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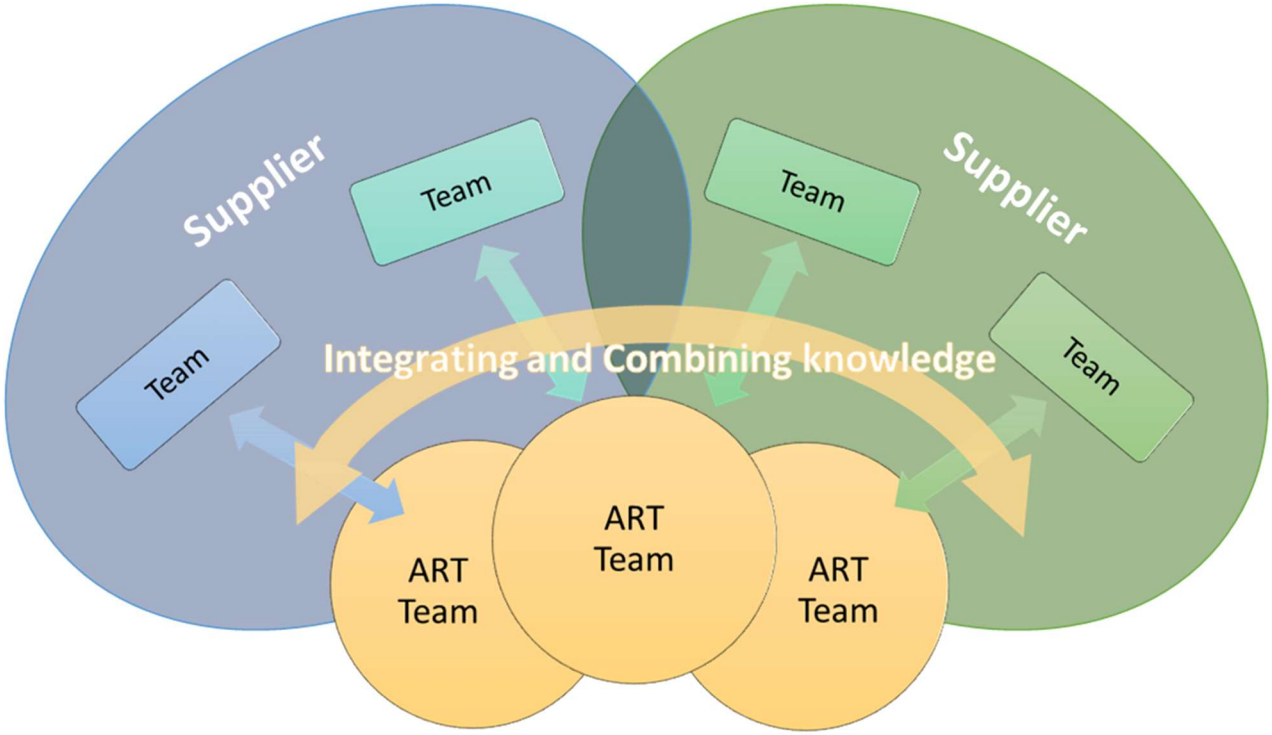

ENABLING CONTINUOUS KNOWLEDGE COMBINING

Learning to interact as teams at Volvo Cars when co-developing across organisational borders

Master Thesis in International Project Management and Supply Chain Management

VIKTOR BAKKER
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Department of Technology Management and Economics
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Cover:
[Visualisation of how several teams, from different organisations,
can integrate and combine knowledge]

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Abstract

Partnerships and relations within the entire supply network are becoming increasingly important, and unavoidable, as companies strive to be competitive. Utilising *Inter-Organisational Collaboration* (IOC) has the potential of being highly beneficial and can enable innovative competitiveness through knowledge combining, but also comes with many challenges.

An increased degree of collaboration is a global industrial trend highly affecting Volvo Cars Corporation (VCC). Managing to collaborate is important as a consequence of these developments, the large presence of networking and reliance on other partners expertise to succeed. Current trends are leading the automotive industry to include a diverse range of other competence bases and being in the forefront of new innovations and market trends. In studying the IOC, its processes and potential benefits in automotive, other industries can find similarities and learnings deriving from this context.

