Accelerating Open Digital Innovation in the Automotive Industry: Action Design Research in Progress

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Abstract

As digital technology becomes embedded in the core of customer offerings, companies find themselves being part of dynamic networks and must develop more open and distributed innovation processes. However, important and mature industrial domains, such as the automotive sector, find it difficult to fully utilize digital technologies due to closed innovation processes. Therefore, automotive companies try to attract external software developers by establishing new organisational forms for open digital innovation. Yet, the understanding of the problems that the organizational forms are expected to solve, how the organizational interventions should be designed and their effects on digital innovation are uncertain. Therefore, our goal is to contribute with knowledge of how the automotive industry can accelerate digital innovation by mindfully selecting and designing appropriate organisational interventions for open digital innovation. In this research in progress paper, we present a two-year action design research project and contribute with initial empirical results on the problems with open digital innovation in the automotive industry, a comparison of organizational forms for open digital innovation, based on a literature review and an assessment of the organizational forms' potential to overcome the problems. The next step is to perform a structured literature review, and to design and implement an organizational intervention to facilitate a first iteration of externally initiated innovation cases.

Keywords Open innovation, digital innovation, automotive industry, innovation organization, action design research.

1 Introduction

In the automotive industry, digital innovation could generate radical improvements in terms of sustainability, efficiency and safety. For example, autonomous driving, mobility services and new powertrain concepts are dependent on digital technology. However, leading vehicle manufacturers, or OEMs (Original Equipment Manufacturer), and Tier1 suppliers are slow in utilizing digital technology and challenged by new market entrants. For example, Tesla has challenged manufacturers of conventionally fuelled vehicles by introducing fully electric vehicles. And the 450-engineer strong software company Mobileye with software for autonomous driving, was recently bought by Intel at a price like the market value of car manufacturers as Peugeot and Suzuki[1] with thousands of engineers each. Despite the potential with digital technology in the automotive industry, in a recent rating of the 50 companies that best combine innovative technology with an effective business model, only two automotive companies made it: Tesla and Daimler, on number 31 and 46 respectively (MIT Technology Review 2017).

To better take advantage of the opportunities that digital technology brings to product innovation, automotive companies try to attract external software start-ups and creative programmers by organizational interventions. E.g. BMW has established the Start-Up Garage and Mercedes-Benz has launched the Mercedes-Benz Challenge. But research is limited on the problems these interventions address, how they should be designed and their effects on digital innovation. To close this gap, our goal is to answer the following research question:

How can innovation be organized in the automotive industry to utilize the external opportunities brought by digital technology while keeping the internal strengths of its current innovation practices?

We use action design research, in collaboration with senior employees from two OEMs, three Tier 1 suppliers, and several external software developers. At this early stage in our research we contribute with: I) empirically grounded knowledge about the problems for open digital innovation in the automotive industry. II) a comparison, based on a literature review and a document study, of organizational forms for open digital innovation. III) an assessment of the organizational forms' potential to overcome these problems, to serve as a basis for a future design of an organizational intervention to make current innovation practices more open, to make better use of the properties of digital technology in automotive products.

The paper is organized as follows. In the following section, an extended background is provided to anchor the problem in practice as well as in theory. In section three, the research approach is described. Empirical results from the problem investigation is presented in section four and emerging organizational forms of open digital innovation are compared. In section five, an assessment of the potential of these organizational forms is presented, and in section six the results are discussed and the paper concluded with suggestions for next steps.

2 Extended Background

The extended background provides a presentation of barriers to digital innovation in the automotive industry and a comparison of emerging forms for organizing digital innovation involving external software developers.

