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The changing role of IP

A case study of open innovation in automotive

Master's thesis in the Master's Programme
Entrepreneurship and Business Design

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SUMMARY
Firms are turning the focus from production equipment and machines to management of information and knowledge, with the entrance into the fourth industrial revolution. This evolution poses new types of challenges, but also provides opportunities. In combination with this paradigm shift, many industries are experiencing converging technologies with ICT companies entering into new application areas. This has been especially evident in the automotive industry. One strategy is to collaborate with these new actors through open innovation. However, the capability to manage and trade knowledge is less established at the OEMs. That is why this capability needs to be developed. The IP function is already used to work with intangible assets and might play a central part in this transformation.

This study aimed to understand the role of IP management in projects where an OEM incorporates an innovative technology by collaborating with an external actor. This was done through a multiple case study of two collaboration projects at Polestar, with data from 12 interviews and project documents. The two case studies were very different, which highlights the need to adapt the IP management to the specific conditions of each project. However, the result showed that one of the main objectives of IP management was to assemble the parties resources and construct a framework that allocates the project results. This role is explored in the literature, while the results from this study provide an additional perspective on how IP management can be adapted to fast-paced environments and start-ups with limited time and resources. One of the main findings was that a cross-functional team consisting of IP, business and technology expertise would manage any IP at the time it is created in the project. By agreeing on the basic principles for allocating IP results, at the start of the project, some elements of the IP management can be pushed to the future. This setup allocates the team's time and resources to the projects generating the most IP.

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Keywords: IP management, Open innovation, Collaboration, R&D, Patent, Automotive.

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Glossary and Abbreviations

IA *Intellectual Asset*
ICT *Information and Communication Technology*
IP *Intellectual Property*
IPR *Intellectual Property Right*
OEM *Original Equipment Manufacturer*
PR *Project Result*
R&D *Research & Development*
OS *Operating System*
VCC *Volvo Car Corporation*

Legal framework
The rules, responsibilities and institutions governing the behaviour of actors are central to optimal resource management (Natural Resource Governance Institute, 2015).

Knowledge
Knowledge will in this study be used as a broad term covering intangible assets such as technology, information, capabilities, instructions, software, know-how, know-what, software etc.

Background Knowledge
Knowledge relevant to but produced before a collaborative venture (Granstrand, 2001).

Foreground Knowledge
Knowledge relevant to but produced within a collaborative venture (Granstrand, 2001).

Sideground Knowledge
Knowledge relevant to but produced simultaneously but outside a collaborative venture (Granstrand, 2001).

Postground Knowledge
Knowledge relevant to but produced after a collaborative venture (Granstrand, 2001).

Intellectual Capital
Knowledge that can be used to create value.

Intellectual Assets
Codified knowledge that can be used to create value.

Intellectual Property
Legally protected intellectual capital.

Resources
Include assets, capabilities, knowledge, technology etc.

IP Management
Everything that relates to managing intellectual property. It does not necessarily have to be performed by an IP manager or the IP function.

Complementary assets
The concept of complementary assets implies that the assets are more valuable when combined than in isolation.

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1. Introduction

The section will describe the background situation leading up to the research problem, the purpose of the research and specific research questions.

1.1. Background

While the fourth industrial revolution is gathering speed, firms are increasingly turning their focus from tangible assets like machines and production plants to the management of knowledge and information. This paradigm shift poses new types of challenges but also creates opportunities for new types of firms, business models, and ecosystems. This evolution is embodied in the fact that intangible assets made up about 17% of the S&P 500's total market value in 1975, in comparison to 87% in 2015 (Ocean Tomo, 2015). As a result, firms in knowledge-intensive environments will have to adapt to the new reality by developing strategies and capabilities on how to manage their intellectual capital and acquire new knowledge.

Furthermore, many industries are experiencing a convergence of technologies with information communication technologies (ICT) entering into new industries. One example is the development of the internet of things (IoT) in application areas such as smart cities, smart homes, and connected vehicles. The converging technologies are especially evident in the automotive industry, which is being profoundly affected by disruptive trends such as electrification, autonomous driving, diverse mobility, and connectivity (Beiker et al., 2016; Bogers et al., 2019). The automotive industry has traditionally been dominated by a few large original equipment manufacturers (OEMs) that have built economic moats by being heavily integrated into the value chain (Stuckey & White, 1993). However, these new disruptive technologies have created a space for high-tech companies and innovative start-ups to enter the market (Beiker et al., 2016). OEMs will also be needed in the future, but they will have to find ways to incorporate the new technologies into their cars. Otherwise, the traditional OEMs could risk being replaced in the value chain by these new actors in something described by Schumpeter (1942) as *the gale of creative destruction*. This phenomenon has historically seen large incumbent firms fail and be replaced by innovative start-ups.

Instead of competing with these new actors using internal R&D, an alternative approach could be to collaborate. New technologies could be introduced to the car by combining the company's internal assets with complementary external assets. While most purchasing departments are used to dealing with tangible assets, the capability to deal with knowledge is not as commonly established. It is not a simple task since knowledge by nature is non-rival and to some extent non-excludable and hence could be considered an impure public good, making it challenging to trade (Stiglitz, 1999). The function that potentially could be best suited to face this challenge might be the IP function, which already has the experience of working with intellectual assets. However, being a knowledge broker in these collaborative environments is different from the traditional function of IP management, and the role must, therefore, be expanded.

1.2. Purpose

The purpose of this multiple case study was to investigate the role of IP management in open innovation by exploring how a start-up in automotive engages in collaboration projects with the ambition to incorporate external technology. The research was done through a multiple case study of two projects at Polestar. It was especially important to understand the role of each involved party, how the project was governed, and how the flow of knowledge was managed. The results aim to provide insights and recommendations on how companies can access new technologies through open innovation. Furthermore, the study contributes to the research fields of IP management and open innovation with practical insights on how firms are managing their IP when incorporating external technology through open innovation.

1.3. Research questions

To carry out the purpose of this study, the research was narrowed down into one main research question that was answered through two separate sub-question. Together, the questions intend to fulfill the purpose of this study.

Research question: What is the role of IP-management when incorporating new technology through open innovation?
This question aims to understand the IP management's role in sharing knowledge, distributing intellectual property, and creating value in the project.

Sub-question 1: What is the role of the involved parties?
The question aims to investigate the involved actors' role by examining what resources they have contributed with and what they hope to get out of the collaboration.

Sub-question 2: How is the project's legal framework structured?
This question aims to investigate how the projects were legally structured to share, transfer, and distribute intellectual assets.

2. Literature Review

The challenge for firms in the automotive industry to integrate new knowledge and technology could be solved through open innovation. In this thesis, the role of IP management in open innovations was studied. The thesis, therefore, aimed to contribute to the intersection of the research fields of open innovation and IP management.

The paradigm shift from an industrial economy to a post-industrialized economy is by Bell (1969) described as the change of focus from the production of goods into the production of knowledge and services. Drucker (1993) expands on this idea by claiming that the most valuable resource is no longer capital, land, or labor, but knowledge. The future value will, therefore, not be created from means of production, such as allocation of capital and labor, but from knowledge applied to production, resulting in increased productivity and innovation.

Even though there are some clear signs for the increasing focus of intellectual capital and production of knowledge (Powell & Snellman, 2004; Bollen et al. 2006), many scholars have highlighted the problems of transferring knowledge in the market (Arora, 1995). Some of the reasons for the market imperfection for technology licensing may arise from obstacles such as small numbers bargaining, asymmetric information, uncertainty, risk aversion, and transaction costs (Caves et al., 1983). However, knowledge could also be acquired through inter-firm collaborations. This phenomenon is not something new but has experienced an upshift in the literature ever since Chesbrough (2003) coined the term Open Innovation and described a paradigm shift towards openness. Furthermore, an article by Lichtenthaler (2008) identifies the IP department as a key informant in technology acquisitions due to the importance of patents in this setting.

Despite the increasing importance of intellectual capital in business, the IP function is in many organizations poorly integrated with the R&D and the business strategy (Fisher III & Oberholzer-Gee, 2013). The traditional way of managing IP involves patent prosecution and decisions between patenting, publishing or secrecy at the front end while managing patent discontinuation and legal enforcement at the back end (Holgersson & Wallin, 2017; Holgersson & van Santen, 2018; Soranzo, Nosella, & Filippini, 2016).

The closed innovation paradigm assumed that innovation could only be monetized through a product, and the sole purpose of IP was to exclude competitors from using the invention (Chesbrough, 2003b). Within the context of open innovation, the role of IP management has expanded into a structural tool to protect and share background knowledge while governing the project results (Manzini & Lazzarotti, 2015).

The fields of IP management and open innovation have, in recent years, attracted a lot of attention from practice and academia, with IP management in open innovation being a common topic (Huizingh, 2011; Holgersson & van Santen, 2018). While the interplay between IP management and open innovation is widely discussed in the literature, there is a lack of tools for practically managing IP in collaborations (Deschamps et al., 2013). One stream of IP management has approached this problem by providing a framework for differentiating between different types of knowledge and highlighted the IP disassembly problem (Granstrand, 2001; Bogers, 2011; Granstrand & Holgersson, 2013; Granstrand & Holgersson, 2014). The framework facilitates the management of IP in open innovation by providing a common language and highlighting a critical problem but does not explain how the legal framework practically should be designed.

3. Theoretical frameworks

The section describes the most relevant theory for providing an understanding of the analysis and discussion of the results.

3.1. Properties of Knowledge and Intellectual Property

The resource-based view of the firm describes how a firm's internal resources are affecting its performance by examining how characteristics of such resources build competitive advantages. Barney (1991) takes a holistic approach by defining the term resource very broadly and including all of the assets, capabilities, organizational processes, firm attributes, information, etc. that is both controlled by the firm and increases performance in any way. In the same article, he develops a framework describing the underlying properties of resources creating sustainable competitiveness as being *valuable, rare, imperfectly imitable,* and *non-substitutable*.

The concept of knowledge is usually divided into two different categories depending on whether it could be codified or not. It is described as *explicit knowledge* or *know-what* if it can be codified and *tacit knowledge* or *know-how* if it is not possible to codify, e.g. how to bike or recognize faces. The codability of knowledge affects the possibility to transfer or communicate certain knowledge, where explicit knowledge could be easily acquired by reading a book, or having a conversation while tacit knowledge often needs close collaborations, observation and coaching during a longer period of time. However, the distinction is not always withstanding, and by, e.g. translating know-how into a software script, the knowledge can be translated from being tacit to explicit.

As some knowledge, under particular condition arguably fulfils the criteria in Barnes framework, it could be considered a source of sustainable competitive advantage. At the same time, the properties of knowledge make it hard to trade or in any other way shared with external actors without losing the competitive edge, since secrecy and the inertia of trading know-how are the main mechanisms of preventing imitation. Hess and Ostrom (2007) are in their book analyzing knowledge as a commodity and discuss how knowledge often falls into the category of a public good since it is both non-rival and non-excludable. That means that more than one can know the same thing and not exclude someone else from using that knowledge. However, the intellectual property rights and control of complementary assets make knowledge excludable to some extent. Therefore, Stiglitz (1999) makes the categorization of knowledge more nuances by defining it as an impure public good.

