which is, after all, the goal of industry exhibitions. It could also be argued that a historical and cultural context plays a key role - as Germany's tight linkage to successful engineering and the strong presence of leading actors within the automotive industry in the country influence other actors within the wider network to pay attention to the actions and ideas discussed.

In a wider perspective, the successful travel of the idea of Industry 4.0 technologies to Volvo Group University was also timely as it latched on to the zeitgeist of increased digitization of both the industrial sector and society as a whole. As Sundin and Tillmar (2008) notes in their work on institutional entrepreneurship, some ideas can be

introduced as opportunities as they become part of a macro-discourse. As the concept of Industry 4.0 can be seen as a shift in the macro-discourse, where focus shifts towards digitization of practices, we argue that VE3 used these changes in the discourse to his advantage when introducing the idea to use these new technologies. The notion of introducing augmented and virtual reality as a tool for education also latches on to what Czarniawska and Sevón (1996) define as master-ideas; concepts which have appeared in people's minds prior to their practical introduction (the technologies have been represented in in science-fiction sagas and movie universes for decades), formulating a possible framework of how to adapt to a new environment; a bridge between established practices and new ideas, of which local actors translate the idea to fit their setting. As the technical capacity of the hardware develops, ideas of possible applications within the industry arise in similar organizations at the same instances of time - constituting a new wave of organizational fashion, where the German researchers and Industry, as well as Technology Giants such as Google, Apple, and Microsoft act as fashion leaders, swiftly adopting (and developing) the technology - which the wider industry then seeks to imitate or emulate (LEM1).

As per definition, fashion is an expression of modernity, a short-term temporal occurrence which challenges the institutionalized perception of order or standard operating procedures (Czarniawska and Sevon, 1996). As such, the two could be viewed as inherently opposite, yet are intertwined and co-dependent phenomena. This is described through the simple notion that fashion followers – in this case, the general automotive/manufacturing industry – will 'act different due to the attempt to act in the same way' (as fashion leaders), effectively breaking the institutional order to adhere to fashion – which may, if widely spread, emerge as a new institutional order. As such, MNCs in the automotive industry acknowledge the industrial fashions of a given time and space in an effort to adhere to stakeholder interests and to sustain their industrial position – if successful, offering a prospective competitive advantage, alternatively, if they merely imitate practices, to align their practices with actors in their environment to perpetuate the status quo. However, when relating the activities in Volvo to the works of Czarniawska and Sevon (2005) and Sahlin and Wedlin (2008) there is a large difference in the fact that there are no organizations in the field to imitate, only other actors trying their best to implement the ideas, as stated by LEM6;

"We were on a visit to SKF which I have heard are very far ahead, although I did not understand quite how they work with it. [...] I have also heard that IKEA has a large team fully dedicated to working with it, and are also experimenting with an augmented reality mobile application..."

This entails that as ideas became trends, through industry conferences, exhibitions and networks, imitation of best practices was not the driving factor in this case - rather, an imitation of theoretical ideas and attempts to translate them into novel organisational practices. Once the idea, no matter if it involves established practices or novel concepts, has reached a new local context, the adoption of an external idea in a local context also involves a continuous process of translations. In order to do so, the idea must first attract the attention of the actor(s) who operate within the given context. Bruner (1957) describes how perception involves the categorization of stimuli in accordance with established mental frameworks and experience. As such, categorizing a new phenomenon depends on the previous knowledge and experience of an individual, and they will in turn base their perception of new ideas in relation to what

they already know. These ideas are further elaborated by Baron (2006), who iterates the importance of attention as the active search for opportunities for entrepreneurs/intrapreneurs, and that prior knowledge of a market, an industry or specific domain may act as the previous experience of which new ideas are categorized towards. These notions correlate with the events that unfolded in the case study, as VE3 was introduced to the idea, and instinctively pondered how the technologies could be used within his own area of work - his experiences and framework.

In order to enable the translation of new ideas in a context which has existing action patterns, local labelling is of key importance (Czarniawska & Sevón, 1996). By tying the idea to the notion of increased effectiveness of their educational practices, VE3 tied the introduction of the technology to existing goals from management, as well as trends in the broader society, of an increased effort towards digitizing their processes, initiating a chain of translations which eventually took the form of organizational action in the allocation of employees towards working with the introduction of the idea. The fact that all actors within the newly formed network had similar areas of expertise and understanding of what they wanted to achieve with the idea might have hindered them in their successful translation process, as they may have missed out successfully problematizing the idea for a wider range of actors. This is in line with Lamine et.al (2017)'s work on entrepreneurship, showing that heterogenous networks are more likely to succeed as they, to a further extent take a wider set of actors' interests in to consideration.