This Master Thesis therefor fulfils the purpose to *identify and create a greater understanding of what enables or limits knowledge combining in Inter-Organisational Collaboration*. These parameters are considered in an Agile context where multiple parties contribute to product development continuously during an extended period. Within this study the context is therefore two different groups (ARTs) of *Agile teams* working with suppliers in continuous collaboration. Empirical material from these ARTs and suppliers have been gathered through 16 interviews, analysed and concluded upon. Five stories of certain trends and findings are presented, as well as analysis of how this relates to theory. Ending this Master Thesis is a conclusion leading to managerial and research implications, as well as proposals for future research.

Collaboration is, according to our findings, ever more important and to treat all the underlying complexities the organisations have to start by creating a common understanding through interaction points and tight collaboration. This coupled approach of development allows common goals and increased commitment for every party. From this it is later possible to understand each other better even when not working tightly together. According to our findings Agile always calls for coupled collaboration in order to build common goals and then allows dividing tasks more sufficiently.

Keywords: *Collaboration; Inter-Organisational; Automotive; Supplier Collaboration; Knowledge Combining; Agile; SAFe;*

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Viktor Bakker & Martin Claesson

Terminology

Words in this list are in italics at the first occurrence of each chapter in the report.

Agile methodologies: Agile development values, principles and methods used to increase flexibility and responsiveness of development teams in an organisation.

Agile Release Train (ART): is the main source for delivering value within Scaled Agile framework by creating stable teams-of-Agile-teams, in the form of an ART.

Agile Supplier: An organisation that embraces project methodologies that are more supportive towards changes e.g. Scrum and Kanban.

Agile Teams: Autonomous cross-functional teams following an Agile methodology. In this report the teams referred to are generally Agile Teams, otherwise they are noted as traditional teams.

ICT-platform: An Information Communication Technology for handling backlog items, documentation, and communication.

Inter-Organisational Collaboration (IOC): Multiple parties collaborating on e.g. a common task, product or solution. Many of the important interactions occur over organisational boundaries, going beyond the ownership structure or common organisational structures. This kind of collaboration could include organisational alliances (partners), suppliers, customers and competitors, all interacting in order to create a common end delivery.

Product Owner (PO): Responsible to make best use of the development team's capacity by maximising the product value. Further, responsibilities of the product owner incudes maintaining and prioritising the content of the *Product backlog*.

Scaled Agile Framework (SAFe): Grouping of several Agile Teams into a scaled version of Agile, covering a larger part of the organisation. In this context the SAFe version referred to is 4.5 and Full SAFe.

Scrum Master (SM): Supports the team in incorporating Scrum theory and practices. This role includes the responsibility of safeguarding the team towards unnecessary interaction with people outside of the team.

Sprint: is a predetermined timeframe of one month or less in which a certain number of tasks from the product backlog are added to the sprint backlog and developed during the sprint. A sprint duration is normally one to two weeks at VCC.

Traditional Supplier: An organisation which uses project methodologies that requires a large degree of front loading e.g. Waterfall methodology.

Program Increment (PI): Shorter sprints of work done by the ART's teams are combined into Program Increments that are set out to deliver value to the Large Solution every eight to twelve weeks.

Product Backlog (backlog): An ordered list consisting all the features, functions, and requirements which at a given moment is identified to be sufficient to complete the project

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1 Introduction

The automotive industry is today characterised by a shift from traditional contractual relationships with its suppliers towards a more collaborative model in order to gain many diverse advantages (Schadel et al., 2016; van der Valk et al., 2018). Partnerships and relations within the whole supply network are becoming increasingly important, and unavoidable, as companies strive to be competitive (Binder et al., 2008; Ford et al., 2011). Companies are focusing more on developing core competencies in order to differentiate, increase performance and gain competitive advantages, and are as a consequence becoming dependant on suppliers and partners (Christopher, 2000; Clegg, 2008; Newell et al., 2009). *Inter-Organisational Collaboration (IOC)* has the potential of being highly beneficial and can enable innovative competitiveness through knowledge combining (Ale Ebrahim et al., 2009; Binder et al., 2008; Rosell et al., 2014). Rosell et al. (2017) even state that for radical innovations and improvements to happen a deeper collaboration with suppliers must be present. Overall, working in increasingly collaborative settings increases responsiveness, flexibility and innovation capability of organisations (Newell et al., 2009).