Acknowledging that knowledge is a valuable source of competitive advantage while being complicated to appropriate the benefits from, the Intellectual Property Rights (IPR) plays an important role by introducing a right to exclude other from commercial use and hence making certain knowledge into a private good and much easier to trade, during a limited period of time. The IPRs are constructed to protect inventions, industrial designs, trade names and symbols, and creative work. To conduct this task, the system comprises the following IPRs.

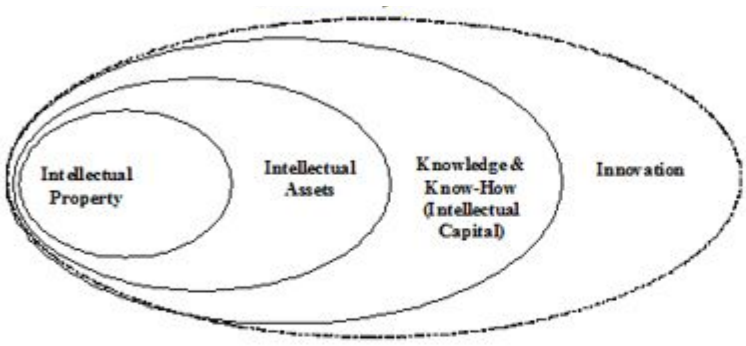


Fig. 1. Illustration of an innovation

Patent

Anyone that has made an invention that is new, inventive and industrially applicable could file for a patent. The patent gives its owner an exclusive right to commercially make, distribute or sell the patented solution for a maximum amount of 20 years from the filing date (PRV, 2020).

Conditions of patentability:

a) novelty; meaning that the invention is not disclosed in any prior art at the time of filing.

b) inventive step; meaning that it should not be obvious for a person skilled in the art to make the invention based on the previous art.

c) industrially applicability, meaning that the invention can be produced or utilized in any kind of industry.

In most legislations, there are exemptions for scientific theories, mathematical methods, plant or animal varieties, discoveries of natural substances, commercial methods or methods of medical treatment, which could not be patented.

Design Right

Design right relates to the visual appearance of an industrial product or handicraft item. In order to get protection, the item has to be original and non-functional, meaning that it must differ from the prior art while the exclusive feature must be of aesthetic nature and not a technical feature. The design right prohibits unauthorized copying and imitation of the product for a maximum of 25 years from the time first made public (WIPO, 2020).

Trademark
A trademark could be one or a combination of words, letters and numerals. It could furthermore be drawings, symbols or three-dimensional signs, such as the shape and packaging of goods. In some legislations, non-traditional marks can be registered such as holograms, motion, colour and non-visible signs such as sound, smell or taste (WIPO, 2020). The intellectual property right gives the holder an exclusive right to use the trademark.

Copyright
Copyright grants the creator of artistic or literary work protection for their work. The intellectual property right gives its right holder the exclusive right to its work. Copyright protection is obtained without registration, provided that the work is sufficiently original. Some examples of works that could obtain copyright are software, text, pictures, illustrations, and performances. (WIPO, 2020)

Trade Secret
A trade secret is a non-registrable IPR that protects valuable and secret information, which could be sold or licensed. For a secret to obtain trade secret protection, it has to fulfil the following criteria (WIPO, 2020b):

- Commercially valuable because it is secret
- be known only to a limited group of persons, and
- be subject to reasonable steps taken by the rightful holder of the information to keep it secret, including the use of confidentiality agreements for business partners and employees.

3.2. Open Innovation

The historically dominating strategy for innovating firms has been to invest in internal R&D and keep control of the innovation. This was done by preventing any ideas to leave the boundaries of the firm, hiring the brightest minds, being first to market with innovative solutions and reinvesting the profit into R&D in order to come up with new ideas. IP was considered as a tool to prevent imitators and force competitors to spend resources to invent around the patented solution. This strategy resulted in knowledge monopolies, dominated by several big firms and made it hard for any new entrants, which is by Chesbrough (2003) described as c*losed innovation*.

Closed innovation has been successful in the past. However, trends such as globalization, the emergence of the internet, increased mobility on the labour market, and the increasing presence of venture capital have changed the environment. Knowledge is now diffusing between firms, and new entrants are backed with venture capital. Innovation is happening everywhere, and knowledge monopolies are less influential. These trends have driven the paradigm shift to what Chesbrough (2003) describes as *open innovation*. The idea of open innovation is based on the same concept as Joy's law, which states that "no matter who you are, most of the smartest people work for someone else".

Instead of entirely relying on internal ideas, Chesbrough suggests that firms should take an open approach towards innovation by opening up the firm's boundaries and leveraging both internal and external ideas (Chesbrough, 2003).

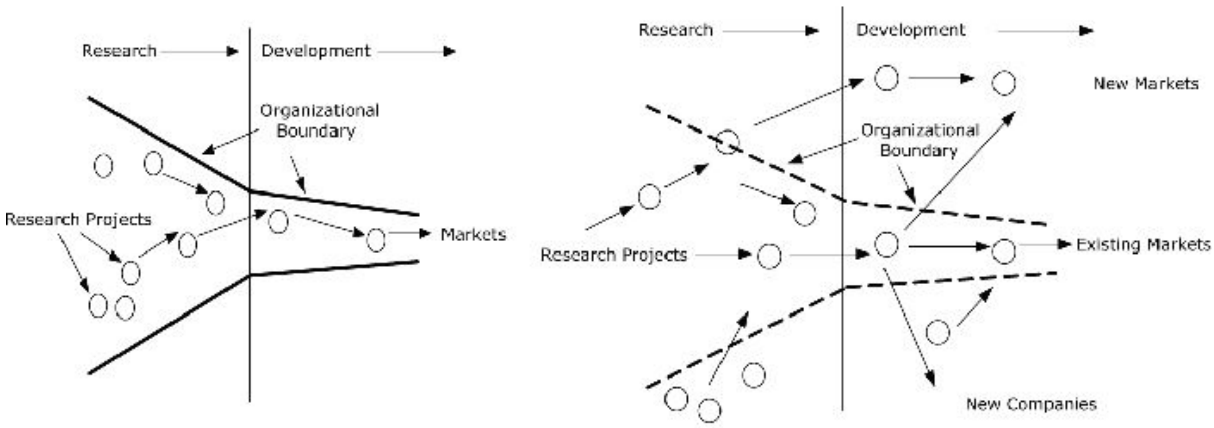


Fig. 2. The logic of closed innovation vs. The logic of open innovation (Chesbrough, 2003)

Dahlander and Gann (2010) further divide the concept into four different categories. They argue that open innovation could be either inbound innovation or outbound innovation, depending on whether it is an external idea that is utilized inside the firm, or if it is an internal idea developed inside the firm that is utilized elsewhere. Furthermore, the logic of exchange was divided between pecuniary and non-pecuniary, according to Table.1.

	Inbound innovation	Outbound innovation
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

Table.1. Dahlander and Gann's model of open innovation

By focusing on the acquisition of new technology, Ortiz-Gallardo et al. (2014) argue that it generally exists three different options. You could either develop the technology internally, engage in collaborative development, or internalize external technology. The same article goes on to develop a practical framework on how to succeed in the latter two types of technology acquisitions. The results from the study indicate that the three conditions having the most influence on the outcome of collaboration are the combination of *effective partnership management, effective execution of the co-development project,* and *effective transference of the technology to the recipient system in the acquiring firm*.

The categories are explained to consist of several factors and can be broken down further. A shared vision, trustful relation and agreement on the management of both existing and resulting IP are all part of effective management of the partnership. Furthermore, the quality of communication, R&D capabilities and maturity of the technology do all affect the efficiency of the execution. Lastly, the operations and processes of transferring technology determine the efficiency of technology transfer. The last category is described as especially complicated because of the inherent challenge of transferring knowledge. The technology must often be embodied into a product or process that fits with the acquirer's operations both technically and economically.

The logic of open innovation is that external R&D creates significant value, which, to some extent, can be captured by an internal R&D organization. That means that also the role of R&D is shifting towards a new rationale. The R&D organization is not only doing basic research but continuously scanning the environment for external knowledge that could generate value in the firm, integrate such knowledge and fill in the internal knowledge gaps with external knowledge. IP should no longer be statically kept within the company to prevent imitators but should be actively traded on the market to maximize the value (Chesbrough, 2003).

Furthermore, open innovation is focusing on innovating business models by claiming that finding the right business model is more important being first to market. That somewhat turns the focus away from competing with proprietary technology into competing on the amount of value created for the customer (Chesbrough, 2003).

Even though Chesbrough coined the concept in 2003, the phenomenon was not something completely new. Nelson and Winter (1982) described the firm's decision to search for external technologies, while Cohen and Levinthal (1990) wrote about the two faces of R&D. Granstrand, Bohlin, Oskarsson and Sjöberg (1992) presented a model presenting several different technology acquisition and exploitation strategies. What made the concept gain attention was that Chesbrough successfully gathered the ideas under one term.

3.3. IP management and Contracting in Open Innovation

One of the main challenges with collaborative development occurs when the project is coming to an end, and it is time to distribute the results among the involved parties. This is by Granstrand and Holgersson (2014) described as the *Intellectual Property Disassembly Problem.* It has already been discussed how knowledge, if not protected by IP, by its nature, is non-rival and non-excludable and therefore by default free to distribute and commercialize by all involved parties. This might not be desirable and hence require a legal framework of how both results and risks are shared among the involved parties. To make the knowledge results tangible, the IPRs play a significant role. The legal scope of protection is well-defined, and it becomes clear what is covered by each IPR.

There is a need for new IP-strategies enabling openness, which considers more than just how results should be protected. A collaborative development raises important questions like; How are previous knowledge dealt with, and not unwillingly transferred to other parties?

How are the parties' knowledge outside the scope of collaboration handled? What happens with further improvements after the project has ended, but which are within the scope of the jointly developed technology? Should the parties be allowed to sell or transfer the acquired knowledge to the other party's competitors? Or even enter the same market as the other party? There is no simple answer that applies to every setting, and the structure should be discussed and considered before entering into any new project.

Granstrand (2001) defines four types of knowledge that are relevant in a collaboration project agreement, which are presented in Fig. 3. Any knowledge that is relevant for the project but was created before the start of the project is described as *background knowledge*. Bogers (2011) suggests that each party should assembly its intellectual property and declare ownership of any intellectual property used as input in the project. This could prevent disputes regarding what was created in the project, in comparison to what was already known. When background knowledge is combined to develop new results within the scope of the project, the results are described as *foreground knowledge.* The two categories are covering the fundamental issues of a project; who owned the respective input and who owns the results. However, the framework is suggesting another two categories that should be considered in the setting of a collaboration agreement. Any of the parties could be engaged in projects in parallel with the collaboration project, which might result in intellectual assets relevant to the collaboration. This type of knowledge is described as *sideground knowledge*. It is especially relevant when a small actor within a specific technology collaborates with a large firm with extensive R&D capabilities which might run several in-house projects involving competing technologies (Granstrand & Holgersson, 2014). There is a possibility that the competing sideground technology is prefered, and the foreground knowledge developed in the project is never commercialized. If the agreement was only covering a percentage on sales of the foreground knowledge, the smaller actor runs a risk of leaving the project with nothing. The fourth and last concept relates to improvements to the technology after the project has ended, which is described as *postground knowledge*. This type of knowledge is conventional in most software licenses, where it is common that a license also includes the right to use further improvements or updates of the software.