For an idea to travel from its origins and become institutionalized practices, it progresses through conversation, is translated into quasi-objects, after it is evaluated and may be materialized into organizational action or discarded. For Volvo, a firm who believes in the importance of innovation to such a degree that it is seen as paramount for continued business success, the generation of translating innovative ideas or practices into quasi-objects is promoted. Nevertheless, once the ideas reach the stage of evaluation in regard to creating tangible value, most ideas lose momentum and are left as proof of concepts - out of a large number of ideas, very few reach the status of being materialized into organizational action or practices, being described as 'lacking one thing or the other' (MAN1).

Stabilizing the network

After a hiatus of dormancy between the idea travelling from its original context and reaching the organization, the idea was eventually revisited when the pioneering member engaged a colleague through conversation. As the driving force behind the idea had past experience in managing change initiatives, he (VE3) understood that the successful spread of an idea in an organization is as much of a result of the capabilities or benefits of the idea itself as it is a social and political process. This is echoed by Lamine et.al (2017), who argue that institutional entrepreneurship has a strong focus on understanding the complex nature of the network one is creating, and that nurturing the different needs and wants in the network is key. The descriptions provided by co-workers of VE3 align with Hardy and Maguire's (2008 p. 263) notion of the institutional entrepreneur, who is an *"analytically distinguished social type who has the capability to take a reflective position towards the institutionalised practices and can envision alternative modes of getting things done".* As such, the focal point of the idea reaching

and manifesting itself within the specific context of Volvo Group University is due to the attention, social interaction and pragmatic efforts made by VE3 - and the eventual friction the idea met once entering a chain of translation could be related to the departure of VE3 from the project.

The actions taken, and how events unfolded, can be understood through an Actor Network perspective and the framework of the sociology of translation (Callon, 1986) adapted by Czarniawska and Sevón (1996) as well as Czarniawska and Hernes (2005). The framework describes innovation, in its most basic form, as a perpetual search of allies - and that the successful spread of an innovation is synonymous with the successful establishment of a social network surrounding the idea. As such, the spread of an innovation is a social process, wherein conversation and communication is a key medium. This also entails that successful innovation of a product or idea is not dependent on the inherent capabilities of the idea itself, nor that the primary innovator is the 'entrepreneurial hero' responsible for guiding a firm. Instead, innovation is at the hands of the collective - the core project group, key stakeholders, and the technology itself as they all contribute (or counteract) to the development of the idea. As stated by experts within the industry, the first interaction individuals have with an idea or an innovative technology are key for the continued success - people need to find new ideas 'fun' and interesting (EXP2). As such, successfully translating the idea into an idea-become-material adds a degree of complexity to the primary actors, as if their first iteration of the idea fails, the network would most likely become destabilized. Understanding technology-based innovation as a social process, and the aligning of actors in a network, is further emphasised by the work of Nicolini (2010) who stresses that innovation work should examine the structures and network that solidifies the innovation and how it is anchored in the given context.

Once VE3 successfully tied a colleague to the idea, the network supporting the idea had begun to expand. From this point onwards, the spread of the idea would be dependent on the actions taken by actors within the network and a continuous process of translation. The initial idea, and the concept that the group proposed, is that AR/VR technology would be beneficial in developing the educational practices of the organization. This involved translating the technology used in the entertainment and gaming industry to fit the context of a learning environment, and to mobilize learning experts to support the idea. In order to perpetuate this idea, and to anchor it within the organization, the main actors needed to formulate a problem and promote an image of how the technology would enhance the practices. Within the context of learning professionals with an academic background, mobilization could be done through the research phase, in which potential benefits and use cases were documented and presented. Through the research phase, the inherent agency of the technology itself is also illuminated (Callon, 1986; Lindahl, 2005). Despite being man-made, once a hardware/product has been selected and is part of the network, the capabilities and limitations of the product will make itself 'heard', as it imposes boundaries (physical design and requirements, technological aspects such as refresh rates, graphic resolution and associated problems, such as 'cyber sickness') upon how the idea can be translated. Nevertheless, the technology is tied to the progression of the idea and network, as the application within organizations would ensure it's further development and spread. A primary reason as to why the technology had failed to become adopted within the industry during the initial hype was primarily due to the inherent technical capabilities, as there were physical and virtual limitations with the technology (as

well as supporting technologies). As these the technological capabilities progressive expand, an increasing number of actors of different fields start to re-visit the technology consequently proving that the technology itself has agency as its capabilities to an extent determines its success in attracting allies and bringing itself out of the limbo-like state it had been in, as LEM1 hopefully explains;

"When it comes to AR and mixed reality, I think we are going to experience a revolution – I don't think we have seen the bigger, final incarnation of it [...] We will have completely innovative ways to present information to clients, and vice versa... "