2.1 Barriers to Digital Innovation in the Automotive Industry

The unique properties of digital technology and the structure of digital products enable new types of innovation processes that are rapid and difficult to control and predict (Nylén and Holmström 2015). By separating the logic from the physical form, a digital device can provide many reprogrammable functions (Yoo et al. 2010; Yoo et al. 2012). This is referred to as generativity and makes digital solutions versatile and flexible. Also, by representing data in a uniform way, a digital device can handle any type of data (audio, video, text, image). This, so called convergence, means that a single digital device can provide new affordances that each used to require a separate tool or service. Convergence also means that digital technology can be embedded in non-digital products, such as cars, making them "smart". Finally, digital technology is self-referencing, meaning that digital innovation requires digital technology. The effect is that diffusion of digital technology increases and entry barriers in terms of knowledge and investment cost are lowered. These unique properties require a product structure that is both modular and layered (Meyer and Webb 2005). A modular and layered product structure makes it possible for digital products to remain fluid and open to new meanings. Hence, it promotes a doubly

[1] www.forbes.com/global2000/list/#header:marketValue_industry:Auto%20%26%20Truck%20Manufacturers

distributed organization logic (Yoo et al. 2010) which leads to that companies find themselves being part of intricate business ecosystems (Olsson and Bosch 2014) and must develop more open innovation processes (Chesbrough 2003). The organization logic is distributed because value creation comes from a mix of heterogeneous resources, including open source development and third-party developers (Boudreau and Lakhani 2009), and organizations partner and compete at various layers of the architecture. Also, it is double since the control over components is distributed across several companies and the knowledge is distributed across different disciplines and communities.

An automobile is becoming a computing platform for networks, services and content (Henfridsson and Lindgren 2010) as most subsystems of a vehicle is digitized and digitally integrated, through e.g. the AUTOSAR standard (Fürst et al. 2009). Although the opportunities for digitally enabled automotive functions and products are startling, several challenges arise when the mature, capital-intensive and asset-based automotive industry meets the high-paced and networking software industry (Dodourova and Bevis 2014). Traditionally, innovation in the automotive industry is closed (Ili et al 2010), with a high focus on IP rights and organized according to a stage-gate process (Cooper 2000). It builds on the far-reaching division of the vehicle in well-established subsystems and on the shared responsibility for innovation between vehicle manufacturers and suppliers (Cabigiosi et al. 2013). The automotive industry is characterized by a strong vertical knowledge flow between component suppliers and vehicle manufacturers (Köhler et al. 2013) and 75 % of manufacturing is carried out by suppliers (Wiesenthal et al. 2015). This division is favourable from a production perspective and innovation processes are designed to support the industrialization of ideas in a so-called performance engine (Govindarajan and Trimble 2010). The performance engine shapes the company into a successful business if the technical innovations are limited and remain within the confines of the vehicles and the subsystems. But at major technology shifts, that affect several of the vehicles' subsystems at the same time, the strict organizational division and the previously successful performance engine impedes and discourages innovation and renewal. Simply put, vehicle manufacturers are strong in operational development but weak in organization-wide and cross-functional innovation management.

Standardization of the interfaces between the subsystems, or modules, of the vehicle reduces complexity (Baldwin and Clark 2000) and makes the vehicle more integrated. It increases the OEM's responsibility for innovation of the entire vehicle and makes it easier to change suppliers of different subsystems. So, the introduction of AUTOSAR and similar standards for digital technology in vehicles supports modularization, but so far it doesn't support the modular layered structure of digital products. Attempts to develop layered architectures for vehicles (VANET) has not yet been successfully implemented in end-products (Kaiwartya et al. 2016). Hence, the current vehicle product structure is a barrier to doubly distribution of innovation where knowledge is distributed across other disciplines. For example, today it is not possible for software suppliers to provide vehicle owners with digital services, without the services being approved through the stages of the formal stage-gate development process of the car manufacturer. Hence, the OEM acts as a gate-keeper for innovation.