Along with the need for collaboration there is also an emphasis on the need to strategize the issue to control the cost-benefit ratio of the relationships. According to previous research findings only a few relationships can be under partnership terms and these need to be prioritised to perform high (Araujo et al., 1999; Christopher, 2000). It is crucial to find the right partners and collaborations in a changing business environment and initiate a relation built on trust and common commitment (Binder et al., 2008; Ford et al., 2011). A decoupled approach of outsourced development may, if not controlled, in the long run result in a situation where the buyer's R&D personnel lack the technical knowledge to evaluate the suppliers work properly (Araujo et al., 1999; Binder et al., 2008). This challenges the outsourcing of development as companies must control their own competence to not bleed out all knowledge, increasing the necessity of managing this complex issue suitably, also emphasised by Ford et al. (2011). The authors also continue reasoning about how the complicated act of understanding development initiatives taking place at the other organisations can be observed and benefited from. With the complexity of the automotive industry and its supply chain this is crucial, with many factors to manage according to van der Valk et al. (2018).

Outbreaking certain teams into deeper collaboration with external organisations, might seem as a way to increase collaboration, but risks overall collaborative performance. In order to successfully perform in IOC, internal cross functionality, processes and forums to facilitate integration are prerequisites, according to (Chapman and Corso, 2005; Kanter, 1994). Team members in IOC are also required to have higher competence and understanding in order to enable learning, as their role is more complex (Ahlskog et al., 2017; Kanter, 1994). Technology could support this and facilitate knowledge distribution, but must be completed with suitable processes and proper collaboration (Barratt, 2004;

Chapman and Corso, 2005). Newell et al. (2009) further emphasise the need for working together continuously, to see the collaboration reach its potential benefits. Otherwise positive effects from the relationships might become absent, as it requires more than fragmented interactions and collaboration efforts to be beneficial.

1.1 Background

With a growing interest and requiring more competence for handling the increased need for collaboration and complexity of the business networks, this subject attracts diverse interests. The management part of consultancy firm Knowit, Gothenburg, early on caught interest of the research area. Together with the master thesis students they initiated this specific study to increase learning, giving a foundation for conducting it. This led to the proposal of context, where Volvo Cars Corporation (VCC), as one of Knowit's customers, was proposed as the most suitable. VCC is a Gothenburg based car brand with sales exceeding 570 000 units, sales office presence in over 100 countries and over 34 000 employees worldwide (Volvo Cars Corporation, 2018a).

Increased degree of collaboration as a global industrial trend affects VCC to a high extent. Developments within the automotive industry, large presence of networking and reliance on other partners expertise to succeed, gives this particular industry great relevance for the study (Schadel et al., 2016). With VCC as the main context, understanding knowledge combining in IOC both internally and for external organisations come with large benefits. For VCC this is linked to global company presence and having ambitions to be in the front of safety development, have all new cars being partially or completely electric by 2019, and being a progressive and desired premium brand (Volvo Cars Corporation, 2018b). Studying successful collaboration and knowledge combining efforts in this context makes way for the technical and marketing aspirations, as well as successfully managing the global presence. External benefits of this study spring from the automotive industry's global market presence, its current developments and the fact that the suppliers also have other collaborations where the findings apply. Current trends are leading the automotive industry to include a diverse range of other competence bases and being in the forefront of new innovations and market trends. In studying the IOC, its processes and potential benefits in automotive, other industries can find similarities and learnings deriving from this context.

With the development of cars from previously consisting mainly of technical solutions and mechanics the weight has now shifted towards more software related and high-tech solutions, as mentioned in VCC's vision statements. This involves both the heist towards autonomous driving and active safety solutions, but also connectivity and new forms of ownership. Building competence for VCC within these diverse areas increases the necessity of strategic alliances and inter-company collaboration to continue taking a lead in the market development.

1.1.1 Volvo Cars Corporation and the call for collaboration

For VCC to manage increasing flexibility and the need for continuous growing competence, a shift of research and development (R&D) process and focus has been made, also including adjacent functions (i.e. procurement). The previous emphasis has been on functional departments, development projects and sequential project management. VCC has instead recently shifted focus towards development on entire product/solution level rather than individual projects developing a whole system. This allows for following a product/solution throughout all phases, rather than working in limited parts of the process. Doing so enables the desired knowledge combining, necessary flexibility and speed within VCC (van der Valk et al., 2018). Initially this urge for a more flexible work practise came from managers and teams working with development of fast changing technologies. Introduction of Agile methodologies (see section 2.1) were therefore done in some teams of the R&D department, pushing for further cross functionality and autonomy. With this a tighter collaboration between customer and supplier was also emphasised.