As such, the research phase and initial translation to enrol their peers would need to be followed by additional translations in order to enrol management and the business department, who could then facilitate additional organizational action. If the technology could be used to improve the performance of the department, it is of interest of management (in that they would adhere to the goals of the organization in providing cutting-edge educational practices and working with innovative solutions), the business-end of the department (as they could provide a service that generated value for the organization while carrying it's costs) educators, (as they could develop their learning practices and portfolios), and the technology, in that an adoption would facilitate an increased interest and business relationship with associated firms. In doing so, they are trying to formulate what Callon (1986) describes as an obligatory passage point, in where the actors define a problem that aligns their interests with other actors who may contribute to the configuration of a problem-solving network. Czarniawska and Sevon (1996) explains an obligatory passage point as '*a narrow passage that actors have to cross in order to get their wanted results'*. In doing so, they would render themselves as representative of the network, as the interests of the other actors are only solved through interacting with them and using their idea. The obligatory passage point, as such, is the question of whether augmented and virtual technology can be used to develop the practices of the department (Ibid). As with any organizational change, the importance of gaining support from relevant social groups and actors for an innovation become key (Pohl et.al, 2009; Akrich et.al, 2002).

In order to solidify the problematization and the project group's role as an obligatory passage point, the technology was subjected to a number of translations and displacements (an initial concept with widespread uses was translated into a quasi-object, the 'Waste Hunter' game, based on lean principles for learning - which was eventually re-translated to include increased focus on risk management once dissidence arose from a key stakeholder) from its original form in order to retain the actors in the network as allies rather than sceptics or dissidents. However, despite having reached the department months ago, the concept remained in the form of an abstract idea and a quasi-object - and use cases with tangible results were obsolete. Through the translation of the idea into the concept, the project group also managed to enrol their manager, who in turn supported the idea by validating organizational action through their continued on-the-clock work on the project, as well as the generation of a M.Sc. thesis. However, in retrospect, members of the project group - as well as the main innovator - have voiced concerns of their failure to enrol the business department in the initial phases of the project, which illustrates the failure to translate and displace the idea into an object that would enrol the business managers. The same view was voiced by the business department, as they stated that they could not endorse a project of which they had no

understanding of the cost-benefit. This implies that the idea would have needed to be transformed from the concept of a game to an object - an economic analysis in which the idea is represented in numbers or figures, which could then, if deemed worthwhile, be translated into organizational action.

The failure to enrol the business department through a direct translation into figures could also be explained through another phenomena. When considering the cases of innovation in both Pohl et.al, (2009) and Nicolini, (2010) the empirical accounts illustrate distinct changes in the general market, but also a clear de facto need for innovative solutions to a problem that may be easier to translate, in order to satisfy other actors in their respective networks. For instance, in the case of telemedicine in northern Italy (Nicolini, 2010), there are geographical limitations for medical personnel to travel to clients, which could have dire consequences. For a competitive firm, maintaining best practices and continuously improving is of great performance, yet concretizing a problem within the notion of continuous development is difficult. For Volvo Group University, the portfolio they offer today is favourable in creating value for the firm (as seen by the success and growth of the corporation), and there are no other established industry practices regarding wider educational practices by use of augmented or virtual reality. As such, the problematization is further complicated in the complexity of evaluating the success (or lack of) of current educational practices (in an objective form - such as figures), and timing (aligning a vision with technology capabilities, price, and implementation complexity). This relates to what Hardy and Maguire, (2008) discusses, as certain stimuli in a field generates favourable setting for new ideas - settings which were not as apparent in the case of Volvo Group University.

Connecting the idea of favourable market conditions to the travel ideas and the translation framework, we argue that in our case the enrolment is hindered due to unfavourable conditions to innovate within the field of professional education practices. In the cases of Pohl et.al, (2009) and Nicolini, (2010) the market conditions 'organically' generate a need for a problematization and the formation of an obligatory passage point, which is contrary to the case that we have studied - where the project group, despite their good intentions and goals, rather synthesizes a problem and attempt to establish themselves as representatives. In the case of 'market-generated' needs (or continuous improvement practices, spurred by organizational fashion) rather than an 'organic' need, the travel of ideas or sociology of translation-frameworks are adequate in effectively illustrating how an idea is spread and received - yet may not be specific enough in successfully illustrating the importance of certain characteristics of individual actors in the progression of network-building.

A further emphasis on the individuals within the network may be conflicting with the overarching view of innovation as collective action, yet in our empirical case we find clear individual characteristics that have shaped the outcome (or lack of) of the project. For instance, VE3 described past experience and knowledge of how to successfully manage an innovation process within a firm, including the importance of acknowledging and translating the idea into objects that illustrate value generation to the wider network of stakeholders before they were approached - and as he departed, this knowledge seems to have been lost. As the network around the initial idea also did not revolve around a certain problematization, he still managed to enrol actors to his cause. As such, the idea remained in the form of a quasi-object and the

progression of the idea was haltered, - much like in the case of Latour's (1996) study on Aramis, the demise of the technology wasn't a result of any specific actor, but the inability of the network to adapt and translate it to a changing social environment.