2.2 Organizational Forms for Open Innovation of Digital Technologies

Recently different organizational forms have emerged for organizing innovation of digital technologies with external software developers: Innovation Contest, Innovation Garage, Business Accelerator and Venture Hub. These forms possess complementary features and may be viewed as similar at a first glance. After all, Innovation Contest and Innovation Garage tend to facilitate the growth of novel products from idea to something tangible. Business Accelerator and Venture Hub aim to support promising innovative ventures to reach markets. Innovation Garage certainly is similar both to Innovation Contest and Venture Hub, as they all provide resources and facilities to propel innovation. Like them, Business Accelerator also aims to help promising ventures in the process of formation. However, these forms differ in several ways and the most fundamental difference is the anticipated output. Using anticipated output as the primary anchor, Table 1 displays the differences between the four forms for organizing open innovation of digital technology.

	Innovation Contest	**Innovation Garage**	**Business Accelerator**	**Venture Hub**
Anticipated output	Digital prototype that adhere to organizational goals (Hjalmarsson & Rudmark 2012).	Proof-of-concept demonstrating e.g. customer value (Chansanchai 2016)	Mature and funded business venture (Cohen 2014).	Expanded business ecosystem with a win-win situation (Styhre & Remneland-Wikhamn 2016).

Innovation stage	Early: from idea to prototype (Hjalmarsson et. al. 2017).	Early to mid: from prototype to proof-of-concept (Chansanchai 2016).	Mid: from team to business venture (Malek et al. 2013).	Late: from venture to market growth. (Styhre & Remneland-Wikhamn 2016b)
Goal	Boost external development of new innovative prototypes that adhere to organizational goals (Hjalmarsson & Rudmark 2012) by providing a prize to the winner.	Scout and experiment with new technology; either driven within (e.g. Microsoft Garage) or outside the hosting company (e.g. BMW Garage). (Berry 2016)	Stimulate external ventures to rapidly grow and launch products (von Briel 2014).	Facilitate matchmaking between venture companies and hosting company (Styhre & Remneland-Wikhamn 2016).
Key benefits	Access to needs, structured and rapid prototyping, defined awards (Hjalmarsson et al. 2017).	Access to development resources, service development process, access to experts, customers and coaches (Chansanchai 2016).	Reduced time to market, access to specific networks and support, in-depth education (von Briel 2014).	Sharing of expertise and know-how, reduced costs and time to develop market ready products (Styhre & Remneland-Wikhamn 2016ab).
Support level and type	Low to Medium: open platform/data, general coaching, prototype evaluation and feedback (e.g. by an expert jury) (Hjalmarsson et al. 2017).	Medium to High: platform and outlet for small scale innovation within or outside the hosting company (Kasanmascheff 2017).	High: education and in-depth coaching (von Briel 2014).	Low to Medium: networking, general coaching and access to facilities and tools. (Styhre & Remneland-Wikhamn 2016a)
Innovator	From all (public, companies, start-ups), to restricted participation (by initiation) (Hjalmarsson et al. 2017)	Internal employees (Chansanchai, 2016) or external start-ups (Berry 2016).	Start-up ventures consisting of small teams (Malek et al. 2013; Cohen 2014).	Growth product small and mid-sized enterprises. (Styhre & Remneland-Wikhamn 2016b)

Table 1. Comparison of organizational forms for stimulating innovation of digital technology.

2.2.1 Innovation Contest

The Innovation Contest's (e.g. Hackathon and Innovation Challenge) focal *anticipated output* is the transformation of an idea into a prototype (Hjalmarsson & Rudmark 2012). Innovation Contests are often organized to stimulate the early stages of innovation (Hjalmarsson & Rudmark 2012). For example, Volvo Car Challenge and Electricity Innovation Challenge both had the ambition to stimulate external developers to come up with ideas for solutions and to represent these ideas in workable prototypes. However, it has so far proven hard for external software developers to implement their digital innovations in the end-products as they face multiple barriers after the innovation contest (Hjalmarsson et al. 2014). From the organizer's perspective, the main goal with a contest is to boost external development that adhere to the organizer's contest objectives. Organizers often provide an open platform or open data that facilitate development; in addition to this general coaching, assessment and evaluation (Hjalmarsson et al. 2017). Open digital innovation contests may be open to everyone, but could also be restricted to developers that have been attracted or even invited to participate.