The shift that can be seen today at VCC is an evolvement of the introduced Agile methodologies to include the entire organisation. Grouping and aligning several *Agile teams* to an organisational level (described in detail in 2.2) enables a common shift from system to product focus and increases ability to respond rapidly. This step is larger and more complex than establishing Agile teams and adds new dimensions needed to overbridge. Possibility to gain a thorough overview and alignment of the teams' developments becomes a responsibility of the autonomous teams. The concept of grouping Agile Teams together is at VCC defined as Agile Release Trains (ARTs), with teams having similar planning horizons and processes (ScaledAgile, 2017). Within these ARTs suppliers and customers can be included as additional teams, either during certain time lengths, intervals or continuously. Emphasis also grows on the need for purposeful processes and enabling structures to support knowledge combining and alignment between the teams, through this organisational change.

1.1.2 Specific context description at Volvo Cars Corporation

This study takes of in the context of two different ARTs, both recently started and one that has seen a large growth during the recent period (for more detailed description of the specific context see introduction to chapter 5). They both consist of several Agile teams within the same department, a part of VCC's R&D department, in Gothenburg. These teams thus work within the same or adjacent areas of competence, but the two ARTs have separate focus areas, following separate products (i.e. components, solutions or value streams). All teams have a varying degree of collaboration with suppliers, who are currently transitioning towards more Agile methodologies due to the collaboration with VCC. The ARTs are involving several suppliers in the development of their product (see visualisation in Figure 1:1), either by sourcing limited parts or continuous development, together in collaboration, throughout the entire process. In order for this to be beneficial it is therefore important to get continuous knowledge combining to work, as everything outsourced has to be reintegrated and combined with other contributions (Hobday and

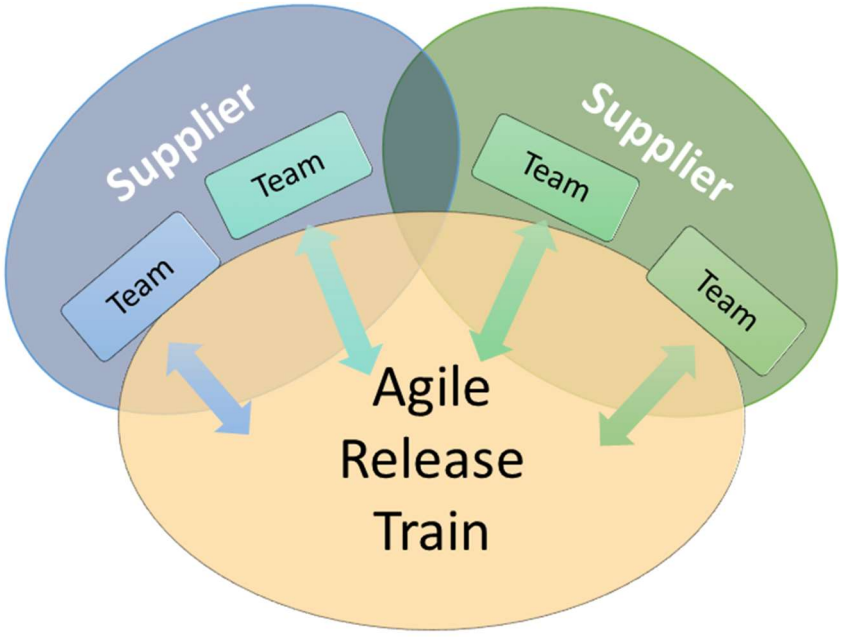

Figure 1:1 *Conceptual explanation of context and the collaboration within an ART. An ART consisting of several teams interacts with different teams and suppliers to develop .*

Bergek, 2011). Using the context of these team's organisations makes it possible to see how the structure and process, set by the *SAFe* framework (further described in section 2.2) supports the purpose of this study. These different factors are studied, and potential benefits and challenges can be identified and analysed in a sufficient manner. Agile processes (see section 2.1) are in place and are also further developed for internal learning and collaboration within a single organisation and several ARTs. The integration of suppliers is more of an unexplored area which, with the trends and developments of the industry, would benefit from studies.