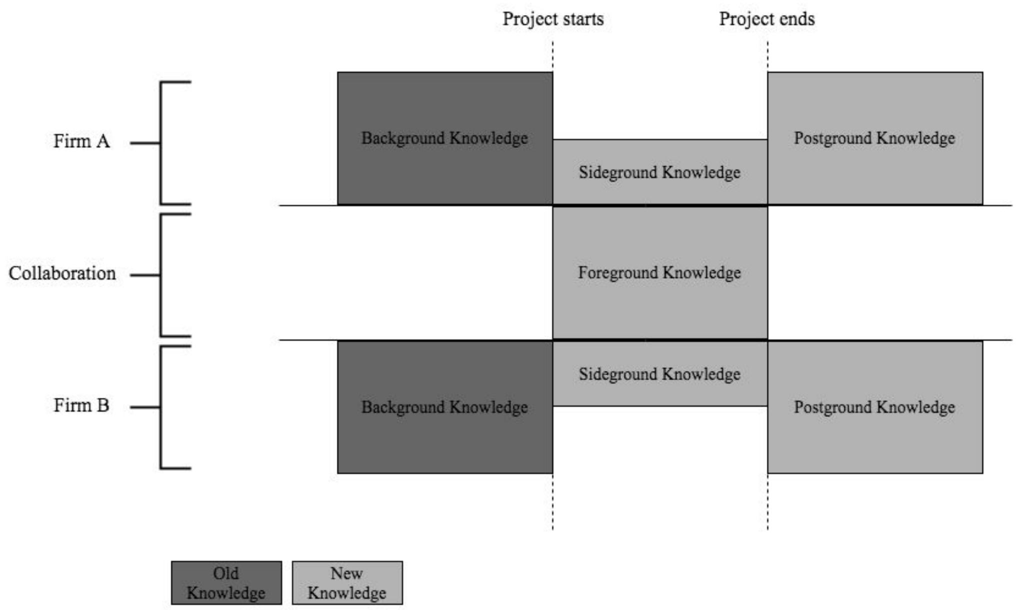


Fig. 3. Relevant knowledge for collaborative projects, from Granstrand & Holgersson (2014).

Another issue is how ownership and rights to the different types are distributed. Granstrand and Holgersson (2014) present three common contractual clauses for assigning the rights to postground knowledge. The first common clause is the *assign back-clause*, that implies that the licensee must transfer the ownership of any improvements back to the licensor. A similar set up is the *grant back-clause* which also relates to postground improvements of the technology but requires the licensee to license any improvements back to the licensor while not affecting the ownership. The third clause is the *grant forward-clause*, where the licensor is obliged to offer the licensee a license to any improvements to the technology.

This list could be extended with ideas from Bogers, Bekkers and Granstrand (2012) who propose various additional alternatives. The licensing architecture should govern what is transferred, who is allowed to use the licensed knowledge, and how the licensees are allowed to use the knowledge.

There are several ways to design an agreement for what is transferred. In the case of a defined set of knowledge or IP that is transferred, this could be pretty straight forward. In the setting where the subject of matter is more complex and involves several aspects of intellectual capital, the complications for such a trade could substantially rise. In order to avoid that situation, the article suggests that a whole set of knowledge and IP could be licensed out by a *block/package license* where all IP and knowledge relating to a certain technology or project are included. There is also a possibility to license upcoming technology by something called a *blanket license*, where everything relating to one future unknown technology is licensed under the agreement. The agreement is often framed in a way that any results from a certain type of R&D activity lead to a predefined license (Bogers et al., 2012).

Furthermore, the terms of a license agreement can govern the usage of the IP by restricting the license to certain geographical regions, specific industries, or application areas. This could enable the right holder to license its IP to actors in other business areas while prohibiting them from entering the same market and becoming a direct competitor, or licensing to a direct competitor but restrict the geographical use. The license often involves payment in the form of royalties. It could be structured as a lump sum, monthly payment, or a percentage of sales etc. When two firms are mutually interested in each other's knowledge, there is an alternative structure to royalties, namely a *cross license*. This structure involves both parties sharing their IP in exchange for the other party's IP, instead of a monetary royalty (Ibid.).

When deciding what actors should be able to gain access to technology, several types of licenses could be considered. The *exclusive license* transfers the full rights to the licensee with the condition of no one else getting the same rights. However, that could mean exclusivity on certain markets or industries to enable licensor rights in other spaces. If the licensor wanted to retain the rights while sharing with just one sole licensee, it would be considered a *sole license.* Another critical aspect of the design is whether the licensee should be able to grant another party the licensed knowledge in what would be described as a *sub-license*. This will obviously result in less control of the knowledge but might increase the chances of getting it commercialized. However, the sub-licensing clause could be written to restrict what kind of actors are allowed for sub-licensing. It could e.g. be permitted only for affiliates (Ibid.).

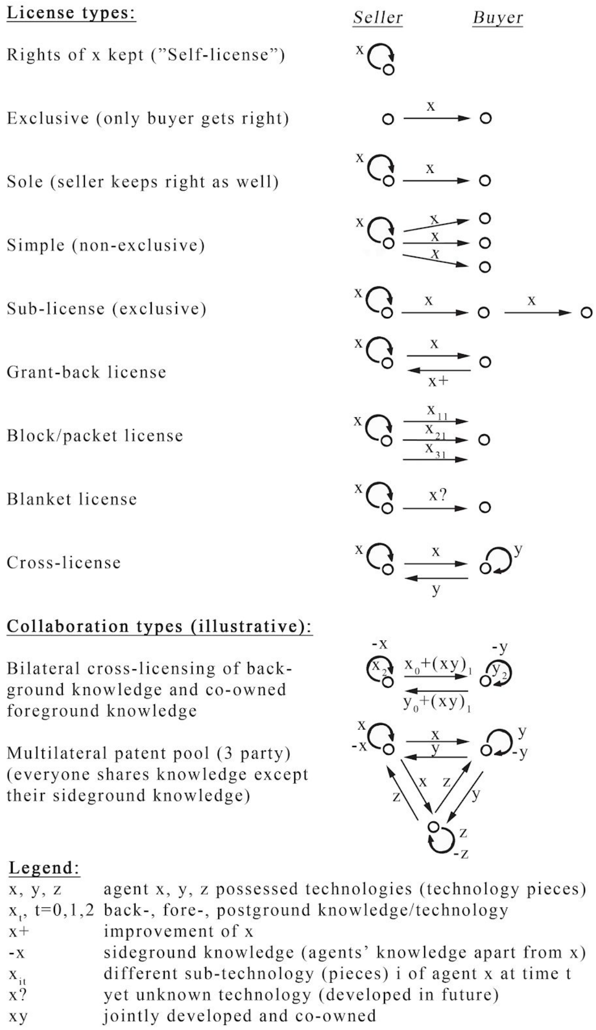


Fig. 4. License types. (Bogers, Granstrand, & Bekkers. 2012)

4. Methodology

This study aimed to examine the role of IP management in open innovation, where a firm in a knowledge-intensive industry wants access to an external technology through an inter-firm collaboration. Even though IP management in open innovation is a widely discussed topic, the operational side of the management is less explored. The study has examined what IP management more practically looks like in order to come up with a theory about the topic, according to an exploratory inductive research strategy.

The research was done through a multiple case study of two collaborative development projects at Polestar. The case study approach was chosen because of the complexity of the research problem and the ability to study the phenomenon in-depth to understand various aspects of the results. The data was qualitative and was collected through interviews with project members, observations from project meetings, publicly available information and documents. Furthermore, the author worked closely with the projects and had access to project meetings as well as informal discussions, which have resulted in data from internal communication that are neither recorded or transcribed.

4.1. Research Strategy

There is an ongoing debate about whether the social world can and should be studied at the same terms as natural science. Social science is divided between positivism and interpretivism in this question. The positivist believes that it should be no difference between the research of the social world and nature, by arguing that science must be conducted by a value-free method and that there is a clear difference between scientific statements and normative statements, where only the former can be considered truly scientific (Bryman & Bell, 2011). The interpretivism instead believes that there is a fundamental difference between the two types of research and that different logics and research strategies should be applied when studying the social world. According to Bryman and Bell (2011), an important distinction is that interpretivism believes that the researcher's understanding and explanation of a situation should be regarded as acceptable science. This research has adopted the approach of interpretivism, which has allowed the researcher to fully utilize the various sources of data and insights into daily operations of the project that comes with the research design of a case study.

4.2. Research Design

The design of the research was a multiple case study of two collaboration projects at Polestar. The multiple case study design was chosen because it allows detailed and intensive analysis of the phenomenon of interest (Bryman & Bell, 2011). Case studies are common in business research since it enables the study of complex matters. Polestar is a start-up that aims to disrupt the automotive industry and has openly expressed its willingness to collaborate with other innovative firms. Therefore, it serves as a relevant example of how firms are collaborating to increase the technology-base. The purpose of a case study is not to provide a theory that could be generalized to every setting, but it is instead a way to make sense of the data from the specific case. Therefore, the results should not be expected to be transferable to every R&D collaboration project.

The choice of a multiple case study instead of a single observation aimed to enrich the data with an additional perspective. That is why the studies were analyzed separately, before being compared to each other in order to identify any patterns of similarities or differences. The method of sampling the case studies was based on the following two criteria:

- It should be a collaboration between two or more firms.
- The collaboration should involve joint R&D.

4.2.1. Semi-structured interviews

The interviews were semi-structured, consisting of mainly open-ended questions to avoid any potential bias from the interviewer. A set of predefined topics was discussed during each interview to increase the study's reproducibility. A template of an interview questionnaire is attached as Appendix 1. It should be noted that the template was modified for the specific purpose of each interview. The four topics were regarding;

- the background of the project,
- the role of each party
- the goals with the collaboration
- the role of IP management

The sampling of interview subjects was done through the method of snowball sampling. It implies that a set of key persons were identified at the start of each case study. After the interview, the interview subject was asked to recommend the next interview subject, which was repeated until the point of saturation, where no new information was raised in the interviews. This method resulted in a set of 12 interviews, with 7 in the BCOMP project and the remaining 5 in the Android project. The group of interview subjects could be divided into either of the following three categories.

- Project lead
- Engineer
- IP manager

The category of project leads included managers, business developers or other employees that have been involved in the decision-making process and running the project. Any people working with the development were included in the category of Engineers. This category could involve roles such as developers, designers, engineers or researchers. The third category consisted of the IP-function that was responsible for managing IP and setting up the legal framework for the project. This category could involve roles such as IP attorney, IP lawyer, IP counsel or patent engineer. The variety of project roles was necessary to fulfil the purpose of the study by understanding involved actors' roles, the structure of the project framework and how IP has been managed throughout the project. The resulting set of the interview subjects is shown in Table. 3.