2.2.2 Innovation Garage

The anticipated key output from an Innovation Garage, originally coined as a format by Microsoft in 2013, is a concept that has been proven, e.g. in terms of customer value and viability (Chansanchai 2016). The difference between an Innovation Garage and an Innovation Contest is thus that a software prototype is not the result in an Innovation Garage. Instead, an Innovation Garage addresses both early and mid-stages in the innovation process as the Innovation Garage often includes activities to propel ideas, facilitate rapid prototyping and conduct validation studies. Within the automotive industry, several examples of Innovation Garage have emerged, such as BMW Startup Garage, Renault Cooperation I-lab, Daimler and Mercedes Benz Startup Autobahn, and Jaguar Land Rover Tech Incubator, where vehicle companies work to attract external developers to engage in digital innovation. These concepts often include a single point of contact for external developers and boundary resources such as APIs, terms-of-use, other facilitating tools and an outlet for the outcome of the process (Chansanchai 2016). The required level of support in such initiatives is thus medium to high, which is higher compared to the demand for engagement from an organizer of an Innovation Contest. This as the utilized digital platforms require more engagement from the organizer to be valuable for the innovators. Platforms are central to distributed service development as they enable organizations to transfer design capabilities to external actors (Peng et al. 2014). Platforms provide, for example, standards (such as APIs) and digital resources (often referred to as Software Developer Kits). One example is Google's developer platform for the mobile operating system Android, which supports developers in the design and development as well as the distribution and marketing of digital products.

2.2.3 Business Accelerator

The output from Business Accelerator and Venture Hub (see section 4.4) differs significantly from Innovation Contest and Innovation Garage as it moves from product evolvement to business venture and business ecosystem innovation. The expected outcome of a Business Accelerator is a mature and funded business venture (Cohen 2014). Compared with the other three forms, the objective in the Business Accelerator requires a high degree of engagement from the hosting organizations and partner stakeholders. The aim is to nudge the innovator, participating in a Business Accelerator, from being a team with an idea or product, to a business venture credible to receive venture funding to scale-up the business (Cohen 2014). This requires education and in-depth coaching which in turn entails high degree of engagement by the hosting organization (von Briel 2014). There are not many business accelerators with a focus on the automotive industry, one exception is the Detroit based Techstars Mobility.

2.2.4 Venture Hub

The anticipated output from a Venture Hub, is an expanded business ecosystem through a win-win situation for both the venture and the company hosting the Venture Hub (Styrhe & Remneland-Wikhamn 2016ab). Companies accepted into a Venture Hub consist of entrepreneurs that have evolved into a small or mid-size growth enterprise (Styhre & Remneland-Wikhamn 2016b). To be admitted to a Venture Hub, these SMEs consequently are positioned in the latter stages of the innovation process, and have emerged into a mature business venture. The need for active support from the Venture Hub host is thus low to medium, and is materialized on one hand in access to tools, key experts or facilitates, and on the other hand access to an established network of experts and potential funding organizations (Styhre & Remneland-Wikhamn 2016a).

3 Research Approach

The research and innovation project SHOP, connecting Software and Hardware Opportunities to Performance engines, is an R&D project scheduled to last for two years[2]. It involves two prominent OEMs (Volvo Car Group and Volvo Group), three Tier1 suppliers (Ericsson, Autoliv and Combitech), several software suppliers and a research institute (RISE Viktoria). The goal of the project is to develop, implement and evaluate a new organization to connect externally initiated digital innovations to the core products developed by the OEMs. It is a response to the problem situation experienced by the partners, where they find it difficult to absorb and coordinate externally initiated innovation of software functions in the areas of e.g. autonomous driving, electric motors and mobility services. Hence, the new organization will be used to unlock the OEMs' organizational borders to external software developers and to facilitate outside-in and collaborative types of open innovation (Gassmann and Enkel 2006). Innovations can refer to products as well as manufacturing processes. As digital technology is the basis for innovation, we refer to this as open digital innovation (Hjalmarsson et al. 2017).