1.2 Purpose and research questions

The thesis aims to *identify and create a greater understanding of what enables or limits knowledge combining in Inter-Organisational Collaboration*. These parameters are considered in an Agile context where multiple parties contribute to product development continuously during an extended period. Organisational structure and processes that enable or hinder collaboration is central for its success, thereby, the following research questions are investigated:

RQ1: How is continuous knowledge combining supported?
RQ2: What parameters affect the extent and willingness for knowledge combining?
RQ3: What categories of improvement can knowledge combining generate?

The *first* research question considers how the interaction points between organisations effect the ability to combine knowledge. Evaluating what structures and processes are needed to effectively combine knowledge in the studied context. Focusing on the parties' relationships is done in the *second* research question, looking at how they affect the tendency to collaborate closely and to what degree. One relation might affect yet other participants' willingness to collaborate, aiming to identify parameters for knowledge combining in this setting. The *third* question aims to evaluate the characteristics and potential of knowledge combining in inter-company collaboration. In this, targeting how the combined knowledge is used e.g. to improve product quality or collaboration processes, and how it varies depending on the existing business relations.

1.3 Disposition

Chapter 2 provides a better understanding of the background in which the study has been conducted, by describing the Agile methodologies in which VCC and its supplier currently are incorporating. *Chapter 3* shapes the analysis framework from which the empirical material is viewed, and the coming conclusion is established. Each subchapter begins with a summary of what will come in the following sections, where each section in detail describe different aspects of collaboration and knowledge combining. Reading the summary and viewing the figures give a general overview of what later will become the used analysis framework established in the end of chapter 3. Thereafter comes the method *chapter 4* which in a transparent way shows how the case context was approached, how interviews, analysis and concluding discussions were conducted. This part presents the interview group in detail, categorising the interviewees under different labels.

The empirical material is presented in *chapter 5* using a story-telling model, after first describing the two sub-units within the context in detail. The stories are descriptions (built upon the overall data) of five different phenomena, which were found in the case context, strengthened with quotes from interviewees. In this section it is possible to only read the

introduction to the stories and the quotes to get a good overview of the phenomena. Analysis of the empirical findings are done in *Chapter 6*, which follows the structure of the three previously mentioned research questions. The chapter aims to answer these questions in a sufficient manner using the analysis framework to understand the cases and draw conclusions for what kind of implications it entails. Chapter 6 is concluded with a summary giving the essence of each answer for the research questions. From this analysis the final concluding *Chapter 7* emerges, aiming to fulfil the purpose of the study by presenting managerial and research implications. This section also presents suggestions for further research, in the form of questions, identified as a result of the conducted study.

2 Agile methodology within the case context

With VCC's current transformation towards using Agile as base, this chapter aims to provide the necessary theoretical background to understand the studied context and the implemented methodologies. This introductory section does this by presenting the crucial values and principles that are consistently used for understanding Agile, whereby the lists come directly from the cited references.

Agile project methodologies derive from the software industry where it was created to provide the required structure for developing and sustaining complex systems (Schwaber and Sutherland, 2016). The core values for Agile methodologies are presented in the Agile Manifesto which emphasises four key points (Beck et al., 2001):

- **Individuals and interactions** over process and tools
- **Working software/product** over comprehensive documentation
- **Customer collaboration** over contract negotiation
- **Responding to change** over following a plan

Beck et al. (2001) further present a number of principles in order to create the above presented desired characteristics:

- Prioritising customer satisfaction by delivering value early and continuously through-out the collaboration.
- Embrace change in requirements, even late in development.
- Daily cross-functional communication, business people and developers must work together daily.
- Trust individuals to get the job done by giving them the environment and support they need.
- Face-to-face conversation is perceived to be the most efficient method for conveying information to and within a team.
- Self-organised teams are the best source for architecture, requirement, and design.
- Teams need to regularly reflect on how to become more effective and then adjusts its behaviour accordingly.