BCOMP	
IP manager	Polestar
Engineer	Polestar
Project lead	Polestar
Project lead	BCOMP
Engineer/Project lead	Polestar
Project lead	BCOMP
Engineer	Polestar

Android	
IP Manager	Polestar
Project lead	Volvo Cars
Project lead	Polestar
Engineer	Polestar
Project lead	Third-party developer

Table. 3. List of interviews

4.2.2. Documents

Documents were reviewed to understand the legal framework for the collaboration and act as a comparison to data from the interviews. Documents that were relevant for the purpose of this study are the contractual agreement, policies or guidelines relating the different projects. Because of the confidential nature of some of these documents, all details could not be shared in the report.

4.2.3. Public Data

Public data was used to understand the involved actors' assets, line of products, capabilities and business model. The data comprised sales material, official web sites and news articles.

4.2.4. Data Analysis

The interviews were recorded and transcribed before being analyzed through the method of thematic analysis. This method involves getting familiar with the data before labelling quotes that were considered interesting for the study in a process called coding (Bryman & Bell, 2011). As a second layer of analysis, the labels were clustered to find themes among the answers. After the data were clustered, and the different themes were identified, a selection process, based on the theme's relevancy for the research question was initiated. In this selection, themes that were not answering the research question were eliminated. The results were then presented through a narrative, supported by quotes based on the outcome of the thematic analysis. The themes were iteratively analyzed and compared to the closest literature, until the point where a conclusion was reached.

Sub-question 1 aims to understand the parties' roles, contributions and background knowledge. In order to answer this question, the IAM framework methodology of identifying intellectual assets was used (Petrusson, 2016). The method involves an initial identification and objectification of the intellectual assets before applying a system of different categories. It is suggested that categorizing intellectual assets has a normative effect, making them easier to compare against each other (Ibid.). The identified assets are then stored in an asset list which creates a portfolio of intellectual assets and provides an understanding of how the assets can create value and be controlled. The list could include several categories of metadata, but in this study, a basic approach of categorization, objectification and stating ownership was used.

The possible project results were also presented within an asset list. To fully understand how the results can create value in relation to the involved actors business, they were mapped on an industry value chain. The value chain was initially created by Porter (1985) as a tool to analyze the value-creating activities within a firm but was in this study adapted to illustrate the value-adding steps in the industry supply chain. The automotive value chain is illustrated in Fig. 5.

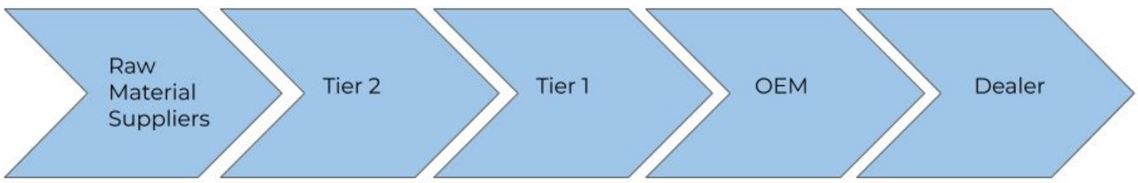


Fig. 5. The automotive value chain. (Team NEO, 2016)

4.2.5. Validity and Reliability

To ensure quality and validate the results from the study, LeCompte and Goetz (1982) quality criteria have been considered. The framework presents four different criteria, according to Table. 4.

	External	Internal
Reliability	To which degree a study can be replicated.	Whether there is more than one observer that agrees with the results.
Validity	To which degree the results can be generalized across different settings.	To what degree the developed theory and observations are corresponding.

Table. 4. LeCompte and Goetz (1982) quality criteria.

Only one researcher conducted the study, but by discussing and analyzing the results together with mentors from both the academia and at the company the internal reliability was enhanced through respondent validation (Bryman & Bell, 2011). To further increase the external reliability and validity, the interviews were based on a semi-standardized template, that can be found in Appendix 1. Furthermore, triangulation was applied by using data from various sources, where the different sources of data were critically compared against each other.

4.3. Polestar

In 1999, Volvo sold its passenger car business to Ford which went under the name Volvo Car Corporations (VCC). Because of its financially unstable situation, Ford sold VCC to the Chinese corporation Geely Holding Group in 2010, which is the current owner of the corporation (Granstrand & Holgersson, 2013).

The Polestar trademark was acquired by Volvo Cars in 2015, before being announced in 2017 that it would sell electric performance cars under its own brand. Polestar is a joint venture between Volvo Car Groups and Geely Holdings. It will be the group's performance brand and act as an innovation lab testing new designs, business models, and technologies while benefiting from the support of Volvo Cars (Polestar, 2017).

The industry has traditionally been dominated by several large companies that have created barriers to entry by being very vertically integrated into the value chain (Stuckey & White, 1993). However, with the converging technologies in automotive, the last years have seen the rise of several new start-ups in the industry. In order to thrive in this new environment, Polestar approach has been to adopt an asset-light strategy to remain agile and quick to adapt, while being built on the technologic platform developed by Volvo Cars, and incorporating new fields of technologies through collaborations with actors across industries. With this background, Polestar has increased its technology base from some collaborations and is now delivering its first cars. Therefore Polestar serves as a relevant case study to answer the research questions and purpose of the study.

4.4. Case study 1 - BCOMP

The history of BCOMP originates back to 2003 when one of the founders developed a pair of skis made of a carbon fiber base. The vision was to create the lightest high-performance ski core on the market. By bringing in two engineers to the team, they come up with the solution to develop a novel composite material based on natural fibers. The company have later diversified their product offering into new areas and are today present in sport and leisure industries and areas such as automotive, acoustics, electronics, and design (BCOMP, 2020). They have a product portfolio consisting of the three groups of products ampliTex, powerRibs, and bCores with patent-protected technology and manufacturing processes. By collaborating with actors from different industries, the company is engaged in product development by leveraging their intellectual capital by combining their unique set of know-how, IPR protected technology, and engineering skills to create a tailor-made solution for their customers.

The collaboration between Polestar and BCOMP reaches back to 2018. The first contact between the companies was established when a BCOMP representative reached out to the management team at Polestar for a display of the technology and material. The team at Polestar was immediately impressed and initiated an internal process of evaluating alternatives and substitutes for BCOMP's products. The evaluation resulted in the conclusion that BCOMP's offering was promising, and the collaboration could have positive impacts on the product. Furthermore, the material is very much in line with Polestar's agenda to drive sustainability in automotive. At the same time, the material is not ready to be put into production, where the companies see the potential to develop a process for industrializing the material. BCOMP is also collaborating with other OEMs, but Polestar aims to be the first brand to put the material into production.

4.5. Case study 2 - Android Automotive OS

Google initiated the android open source project to build an operating system (OS) for cell phones. The OS is based on a modified Linux Kernel and allows contributions from independent developers. Even though anyone is free to contribute to the project, Google is the main contributor and decides what goes into the software stack. The software is free for anyone to download, and most parts are licensed under the *permissive* license *Apache 2.0* (Android, 2020a).

With the car going in a similar technical trajectory as cell phones, connected functionalities and digital entertainment have received a lot of attention. A central part has been the infotainment system, where the driver has been able to perform tasks such as navigate, make phone calls, and manage the heat and air ventilation conditioning (HVAC). In fear of giving away market share, valuable data, and control of the IT security, OEMs have tried to avoid partnering with the software giants and instead have opted to develop their own infotainment systems. However, the success of these systems has been absent, and a few actors have let Android phones project its operations system on the car's infotainment system through Android Auto (Goodwin, 2020). However, with the Android OS being powered by a smartphone, applications like navigation are adapted to the battery limitations of a cell phone, meaning that an infotainment system powered by a car has the potential of higher precision (Ibid.). Therefore, Google decided to launch Android Automotive OS, a complete OS developed for cars. This OS will just as its cell phone equivalent be an open source project and licensed under *Apache 2.0*. An illustration of the architecture is displayed in Fig.5.

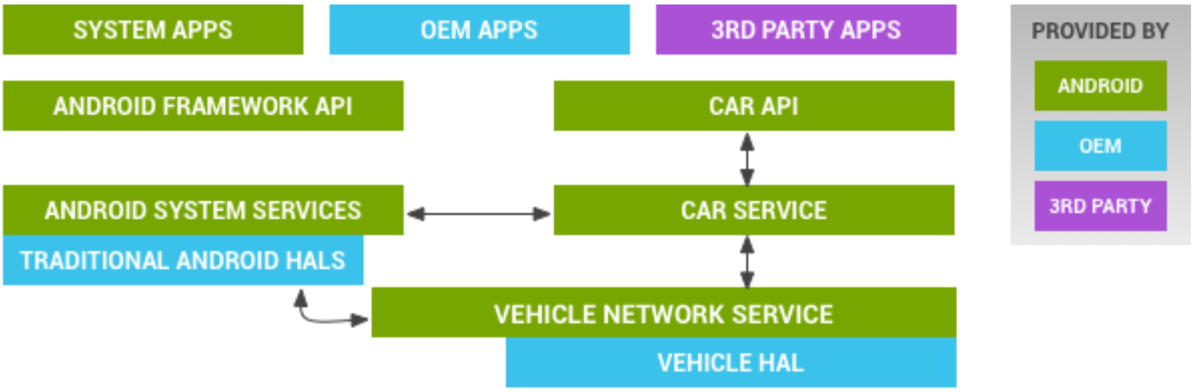


Fig. 6. Android Automotive Architecture (Android, 2020b)

Polestar 2 will be the world's first car sold with an Android Automotive OS, with Polestar announcing its collaboration with Google. In order to launch this new set up, Volvo Cars, Google, and Polestar have jointly developed the Android-powered operating system. The case study in this report could be described as an open ecosystem rather than a specific project. Under the umbrella of Android Automotive OS, the project could be considered to involve a development phase and an integration phase. The development phase is a collaboration between Google and Volvo Cars with the objective of combining Volvo Cars knowledge about automotive hardware and driver safety with Google's knowledge of building operating systems and applications, to build an Android-based OS for cars.

The integration phase builds on the groundwork made by Volvo Cars and Google. In this part, Polestar is allowed to publish its own applications in a separate area of the Google Play Store. In this area, Polestar is partnering with third-party developers to include their services in the car's OS. Since the phases are very much interconnected, some of the foreground knowledge from the development phase will be background knowledge for the integration phase. This study was conducted in the intersection between both phases, illustrated in Fig .7.

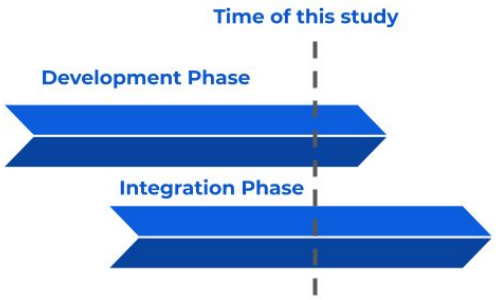


Fig.7. Illustration of project status.

5. Results

The section aims to present the data from the two case studies, that will help answer the Research question and support the Discussion and Conclusion.

5.1. Case Study 1 - BCOMP

The section presents the critical data from the BCOMP and Polestar collaboration. The results are supporting the Discussion.