The organization will be co-owned and shared, through a legal agreement, by the partners. It includes a physical space, rules for financing, a work process and a digital platform for building and testing software. The role of the research institute is to collaborate with the partners to identify problems to open digital innovation in the automotive context, build the organization, implement the organizational intervention and evaluate the new organization. From a research design continuum, the research could be viewed as organization dominant (Sein et al. 2012). However, the intervention involves the design of an advanced digital platform and the aim of the intervention is to stimulate digital innovation, i.e. software based innovation, in vehicles. Therefore, it is somewhat difficult to position the research design along the continuum suggested by Sein et al. (2012).

[2] SHOP is partly funded by Sweden's innovation agency Vinnova under agreement number: 2016-03189.

To reach the project's objectives and to answer the project's research question, we have chosen the Action Design Research method (ADR; Sein et al. 2011) as the overall approach to structure the two-year collaborative project. ADR, as a research method, is unique in that it supports organizational and technological development and provides support for solid research. ADR has been developed to address a problem situation that has arisen in a specific organizational context through intervening efforts and evaluation of these efforts, and partly to design and evaluate an organizational and technical solution that corresponds to the category of problems typically encountered in the IS field. ADR fits well in this project because the project's goal is to develop and evaluate a new organization for digital innovation in collaboration between industry and research partners. In the steps advocated by ADR, additional research methods have been used, e.g. for data collection and analysis.

Sein et al. (2012) suggest ADR to be conducted in four steps: 1. Problem Formulation, 2. Building, Intervention and Evaluation, 3. Reflection and Learning and 4. Formalization of Learning. The research status reported in this research in progress paper, is that we have theoretically and empirically investigated problems (Step 1) and theoretically investigated potential designs for the organizational intervention (a first iteration in Step 2).

3.1 Stage 1. Problem Formulation

To investigate the perceived problems in innovation of digital technologies in the automotive industry, we used the nine first steps in Guba & Lincoln's methodology of fourth generation evaluation (Guba & Lincoln 1989). To collect information about the problems we performed a review of literature and documents, and conducted several interviews and workshops with involved stakeholders. The respondents represent OEMs, Tier 1 suppliers, and digital product providers. In total, 18 interviews and six workshops were conducted from Nov 2016 to March 2017. The interviews were semi-structured and based on a set of common questions. Twelve representatives from OEMs and Tier 1 suppliers were interviewed, followed by interviews with six representatives from digital product providers. The workshops lasted for two hours and were organized around different topics with the aim to describe current innovation practices and to identify problems associated with digital innovation. The workshops included representatives from the two OEMs and the three Tier 1 suppliers participating in the project. The interviews were recorded and transcribed while the workshops were documented using notes by three separate researchers. The notes were then combined into a shared documentation. 20 problems were sorted out by the two researchers working in pair to analyse the collected data, and evaluated in terms of temporality and affected actors (Guba and Lincoln 1989). The problems were categorized according to themes discovered through thematic analysis (Braun and Clarke 2006), and jointly evaluated and refined during the six workshops.

3.2 Stage 2, Iteration 1: Building, Intervention and Evaluation

To build a foundation for designing the new organization, literature and practice documents were reviewed. Four different organizational forms for stimulating open digital innovation were identified, and then compared and described using a checklist matrix format following the guidelines provided by Miles & Huberman (1994). The potential abilities of the four different organizational forms to cope with the 20 identified problems were then assessed using the knowledge developed in the comparison, and displayed as a thematic conceptual matrix (Miles & Huberman 1994). The assessment was carried out by qualitatively investigating whether a certain organization form would cope with a certain problem. For each problem and each organization form, an informed argument was formulated, by two researchers working in pair, whether an organization form would cope with a certain problem.