2.1 Being Agile at a team level

Agile methodologies promote work to be done in self-organised teams working to deliver releasable increments of a product (Schwaber and Sutherland, 2016). The product development takes place in the teams which manage their own work (autonomous), meaning that they choose freely how to best accomplish their tasks. They are also solely accountable for delivering the assigned tasks (Rigby et al., 2016). This freedom results, according to Schwaber and Sutherland (2016), in better team collaboration and overall increased efficiency and effectiveness of the team. Further, *Agile Teams* are not to be dependent on competence outside of their own team to complete tasks. As a consequence

Agile Teams are cross-functional and include all necessary skills to accomplish the tasks they have been assigned (Rigby et al., 2016).

2.1.1 Increments for delivering value

The Scrum framework provides Agile teams with the structure needed to work in short iterations delivering small increments of a working product, thereby maximising opportunities for customer feedback during the development (Schwaber and Sutherland, 2016). Each increment or *Sprint* is a predetermined timeframe of one month or less in which a certain number of tasks from the product backlog are added to the Sprint backlog and developed during the Sprint. Tasks are selected from the product backlog by the team which base the choice on the task's priority and the team's capacity. A new Sprint is initiated with a Sprint Planning straight after ending of the previous iteration. Keeping the time duration of these iterations constant throughout the development phase have according to Schwaber and Sutherland (2016) a positive effect on the team's performance. Further, the core of each iteration consists of five key components (see Figure 2:1): Sprint Planning; Daily Scrum meetings; actual Development Work; Sprint Review; Sprint Retrospective (Rigby et al., 2016). These components together with the rules displayed below are, according to Schwaber and Sutherland (2016), the foundation for Agile Teams incorporating the Scrum framework:

- No changes are made that would endanger the Sprint goal.
- Quality goals do not decrease.
- Scope may be clarified and re-negotiated between the Product Owner and Development Team as more is learned.

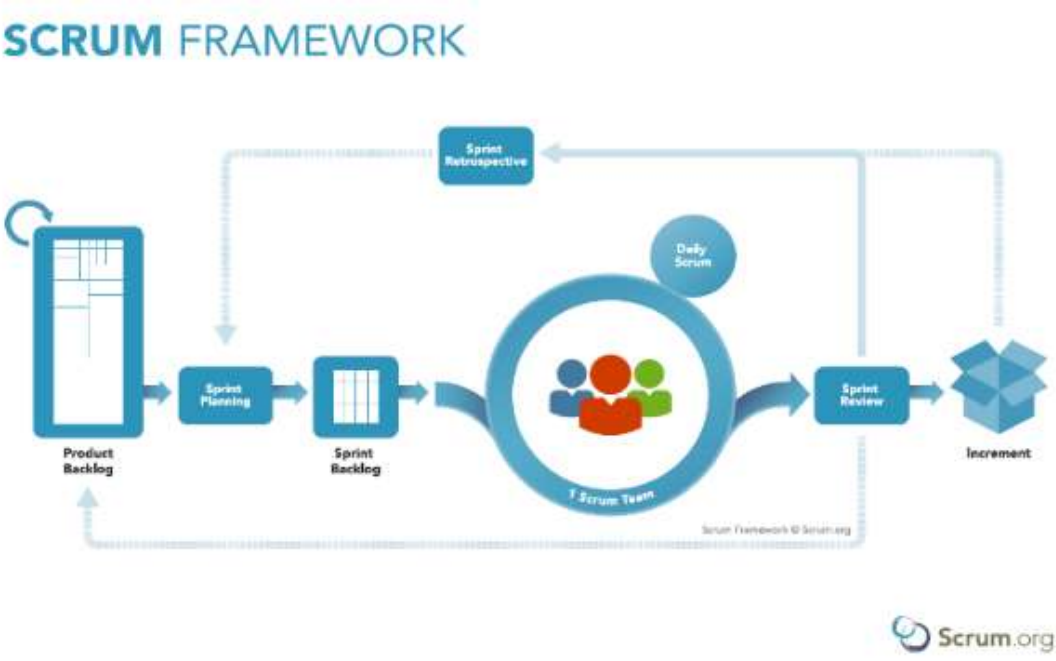

Figure 2:1 *Exhibit of the process for an Agile Scrum team (Scrum org, 2018).*

The *Product Owner's* (PO) role is to make best use of the development team's capacity by maximising the product value. Further, responsibilities of the product owner incudes maintaining and prioritising the content of the *Product backlog*.