5.1.2. What has been the role of the involved parties?

The underlying objective with the collaboration has been to find a way to utilize BCOMP's natural composite materials for a selection of Polestar's interior car parts. BCOMPs natural products aim to reduce the amount of plastics, decreasing the weight and increasing stiffness by replacing the use of Natural Fibre Polypropylene (NFPP) in the car by. While the material displays potential, the manufacturing of applications in the car is yet to reach a fully industrialized level. By combining knowledge and capabilities from both parties, they hope to create an industrialized method of manufacturing interior car parts made of the natural composite material.

A member of Polestar's engineering team described the parties' role in the joint development as following:

> BCOMP is the material expert. They can tell you anything about the flax and anything about the process of getting their material to market. What they do not really know is how their material behaves in our processes. So it is a joint collaboration, they will learn of what their material is capable of from a physical point of view, rather than what they have done so far. We get to find out the limitations of their material and actually industrialize the process, which we have a lot of skills set to do in the UK team.

Taking a closer look at both parties' contributions by analyzing the interview material and publicly available information, the intellectual assets and capabilities that have been considered necessary in this collaboration have been summarized in Table. 5.

ID	Owner	Category	Objectification
IA1	BCOMP	Data	Information of the natural composite material properties and limitations.
IA2	BCOMP	Instruction	Instructions on how to work with the natural fibre material.
IA3	BCOMP	Solution	Novel natural fibre material: AmpliTex, PowerRibs
IA4	BCOMP	Solution	Method of manufacturing natural composite material.
IA5	Polestar	Instruction/Data	Requirements for a material to be used in automotive vehicles.
IA6	Polestar	Capability	Experience of safety testing material.
IA7	Polestar	Capability	Experience industrializing manufacturing methods of interior car parts.

Table. 5. Resources necessary for the BCOMP project

The table should not be considered an exhaustive list of all involved assets and capabilities. However, it could provide an understanding of how each party's contribution to the collaboration and role in achieving the project results (PR). Any possible results that have been brought up either during interviews or project meetings have been summarized in Table. 6.

ID	Owner	Category	Objectification
PR1	To be decided	Solution	Industrialized process of manufacturing interior car parts made out of PowerRibs and AmpliTex.
PR2	To be decided	Creation	Design of interior parts, specific for Polestar.
PR3	To be decided	Data	Physical and mechanical properties of the natural composite material.

Table. 6. Possible project results from the BCOMP project.

The result could be put into perspective of the automotive value chain to understand how the project results might be utilized and who appropriates the benefits of each asset. One of the Polestar engineers describes how this setup differs from a traditional supplier relationship.

> Traditionally, you tell the tier 1: ‘This is what we want in the car, you need to go and develop it’. The advanced engineering department at the tier 1 would then go and speak to the toolmaker and material manufacturer or, if they have the skills in-house, try to develop the process themselves. So for us to be the OEM and do the collaboration with the material and tool makers without the tier 1 is a little different.

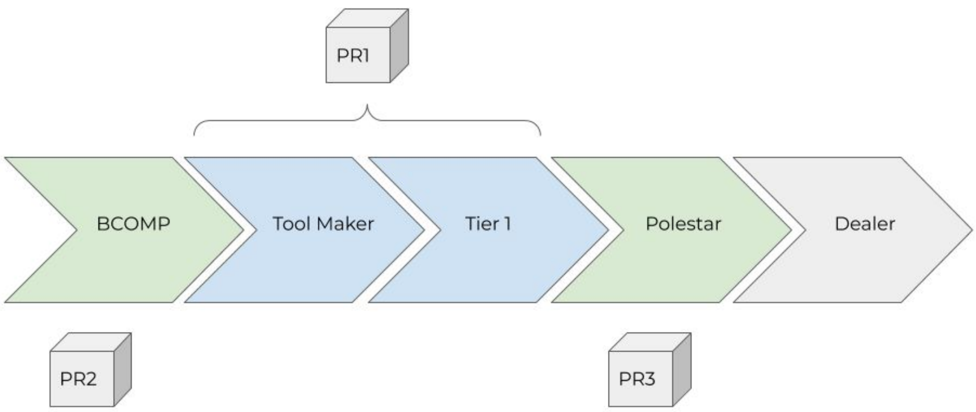


Fig. 8. Projects results mapped on the automotive value chain

5.1.3. How was the project's legal framework structured?

Three types of agreements have enclosed the project. An NDA covered the initial discussions to examine each other's resources and freely explore possible opportunities. After these discussions were held and the companies decided to proceed with the collaboration, the contractual relationship was separated into two agreements with a co-branding agreement regulating any branding or marketing activities, and a co-development agreement regulating the research and development. The agreement that best answers the purpose of accessing new technologies is the co-development agreement, which will be the central point of analysis.

The agreement defines that each party should retain its full rights to all background knowledge, while the principles for allocating any foreground IP is based on which area of development the project result falls into. If the area could not be agreed on, the default situation of any IP created in the project is joint ownership. In the case of any commercial exploitation, the parties have agreed to in good faith negotiate appropriate compensation, for example, a rate of royalties within a predefined range. The IP-manager involved in this process described the agreement as follows:

> It is a joint development agreement. Since Polestar has the potential to serve as a ramp into an industry that could be massive for BCOMP, we wanted an agreement a little bit more in the direction of a supplier agreement rather than purely joint development. In terms of splitting IP, in comparison to a traditional joint development agreement, we narrowed it down and instead included more sole ownership based on which area of technology the development fit into.

The equivalent of sideground knowledge was in the agreement defined as any intellectual property being created after the effective date of the agreement which falls within the scope of the specific project while being developed solely by one party. The creator of such intellectual property retains full ownership of the result while allowing the other party a license.

By analyzing the data from the interviews and the legal agreement, the framework for dissembling IP could be visualized according to Fig. 9. This could be seen as a model of allocating the project results based on which area the development falls into.

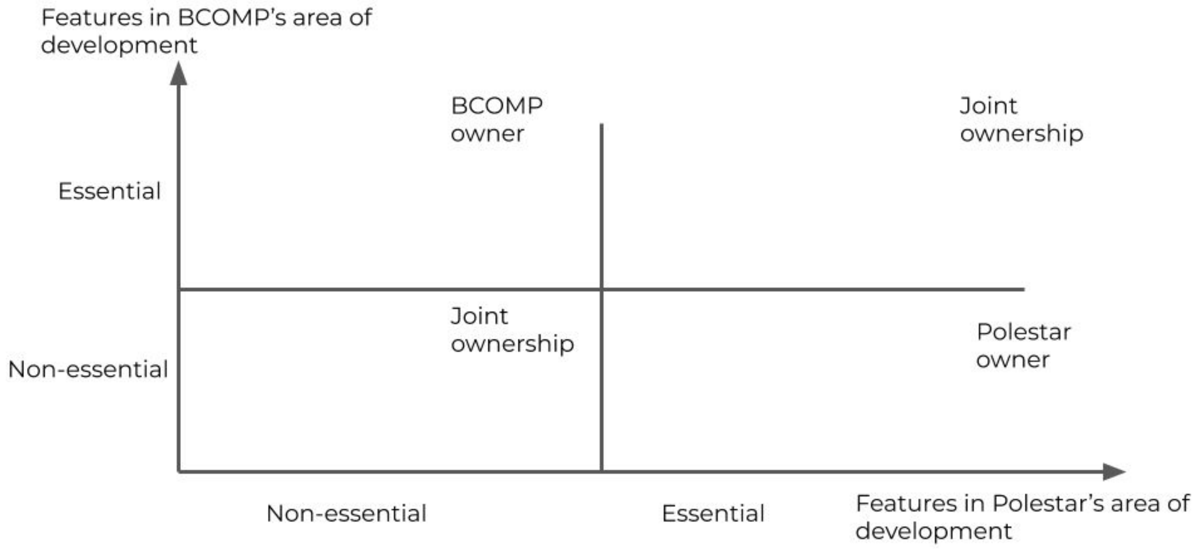


Fig. 9. Framework for allocating foreground IP

Because of the fast pace of the project and the early stage of the technology, it involves much uncertainty. Therefore, the agreement holds some space for later agreements and negotiations. The reasoning behind this methodology was by described as:

> Because it was so early in the project, there was still a lot of uncertainty about how this was happening. That is why we ended up with this structure. Once either of the companies identified any IP, an IP team should have a group sit down. The team should discuss what they see coming out of the project and reassess at that time, the percentage for royalties and things like that. We built in a lot of room to negotiate in good faith.

In the event of any IP being created in the project, a cross-functional team consisting of project leads, engineers, and IP attorneys should meet and categorize the result, decide the ownership, and negotiate a rate of royalties. This team was referred to as the *IP-team* in the interviews. The team consists of experts in intellectual property law, technology, and business strategy to include aspects from every area.

> The IP team has a representative of someone who understands the technical side and somebody who understands the legal side, so the agreement could be live and adaptable as the project develops since it is still so open-ended. This is new-ish in the IP space.

5.1.2. What was the role of IP management?

One of the most occurring answers regarding the most critical aspects of the collaboration has been a good relationship and the absence of slow processes. What more specifically has been highlighted about the relationship is the high level of trust and transparent communication. An interesting aspect of the results is that direct IP management seems to have a positive impact on the level of trust and transparency while having to adapt to the high speed of the project. In an interview with one of the engineers, the impact on the relationship was highlighted.

> As soon as you get something signed, it gives you trust. One of my fears going into this was that we would do a lot of work and develop a process without being able to capture the full value of it.

This view was shared by the IP manager that described it as follows:

> Having an agreement in place and having people mutually aligned on what is in those agreements brings clarity. Having it completed earlier rather than later in the process reduces misunderstandings. Having a strong and transparent legal framework early on in the process only facilitates that trust, and trust is one, if not the most, essential ingredient in effective collaboration. So I see the legal agreement as a necessary part of any collaboration but also really effective for capturing and solidifying that trust. I think it [a direct, understandable legal agreement] makes people feel they have something to fall back on and be more confident and comfortable in the ways of working.

Another argument supporting the importance of a legal framework and IP management was raised during an interview with an engineer at Polestar, who believes that IP management should be introduced earlier in these types of projects.

> I am the one that kicked the process off. To start with there was no agreement. I think that because Polestar is often very keen to collaborate we sometimes fail to put all the things in place to start with [due to the passion for the project]. I have heard there have been those issues in the past, so I wanted to learn from that.

The answers suggest that IP management has played a significant role in this collaboration. One of the most important objectives for the IP-management has been to construct an agreement that governs both the parties' contributions and the utilization of the outcome. It is by no means a simple task to construct that kind of agreement, but learning about the technology and anticipating possible outcomes could facilitate that task.

> You do not need to get a PhD. in the topic, but a solid understanding of the project, technology, and processes involved can deliver huge returns in a reduction of revisions, misunderstandings, and ultimately, wasted time.

The IP manager was asked about how IP management can contribute to these kinds of collaborations.

> IP counsel is uniquely situated to drive these projects because they understand both the legal implications and the technical implications to some level. They are at the heart of these deals by understanding the technology, the IP assets, and the potential value in this technology. I think the question is, how do we realize the value of the time and resources we are investing here, and what are we getting out of this? In contemplating the outcomes that the technology agreements are intended to govern, often nobody is really sure exactly what is going to happen. I think that is where an IP counsel has the responsibility to look a few steps beyond the project and see it from a holistic perspective. So it is beneficial to have a project manager that is more experienced and familiar with the importance of patents and the risk related to IP.