4 Stage 1: Problems with Externally Initiated Open Digital Innovation in the Automotive Industry

The identified problems are presented in Table 2. For each problem, temporality is indicated by positioning when the problem occurs in the innovation process: early, mid or late. Also, affected actor is indicated: OEM, Tier 1 supplier (T1) and External Developer (ED).

Innovation process	**Leadership and organization**	**Product marketing**
1. Closed and top-down Technology Planning Process (OEM, T1; early/mid) 2. Time-consuming development process (OEM, T1, ED; early/mid) 3. Costly development process	9. Lack of knowledge about digital technologies and digital innovators (OEM; early/mid/late) 10. Inadequate ability to develop and attract digital skills (OEM, T1; early/mid/late) 11. Internal resource availability, priori-	16. Restrictive assessment of the market for digital products, easier to say no than to say yes (OEM, T1; mid) 17. Fear of losing control of the product (OEM;

(OEM, T1, ED; early/mid/late) 4. Fear of disclosing information about development needs (OEM, T1; early/mid) 5. Not invented here syndrome (OEM; early/mid/late) 6. Closed IP processes (OEM, T1; mid) 7. Fear of idea being stolen (ED; early) 8. Extensive and costly IP process (ED; mid)	tization (OEM; early/mid) 12. No clear interface between the TPP and advanced software innovations that cross functional and organizational boundaries (OEM, T1; mid) 13. Complex internal decision-making process involving several functions (OEM; early/mid) 14. Low level of support and commitment from OEM to external development, except to T1 (ED; mid) 15. Fear of exclusive relationship with OEM disappears (T1; mid/late)	mid/late) 18. Difficult to reach and understand the market (ED; early/mid) 19. Demanding and costly business relationship with OEM and T1 (ED; mid/late) 20. Difficult to share mature prototypes with other developers (ED; mid)

Table 2. Identified problems, affected actors and temporality in current innovation practices.

To a large extent, the empirically identified problems confirm the problems found in literature and discussed by e.g. Dodourova and Bevis (2014), Ili et al. (2010), Kaiwartya et al. 2016 and Cabigiosi et al. (2013). Problems in the innovation process are related to it being closed with a high focus on IP rights and scepticism against external developers. There are also fears of disclosing information about product needs to external developers and fears of ideas being stolen. Problems in leadership and organization of innovation are related to the established division of responsibility between OEM and suppliers (Köhler et al. 2013; Wiesenthal et al. 2015; Govindarajan and Trimble 2010), resulting in an inability to collaborate with external software developers and to lead innovation that crosses organizational boundaries. However, the empirical investigation also identifies problems related to product marketing not previously found in literature, where OEMs tend to be restrictive to digital products, act as gatekeepers to the automotive market and difficult to collaborate with for external developers.

5 Stage 2: Selecting Organizational Form to Cope with Innovation Problems

To address the identified problems of open innovation in the automotive industry (Table 2), we assess the potential of the organizational forms presented in Table 1: Innovation Contest (IC), Innovation Garage (G), Business Accelerator (BA) and Venture Hub (VH). The result of the assessment is presented in Table 3.