As the project group failed to stabilize the network surrounding the idea, primarily in relation to the business end, the department facilitated the hiring of external consultants to explore the possibilities the technology offered and how it would impact the organization. Such an organizational action primed the idea for a novel, objective, translation. However, despite the problem in translating the concept into a form that would enrol the business end, the consultants were tasked with exploring what impact the technology would have on future educational practices, and the associated competencies that would be required to manage it - indicating that the members of the project group were determined that the technology would become implemented in some form in the future. The consultants task would result in another quasi-object, a report describing the capabilities and implications of the technology. This would, in turn, be used as an object that could be translated to further the goals of the project group as further organizational action (Czarniawska and Sevon, 1996; Pohl et.al, 2009). We, again, argue that the inherent belief in the future use of the technology may instead be hindering the current progress of the process of anchoring the idea and attracting other actors.

Conclusion

Our first aim with this report was to investigate how ideas travel to large organisations and to see how fashion cycles within the industrial sector may contribute to this process. In order to capture these aspects, we have studied the attempts made by VGU to implement an innovative idea in order to enhance their organisational capabilities. In order to analyse the empirical material, a translation perspective and the travel of ideas framework was used as a theoretical lens. As the idea of using AR and VR-technology in their given context stemmed from the social interaction within the industrial sector, the translation of the idea into their given context includes an ambiguous combination of mimesis as well as differentiation as they attempt to conform to shifts in the industry while simultaneously translating fashionable technologies into their distinct context. This entails that within the industrial sphere, and specifically within the relatively homogeneous automotive industry, firms, as 'receivers' of ideas, legitimize imitation and the adherence of organizational fashion due to rationales of modernity and competitiveness in their markets and society as a whole - both through fears of being left behind and to be seen as innovators. A key notion for the spread of an idea was through social processes and industrial gatherings (such as exhibitions or trade associations), primarily made up of a homogenous network of actors.

The second aim of this paper was to analyse how innovative ideas are stabilized within the organisation. Our findings have shown that the spread of an idea can be analysed through the lens of the travel of ideas framework, but that the re-embeddedness of an idea into a new context is heavily reliant on the active attention, knowledge and experience of the actors who seize the idea and attempt to implement it within their context. This slightly contrasts the travel of ideas framework, in that additional emphasis is put on the individual actor(s) and their capabilities, rather than viewing them as a collective or network. Our paper therefore draws on the framework of institutional entrepreneurship in order to expand on the importance of having

actors who understand the underlying reasons for successful actor network-creations happen. In the case of VGU, the experience and mental frameworks of the project team may have been detrimental to the adoption of the idea, as they failed to successfully retain allies to support the concept they proposed, and there were no industry affiliates to mimic, placing the idea in a 'limbo'-like state, where the adoption failed to progress - yet is not discarded. An important aspect in the translation of an idea, specifically if it does not solve a clearly defined problem or is market-driven, is that new technology applications need to be 'fun' and interesting, and that actors who attempt to mobilize other actors to support it need to put a great deal of thought into the first iteration of the concept - as it can make or break the idea. Having an idea or project in a 'limbo'-like state may be economically detrimental to a firm yet maintaining the knowledge and experiences of such projects is important for future adoption - especially if it involves technologies that mature quickly. By analysing failed experiments conducted in the past, the firm can successfully assign future projects to the right set of actors once the technology or market conditions may have changed, as well as learning why some applications may fail, such as the importance of the project team and the first iteration of a concept.

A clear limitation with this paper is the timeframe during which the study was undertaken. As the first iteration of the ideas and the first introduction of the technologies happened several years prior to the study, these interactions are all subject to the interviewees recollection of events, which may be fragmented or subjective. As we have studied the political struggles and negotiations of introducing an innovative idea, there is a limitation in using mostly second-hand information and not experiencing the negotiations in real time. For these reasons, and due to the fact that the introduction of these technologies has been a lengthy process spanning several years, a longitudinal study would capture these intricacies more accurately. In line with industrial fashion cycles, a case study which analyses several different firms who are in the process of adoption similar technologies may provide additional insight into how and why ideas travel and are adopted by firms within the same industry at similar points in time. Furthermore, we suggest that researchers could explore the link between the problematization phase of innovation and individual actors' past experiences and knowledge of innovation processes in order to better understand what factors constitute successful problematization, as well as what role certain actors, the technology, and the market as a whole contributes to innovation work. Another research topic which may be of interest to managers is the concept of ideas that end up in 'limbo'. Focusing on failed, or 'stale' projects could provide valuable insight for project managers and organizations in how they can adopt practices which may enable organizational actors to better handle innovation processes.

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