By taking a more active role in the project, it seems like the IP management can generate substantial value for the business by understanding various aspects of the joint development. However, this might require a new approach from the IP function.

> It is much more exciting. You are being asked to be much more of an asset to the business than a traditional lawyer or traditional IP counsel. I think that is awesome. I also think that if you are not used to working in one way, it can be a big change.

This new approach places higher demands on the IP manager to be more of a solution-oriented generalist by combining business and law aspects while having an entrepreneurial mindset.

> [The entrepreneurial mindset] is a skill set far more suited to a business, entrepreneurial, or marketing role. However, that personality, combined with IP knowledge, makes you much more of a generalist. By being a generalist in the IP world, you also have to be aware of what you do not know to make sure that the question can be answered in a timely manner. I think that is an entrepreneurial mindset. If you can hold that tension [between the open-ended questions of the entrepreneur and the black and white of the traditional legal thinking], you can be much more valuable to the business. There is a relationship between lawyers with business, where lawyers are often seen as a necessary checkpoint. However, by having a little more entrepreneurial attitude or solution-oriented attitude, instead of slowing stuff down, you can be an asset to the collaboration.

5.2. Case Study 2 - Android

The section presents the critical data from the Android case study. The results are supporting the Discussion.

5.2.1. What has been the role of the involved parties?

In the development phase, Volvo Cars has together with Google been developing Android Automotive OS. The partnership could be considered symbiotic in the sense that Google wants to access Volvo Cars knowledge of customer needs, automotive system and driving safety. At the same time, Volvo Cars realize the opportunity to incorporate an OS developed by a world-leading software company and be part of an ecosystem that will span across several OEMs and hence benefit from having a larger user base than they could obtain on their own. Both parties have been important in realizing the OS by supporting each other, while the actual development has been quite separated. The project was by a project lead at Volvo Cars described as following.

> It implies that we work together but not by sitting in the same room. Google develops its parts, and we develop ours. Our parts are pure car development that needs to be done. That involves a fair amount of additions to our platform to make it work. It is thus a partnership where we develop together, but we are not going to put too much effort into the Android development. What we are developing will be utilized by other OEMs. Then we have the GAS issue on top of this platform, where you can have various apps. Either your own apps or apps from Play Store, Google Maps or Google Assistant. That development is done purely by Google. It is Google who owns and runs the development of Google Services, but we take part in the discussions to try to educate Google on how things should work in a car and express our needs.

The resources that have been identified as necessary for the development are summarized in Table. 7.

ID	Owner	Category	Objectification
IA1	Volvo Cars	Data	User research of how an infotainment system should work in an electric vehicle.
IA2	Volvo Cars	Data	Knowledge of safety regulations and requirements for an infotainment system in a car.
IA3	Volvo Cars	Solution	The highly customizable SPA2 platform which can fit many types of hardware.
IA4	Google	Software	Google Automotive Services (GAS), which is a set of proprietary Google software including Google Maps, Google Assistant and Google Play Store.
IA5	Google	Capability	Experience of Android development.
IA6	Google	Data	Hardware requirements for an OS.

Table. 7. Resources necessary for the development of android automotive OS

In order to ensure safety and mitigate risks, Google will only allow third-party developers to publish media and message applications in the Google Play Store (Android, 2020c).

This is where the integration phase of the project comes into the picture. Because of Polestar's fusion of ambition and safety-orientation, it has taken the initiative to be a leader in the integration of non-media apps.

> If you consider a phone and a car, a bad app on the phone means that users will not download the app or delete it and never download it again. In a phone, it is easier to take risks than in a car. Let's consider that I have a bad app in the car. If I launch the app while driving and see a lot of videos and fancy animations, the risk of you being distracted is high. Since driving a car is much riskier, we are very careful. For example, media and messaging apps have clear guidelines on how the app should work. If you don't follow these guidelines, Google won't allow your app in the Play Store. They ensure driving safety by not allowing a lot of apps. It takes time to create

> rules. Let's say they need a parking app, then they need to have another set of rules ensuring, as an example, that the parking app can only be launched when you stop the car.

In order to allow OEMs to include additional categories, Google has provided a portal the OEM can upload and take responsibility for compliant apps. One of the engineers at Polestar described it as an opportunity to show Google the value in other categories of applications.

> If you look at the Play Store in the car, Google is very strictly guarding the Play Store. Right now, you can only have media and messaging apps, while we want to expand the user's choices.

In order to ensure desirable functionality, quality and safety Polestar will have to create a process or mechanism that verifies that the third-party application meets certain requirements. This project is run by Polestar, with the support from both Google and the third-party developers. The integration phase of the project is based on the results from the development phase, where the parties wish to combine its resources, listed in Table. 8, to find a way to include the third-party developed application in the car.

ID	Owner	Category	Objectification
IA1	Android	Software	Android automotive operating system.
IA2	Polestar/Volvo Cars	Solution	The SPA2 platform adapted for Android Automotive.
IA3	Third-party developer	Software	Parking payment service adapted for Android Automotive.

Table. 8. Resources necessary for the integration phase of the Android project

5.2.3. How was the project's legal framework structured?

The development phase of the project has mainly involved Google and Volvo Cars. However, with Polestar being an affiliate of Volvo Cars, Polestar is allowed to take part.

> Polestar is an affiliate. It was another form of ownership when we started this collaboration then today, but Polestar possesses the rights to the platform, both because more OEMs using the platform are needed and because it is a huge saving of costs for the concern to be based on the same platform.

However, the project seems to rely on a commercial license of the GAS applications and the legal framework provided by Android.

The set up for the platform have hence been built on four different layers of control, illustrated in Fig.10. The backbone of Android Automotive OS is based on open source code, mainly licensed under *Apache 2.0*, where the OEM has the opportunity to make modifications. This could as an example be matching the platform's user interface design (UI) with the specific brand guidelines. Next layer is a set of standard applications from the Google Automotive Service (GAS), proprietary software licensed from Google. GAS includes the applications Google Maps, Google Assistant and Google Play Store. In Google Play Store, there is an additional space for the OEM to include their own applications. What the OEM decides to put in the OEM Store is not regulated by Google at this time, creating an opportunity for the OEM to allow third-party developed applications access to this space, illustrated in Fig. 11. This structure involves several aspects of openness, where one of the main issues will be to create a legal structure for liability and indemnification. This can be especially complex in situations where the car is interacting with an independent application through the Android OS, and it could be hard to decide from which end the problem originated.

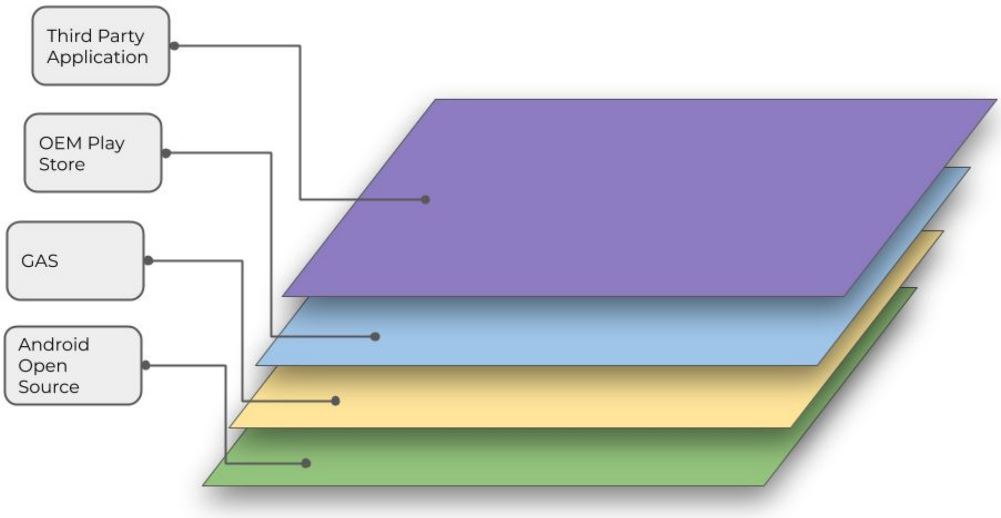


Fig. 10. The project's four layers of control.

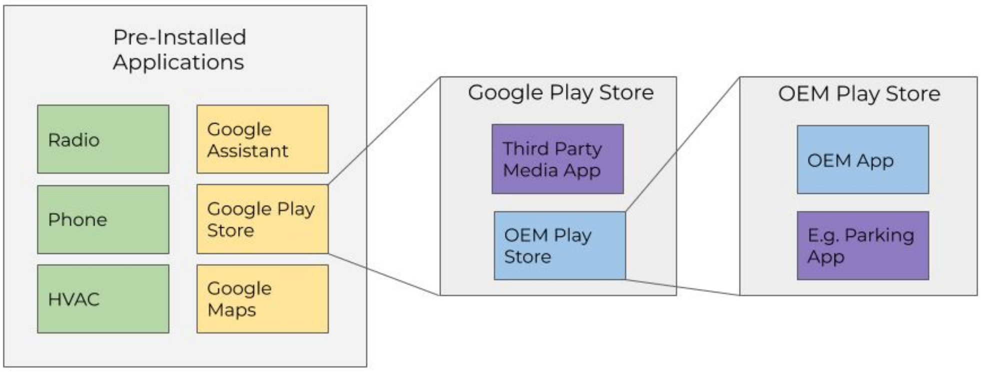


Fig. 11. Illustration of the relation between the four layers

5.2.3. What was the role of IP management?

In the first part of the project, the development has been quite divided between the parties, and the collaboration has not involved any extensive IP discussions or agreements. The integration phase builds on the work from the first part, meaning that the same legal framework also applies to this collaboration. To manage the project handover, a team at Polestar started by mapping out and assembling the different elements of the technology and legal framework in order to base the future work on inherited terms. Even though this work is not IP management in its traditional form, the IP function is well suited for dealing with these kinds of issues by combining aspects of technology and law.

> Most of this stuff should be done by a commercial lawyer who knows technology, as these are not heavy IP issues. However, if you think of it from a software perspective and combining legal and technical knowledge, that makes the IP attorney often the most well-suited. The actual IP issues that will come up will be in the software development agreement and the Google agreement. Usually, the IP issues in these agreements are software indemnification and patent indemnification. In my past experience, a commercial attorney would be doing software licensing agreements and IP counsel would just be called in to consult regarding indemnification or open source issues. So the actual IP issues are just the normal ones that you would see in a software developer agreement.

With the legal structure relying mainly on Android's Open Source licenses and Google's Play Store regulations, the next challenge will be to figure out what the interface between Polestar and any third-party developers will look like. It will be especially important to understand if any IP might come out of that development and whether the existing legal framework covers that or not.

> Now that we are understanding more of what Google wants to do and what they are looking at, I think there are some clear boundaries of what will be viable. I see the third-party developer agreement like a first, albeit important, shot. Hopefully, after that, we will have a better sense of whether there will be any IP we want to capture in the guidelines, specifications or verification of the third-party developed apps in the OEM Store. This work could involve more specific IP issues.

6. Discussion

While there certainly is potential for IP management to be a valuable asset for the firm in these types of collaborations and facilitate the integration of external knowledge, one of the main findings from the results of this study is how the role of IP management has differed between the two case studies.