Problem	IC	G	BA	VH
1. Closed and top-down Technology Planning Process (TPP)		x		
2. Time-consuming development process	x	x		
3. Costly development process	x	x	x	
4. Fear of disclosing information about development needs	(x)	x	x	
5. Not invented here syndrome		x	x	x
6. Closed IP processes			x	x
7. Fear of idea being stolen	x	x	x	x
8. Extensive and costly IP process		x	x	
9. Lack of knowledge about digital technologies and digital innovators	x	x	x	x
10. Inadequate ability to develop and attract digital skills to meet development needs in autonomous driving, active safety	x	x	x	x
11. Internal resource availability, prioritization	x	x	x	
12. No clear interface between the TPP and advanced software innovations that cross functional and organizational boundaries		x	x	
13. Complex internal decision-making process involving several functions		x	x	
14. Low level of support and commitment to external development, apart from for T1		x	x	
15. Fear of exclusive relationship with OEM disappears		x	x	x
16. Restrictive assessment of the market for digital products, easier to say no than to say yes		x	x	x
17. Fear of losing control of the product				
18. Difficult to reach and understand the market	x	x	x	x
19. Demanding and costly business relationship with OEM and T1		x	x	x
20. Difficult to share mature prototypes with other developers				

Table 3. Assessment of how the organization forms cope with the problems. An x indicates a potential of coping with the problem, (x) to some degree, and a blank indicates no potential.

The result of the assessment is that the Innovation Garage and the Business Accelerator have the potential to cope with most of the identified challenges. We also find that a combination of Innovation Garage and Business Accelerator would cope with more challenges, for example the Innovation Garage has the potential to synchronize with a closed and top down technology planning process and the Business Accelerator has the potential to cope with a closed IP process. However, there are still some challenges that are not met by any of the organization forms. External developers' fear of losing control of their product is not managed by any of the forms, nor is external developers' wish to share mature prototypes with other developers. Hence an organization aiming to better support open innovation in the automotive industry should also take these problems into consideration. For example, a digital platform used to support external developers could be enhanced to also include options to share prototypes, like the functions of Github[3].

6 Discussion

In this research in progress paper, we discuss open digital innovation in the automotive industry. The context is the establishment of an organisation hosted and owned by a consortium of OEMs and Tier 1 suppliers to attract digital technology developers and link a selected number of developers to the appropriate internal innovation process within the consortium. The innovation and research project has as objective to design and implement such organization within its two-year lifetime. At this early stage, in our research, we contribute with: I) empirically grounded knowledge about the challenges for open digital innovation in the automotive industry. II) a comparison, based on a literature review and document study, between organizational forms for open digital innovation. III) an evaluation of the organizational forms' potential to overcome these challenges.

We find that a combination of Innovation Garage and Business Accelerator copes with most of the problems faced by the OEMs, Tier 1 suppliers and external developers involved in the study. It is somewhat surprising that the Innovation Garage and Business Accelerator display comparable abilities to cope with similar problems. Yet, problems that are not overlapping are that a Business Accelerator does not work appropriately to open a closed and top-down driven technology process. It does not either, in a sufficient way, facilitate a rapid development process as the purpose of a Business Accelerator is rather to shape a business structure than speed-up technology development. Both these problems are however targeted by the Innovation Garage form. The Innovation Garage, however, lacks in openness when it come to IP processes, which both the concept of Business Accelerator and Venture Hub does. Venture Hub and Innovation Contest cope with too few of the problems to be relevant. However, within the operation of a future open digital innovation organization, contests may be included as a part of the operations. Also, participants may be co-working and sharing which are key features of a Venture Hub. In short, to attract digital technology developers, and link a selected number of developers to the appropriate innovation process of an OEM or Tier1 supplier, a new organisational form combined with features from the Innovation Garage and Business Accelerator is proposed.

The analysis is however still in its infancy and the next step is to perform a structured literature review and to develop and implement the intervention. In the coming months, a first version of SHOP will be designed in detail, staffed and implemented to handle a first iteration of externally initiated cases. Using the experiences from the first iteration as a basis for research, the project is then better positioned to evaluate how open digital innovation practices may help to accelerate digital innovation in the automotive industry. Also, it will provide a foundation for a second design iteration and to build knowledge about the problems and barriers to digital innovation encountered by different actors as well as an analysis of the underlying institutions of the automotive field causing these problems.

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