In the first case study, IP management has played a central part and has been credited as important for the project. In this project, the main objective with the IP management has been to solve what Granstrand and Holgersson (2014) describes as *the Intellectual Property disassembly problem*, by creating a framework for how rights and ownership of any results are allocated. This was solved through the IP function taking an active role in the project by learning about the technology, the parties' relationship and where any potential project result might create value. The results suggest that this role is well suited for the IP function, even though it might require a slightly different approach than traditionally. Instead of being a necessary checkpoint, the IP function has been involved in the project by driving change and finding solutions. Furthermore, it seems like the IP agreement had a positive impact on the relationship between the parties, by initiating a discussion on how both parties contribute to the project and what they hope to get out of the collaboration.

In the other case study, IP management appears to have been less influential with the IP function being consulted only as specialists in key areas. The project relies on a commercial license for Google's services and the Android open source framework for development. With the ability to combine legal and technological aspects, IP management has made a valuable contribution by navigating in the Android environment and mapping out different elements of the legal framework. Compared to the BCOMP project, there has been less communication and clarity among parties.

The nature of the projects differ from each other in the sense that the Android case study aims to foster an ecosystem of digital innovation. In contrast, the BCOMP project aims to find an industrialized process that will enable BCOMP's natural composite material to be used in cars. In the Android project, every involved party benefits from a dispersion of the project results since the idea behind the project is to increase the user base in order to attract more developers and services. In contrast, Polestar might not benefit from a competing OEM using the results from the BCOMP project. This difference is by Huizingh (2011) explained by openness in process and outcome, according to Table. 9. The BCOMP project is using an open innovation process while having a closed outcome and could, therefore, be considered a Private Open Innovation. At the same time, the Android project entails both open processes and outcome and could be considered an Open Source Innovation.

<table>
<tr><th rowspan="2">Innovation Process:</th><th colspan="2">Innovation Outcome:</th></tr>
<tr><th>Closed</th><th>Open</th></tr>
<tr><td>Closed</td><td>1. Closed innovation</td><td>3. Public Innovation</td></tr>
<tr><td>Open</td><td>2. Private Open Innovation</td><td>4. Open Source Innovation</td></tr>
</table>

Table. 9. Huizingh's (2011) model of openness

A possible explanation of why IP management has differed between the two case studies might be because the Android project is based on an already existing open source framework. In a report by Mozilla (2018), one of the expressed benefits with open source projects is that it does not require any cumbersome overhead cost in terms of negotiating about a development agreement or memorandum of understanding and instead provides a framework for anyone to participate. However, the open source framework is usually based on a legal framework and therefore involves IP management and IP strategy at the start of the project. This is especially true in the case of the Android open source project, which involves several licenses, guidelines, and policies. Therefore you could argue the project involves a substantial amount of IP management even though this might have been pushed outside the scope of the case study. This difference displays the importance of carefully designing a specific framework and agreement for each project, which should take intellectual assets, goals, and strategic aspects into consideration.

Another area where the case studies differ from each other is the level of transparency. While the BCOMP project was characterized by a high level of communication and understanding of each other's responsibilities, the Android project functioned more like two traditionally collaborating parties, at least on the developer level. In the BCOMP project, the IP function was actively involved and was almost running the project, while the IP function had more of a supporting role at the backend of the Android project. One possible explanation of the difference between the projects might be the relative background role of IP discussions in the Android project. This discussion could encourage the involved parties to be transparent and explicitly describe their contributions and provide a structure for the collaboration. Without these discussions, the parties' roles could be less determined and result in less alignment and more uncertainty.

You could argue that the joint development agreement is a type of contingency contracting, where the ultimate goal is to align the involved parties' ambition and encourage them to work in the same direction. At the same time, Williamson argues that before the launch of an open innovation project, contingency contracting is always incomplete and could lead to future disagreements (Williamson, 1985). With an exemplifying case, Holgersson and Granstrand

(2014) point out that *ex post* negotiation can be problematic and result in disputes. Therefore, they suggest that IP managers should try to anticipate potential disputes and set up an agreement *ex ante* to the project start. This agreement should govern licensing clauses, royalty pricing principles, and pay attention to IP disassembly in general, and sideground and postground knowledge more specifically.

The BCOMP case study validates this idea by also displaying the importance of these types of contractual tools. Even though postground knowledge was not mentioned in the agreement, the results display how the project comprises a structure for protecting background knowledge while allocating sideground and foreground knowledge. The agreement defines that any sideground knowledge is retained by the developing party, while the basic foundation for allocating jointly developed project results is based on which area of development the project result fall into. If the area could not be decided, joint ownership of the research results is deployed.

Although the project shows some great similarities to the results from Granstrand and Holgersson (2014), the cases differ slightly from each other. In the BCOMP case, the speed of the project seems to have been of greater importance. The collaboration started almost at the first conversation, and the lack of processes was described as an influential factor in enabling the speed. There are no formal processes for involving the IP function, so it got involved first when the joint development was about to kick off. It was also shown in the results how important it is to have a co-development agreement, but it does not appear to have been allowed to affect the pace of the project. It is, therefore, an interesting aspect of the results, how the balance between negotiating a comprehensive agreement at the start and not becoming a roadblock for the project was handled.

In order to not slow anything down, the development went on in parallel with the negotiation and IP discussions, which somewhat increased the pressure to get an agreement in place. Furthermore, with the project being a collaboration between two start-ups where time and resources are limited, the negotiation was also restrained by these constraints. By taking an active role in the project, the IP function could capture the relation, understand the technology, and foresee any project outcome before drafting the agreement. This was enabled due to the IP manager taking a more proactive approach, by taking part in the project and actively seeking up the information, instead of waiting for the engineers or project leads to provide the right information. The strategy was then to get an agreement in place that describes the most important aspects of the relationship and governs the essential issues. Holgersson and Granstrand (2014) described the principles of pricing to be one of the most crucial aspects to have agreed on in advance the collaboration, something which was confirmed by the results of this study.

To add some room for flexibility and push some of the negotiations to the future, the legal structure of the project comprised a cross-functional team that should handle the discussions in the event of any IP coming out of the collaboration. The team consists of engineers, project leads and IP managers from both parties. This team was in the interviews referred to as the *IP team,* and was, based on the predetermined terms, responsible for deciding ownership of any created IP, managing jointly owned IP, and negotiating rate of royalties in the case of commercialization. This allowed the development to maintain momentum. So instead of being a roadblock by having cumbersome negotiations and IP discussions before the start of the project, when the contingency is at its peak, the *IP team* could negotiate when more information about the collaboration and technology was available. As a consequence of the solution, the IP management time and resources are allocated to where it creates the most value. Since negotiation will only occur in the case that any IP is created, that implies that unsuccessful development projects will not require as much attention as collaborations where a lot of IP is created. This structure therefore decreases the initial administrative work, while allocating time and resources to where it is most needed. The strategy is therefore especially suited for collaborations between start-ups with limited resources.

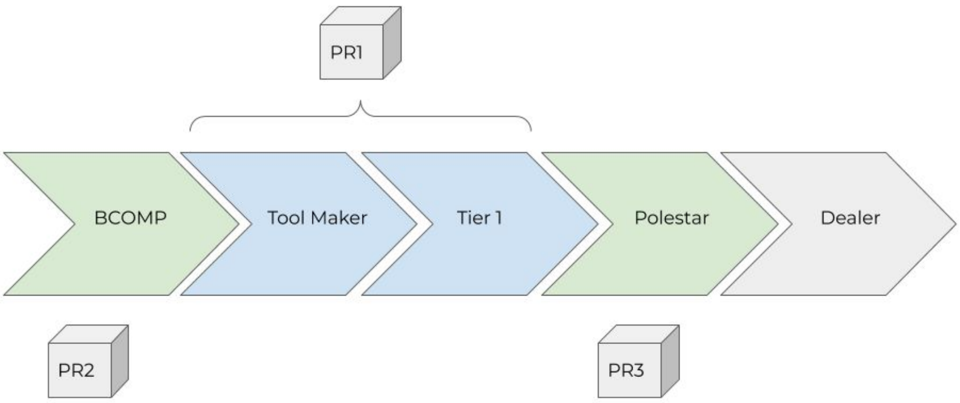
The introduction of an *IP team* seems to be a new way of managing IP in these settings. The traditional view of IP management is as an administrative or technical burden (Soranzo et al., 2016) which is often poorly integrated with the rest of the business (Fisher III & Oberholzer-Gee, 2013). In contrast, the *IP team* provides a unique setting, where business, IP, and innovation comes together to combine their knowledge and make decisions. The importance of integrating IP strategy with business and innovation strategy has been stressed by academia, which has been reflected in the dynamic of the *IP team* (Tanaka, 2013; Germeraad, 2010). The introduction of the team indicates that IP management in open innovation might be an area where the managerial functional silos are first overcome (Fisher III & Oberholzer-Gee, 2013).

With the background of this discussion, the IP management in open innovation projects could be divided into a *three steps method*. The first step was to assemble the involved parties' technologies and capabilities to understand how the resources could be combined to create project results. The next step was to understand how these project results might create value in the respective party's business, and with that information, decide on how ownership of the results should be distributed. The last step was to design a framework that disassembles the resulting IP in accordance with the previous analysis. In Granstrand and Holgersson (2013), a similar framework for disassembling IP was developed, which allocates IP in the divestment of a business. In their framework, IP is allocated based on its importance for the respective business. This study displays the need for a framework also in the setting of a collaboration project and provides an example of a framework that distributes IP on the basis of area of development.

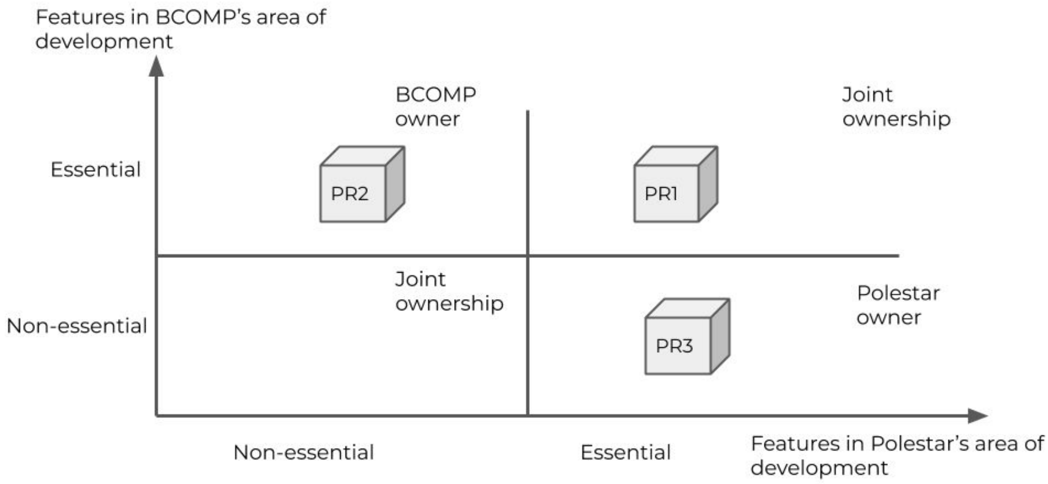
ID	Owner	Category	Objectification
IA1	BCOMP	Data	Information of the natural composite material properties and limitations.
IA2	BCOMP	Instruction	Instructions on how to work with the natural fibre material.
IA3	BCOMP	Solution	Novel natural fibre material: AmpliTex, PowerRibs
IA4	BCOMP	Solution	Method of manufacturing natural composite material.
IA5	Polestar	Instruction/Data	Requirements for a material to be used in automotive vehicles.
IA6	Polestar	Capability	Experience of safety testing material.
IA7	Polestar	Capability	Experience industrializing manufacturing methods of interior car parts.

ID	Owner	Category	Objectification
PR1	Foreground Knowledge	Solution	Industrialized process of manufacturing interior car parts made out of PowerRibs and AmpliTex.
PR2	Foreground Knowledge	Creation	Design of interior parts, specific for Polestar.
PR3	Foreground Knowledge	Data	Physical and mechanical properties of the natural composite material.

First step: Identify parties resources and predict project results



Second step: Put the project result into the perspective of the value chain



Third step: Create a framework for disassembly of project results

Ortiz-Gallardo et al. (2014) framework for technology collaborations suggests that the three most important aspects of a successful collaboration consist of *effective partnership management*, *effective execution of the co-development*, and *effective transference of the technology to the recipient system in the acquiring firm*. Integrating the results from this study with this framework indicates that a legal framework has had a positive impact on each of these categories and hence contributed to the success of a collaboration.

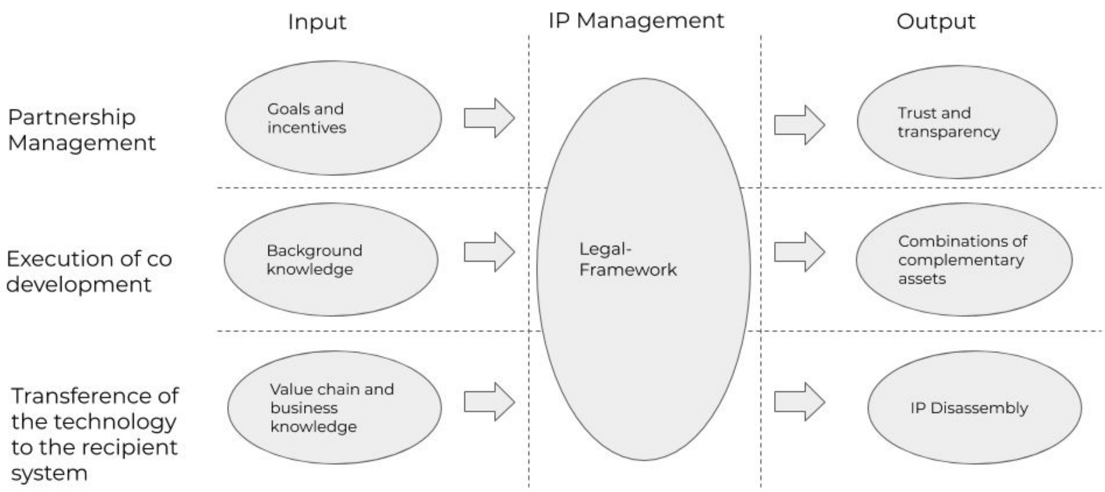


Fig. 12. IP management's contribution in the case studies.

The results of this study could be put into the perspective of the evolution of IP management in conjunction with open innovation. In the closed innovation paradigm, the IP function was disconnected from the rest of the business. At the front end, the responsibilities involved managing invention disclosures coming from the R&D. When an invention should be patented, the IP function would run the procurement. At the back end, the IP function would manage the IP portfolio by maintaining patents and enforcing patent rights. In the case someone would infringe on your IP rights, the IP manager would send a cease and desist letter before going to litigation to ensure exclusivity.

In the open innovation paradigm, IP management has expanded into working in R&D collaborations with external actors by contracting and designing a legal framework for the collaborations. In these projects, the IP function is more integrated with the rest of the business and plays a significant part in allocating rights to the IP results. This new way of managing IP opens up opportunities for new business models of accessing new knowledge through collaborations and skilful contracting (Granstrand & Holgersson, 2014). However, with limited resources, the accelerating change, and convergence of technologies in automotive (Business Sweden, 2020), there must be a balance between the security of a comprehensive legal agreement and the cost of losing valuable time. The BCOMP case provides an example of a strategy on how firms, and especially start-ups, could design a legal framework and set-up for collaborations by several principles. An agreement defining the essential characteristics of the collaboration and principles for pricing should be in place before the start, or early on in the project. The agreement should set the basic principles, while the final decisions are made by a team consisting of business, technology and IP experts at the time any IP is created in the collaboration. That implies that the negotiations will happen when more information is available and that the IP function’s time is allocated to the collaborations that generate the most new IP. The project lead should preferably be aware of business, technology, and IP issues and its related risks while being capable to combine that knowledge with a solution-oriented approach.

6.1. Future Research

Future research should further examine the implications of having extended negotiating at the start of a project, in comparison to pushing some elements of the negotiation into the future. One hypothesis could be that there is a trade-off between creating a sophisticated framework to avoid disputes, and pushing some elements of the negotiation into the future in order to not get in the way of the technical development. It should be noted that the approaches are not mutually exclusive or binary, and it should rather be about finding the right balance between having a shared understanding at the start while not slowing down the speed of the project.

Furthermore, the potential of integrating IP, business and innovation by cross-functional teams should be examined in more settings than just open innovation. Especially with the increasing importance of intellectual capital, there should be an opportunity for a team similar to the *IP team* in this study to be involved in strategic business decisions. Another opportunity that should be explored is the possibility to build a business model around collaborative projects and skillful contracting in order to expand the knowledge base. With the converging technologies, there should be an opportunity to strategically find combinations of assets and incorporate new technologies from third-parties, through collaborations.

Lastly, contracting skills and a contractual tool kit, like the framework presented by Bogers et al. (2012) and the *three-step method* suggested in this thesis, and their impact on open innovation collaborations could be studied. With the high pace, a tool kit could potentially save crucial time and facilitate the negotiations. It could also be a communicative tool, that facilitates the understanding of the agreement in the organization, in comparison to a comprehensive legal document. Fisher III and Oberholzer-Gee (2013) suggest that one reason for the poor integration could be the lack of a common language between engineers, business executives and lawyers. By finding a common language and illustrative frameworks, communication could be facilitated. This research could as an example be done through a multiple case study of collaboration projects, where several archetypes of collaborations are identified, and what kind of legal framework that is applicable for the different archetypes. The tool kits and archetypes do not necessarily have to contain only different types of clauses and licenses, but could also involve tools such as the introduction of an IP team, just like the BCOMP case study.

6.2. Limitations

Both case studies fulfilled the sampling criteria of being a collaboration project between different organizations and involving elements of joint development, which was supposed to make them comparable. However, the nature of the cases made them very different from each other. They were also in different phases, which made any comparisons between the projects complicated. Furthermore, the open source structure in the android case study seems to have pushed most of the IP issues outside the scope of the case study, which made the data collection challenging. The IP issues raised in the interviews were quickly saturated, which turned an increased focus to the publicly available information. In contrast, the BCOMP project was enriched with data on IP management, both from the interviews, but also with an IP agreement between the parties. As a result of the different amount of available data, the results and the discussion were skewed towards the findings in the BCOMP project. Therefore, a comparison between the cases might be unfair. Instead, the differences should illustrate the variety among collaboration projects and highlight that not every project is like another.

7. Conclusion

The study examined two cases of inter-organizational collaborations, where the ambition was to incorporate a technological innovation into the setting of the automotive industry. More specifically, the purpose of the study was to exploratory research the role of IP management and understand how it contributes to these collaborations. The research involved data collection through interviews, observations, analysis of documents, and publicly available information. The various sources of data were triangulated to increase the validity of the results.

The impact and role of IP management differed between the case studies, where one explanation could be the different nature of the projects. The Android case study relies on an open source legal framework, where most of the IP issues have been managed at the start of the open source project and hence pushed outside the scope of this case study, whereas the BCOMP project designed a legal framework from ground up. That implied that the amount of data and analysis was skewed towards the BCOMP project. This variance highlights the importance to design a legal framework adapted for the specific preconditions of each case.

Furthermore, the results from the study indicates that one of the main objectives of IP management, in open innovation, is to assemble the parties' resources and allocate the project results among the involved parties. While this role is explored in the literature, the aspects of flexibility and speed presented the results with some additional perspectives on IP management in a fast-paced environment. Especially in collaborations between two start-ups, where time and resources are limited, there is a need to find a balance between the security that extensive negotiations and an agreement before the start of the project provides, and the risk of being a roadblock for the development. One solution that was found in the results is to agree on the essential principles for allocating project results and pricing at the start of the project while pushing some elements of negotiation into the future. These future discussions will occur in the event that any IP is created in the project, and will be managed by a cross-functional team that consists of IP managers, engineers and project leads from the involved parties. The team was in the interviews referred to as the *IP team,* and was responsible for allocating ownership of the results, managing joint IP and negotiating royalties in the case of commercialization. This set-up seems to be a new approach to IP management and implies that the final negotiations will happen in the future when more information about the collaboration and technology is available. Furthermore, it allocates the administration's time and resources to the projects where most IP is generated and hence limits the downside of a project.

The results display the difference in IP management in the era of closed innovation in contrast to the era of open innovation. In the past, patent management was considered an administrative task of patent prosecution, patent maintenance and patent enforcement. The rationale was to build a patent portfolio to protect your product and ensure exclusivity. In the era of open innovation, IP management has expanded into a tool that governs who could utilize the technology and allocate research results from collaboration projects. This study has shown that trends like accelerating change and converging technologies have increased the importance of speed, which has forced the IP management to adapt further. In both case studies, the IP function had to be more proactive in the project and work closer with the engineers and project managers, than traditionally.

Future research should focus on finding the balance between the security of having agreed on terms in advance of a project, and the time and resources spent on negotiating an agreement. It should also be investigated whether a similar construction to the *IP team* could contribute to other aspects of the business than collaborative joint development. Lastly, it should be investigated if communicative tools, like the *three-step method* in this study, could encourage closer collaboration between different parts of the organizations in the process of designing a legal framework for collaboration projects.

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Appendix 1 - Sample Questions

background:

- What is the background to this project?
- When did you get involved in the project?
- What was your role in the project?
- Why did you enter into the collaboration (instead of developing the technology internally)?
- How was the collaboration partner identified/chosen?
- Who was involved in the decision?

the role of each party:

- How would you describe the collaboration?
- What knowledge from your side was important for this to work?
- What is important when innovating together with external actors?

the goals with the collaboration:

- What was the motive for you to engage in this collaboration?
- What did you hope to achieve with the collaboration?
- Was there any IP/innovation created in the project? Or what IP is likely to be created?

the role of IP management:

- How was the legal framework structured?
- What was allowed to be shared between the parties?
- What could not be shared between the parties?
- What did the negotiation/ IP discussion look like?
- Who was involved in the negotiation?
- What is the role of IP strategy and legal structure in these kinds of projects?
- At what point should an agreement be in place?

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