The *Scrum Master* (SM) is a servant-leader role that supports the team in incorporating Scrum theory and practices. This role includes the responsibility of safeguarding the team towards unnecessary interaction with people outside of the team. It is up to the SM to decide if communication with members outside of the team is helpful and if it shall take place.

The *Product Backlog* (backlog) is an ordered list consisting all the features, functions, and requirements which at a given moment is identified to be sufficient to complete the project (Agile alliance, 2018). Further, the backlog is the sole source for requirements and changes affecting the product (Schwaber and Sutherland, 2016).

A *Sprint Retrospective* is an event conducted in the end of a Sprint, which provide the team with a chance to inspect, reflect upon, and improve their way of working (Rigby et al., 2016). Learnings from the event should be incorporated in the next Sprint which requires the retrospective to be conducted prior to the Sprint Planning. The event is a time-boxed meeting that aims to evaluate the previous Sprint's performance. It is according to Hoda (2011) essential to set aside dedicated time for team learning each iteration when aiming to create and sustain an environment promoting continues learning. Schwaber and Sutherland (2016) further argues that the purpose of the Sprint Retrospective is to reflect upon the following parameters:

- Inspect how the last Sprint went with regards to people, relationships, process, and tools.
- Identify and order the major items that went well and potential improvements.
- Create a plan for implementing improvements to the way the Agile Team does its work.

2.2 Scaling Agile to include the entire organisation

The *Scaled Agile Framework* (SAFe) originates from Agile methodologies and shares the core principles and processes used in Agile Teams. However, SAFe intends to scale these principles to include an Agile approach of working on the entire organisation and thereby supporting larger more complex solutions. The main reason for incorporating SAFe is to reap the benefits of increased speed and flexibility that Agile methodologies entail at a larger scale. This is achieved by avoiding a project-based workflow with clear defined start and stop dates and instead establish a continues flow of work. Continuous work delivery however calls for a higher degree of work visibility among teams, continuous knowledge acquisition and sharing (ScaledAgile, 2017). There exist several configurations of SAFe tailored toward different organisational sizes and needs. *Full SAFe* is the most comprehensive version created to support big organisations where hundreds of peoples are included in maintaining and building large integrated solutions (ScaledAgile, 2017). This configuration is built upon four levels each focusing on a different abstraction level of the solution.

Figure 2:2 *Visualisation of the structural levels within Full SAFe as described by Scaled Agile Inc (2018)*

2.2.1 Detailed description of SAFe's different layers

Is the highest abstraction level dealing with questions such as strategic objectives and lean budgeting in order to allow fast decision making. Further, this level provides governing tools for handling the flow of several value streams.

The role of this level is to align deliverables form multiple ARTs and suppliers into one Solution Train that deliver its value as complete solutions to the customer. The Solution Train Engineer (STE) is responsible for aligning the work between these parties, by facilitating sufficient interaction between them. Supporting the teams with a sufficient architecture for developing the product is the responsibility of the Solution and System Architects. The Solution Management is accountable for customer interaction, thereby aiming to understand and translate their needs to requirements.

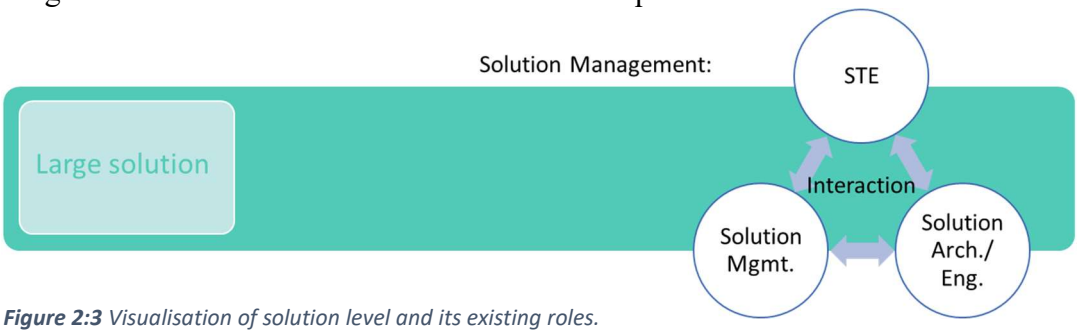

Figure 2:3 *Visualisation of solution level and its existing roles.*

Program level issues evolve around managing the teams-of-Agile-teams that are grouped together to create the ART. The ART's role is to manage teams and stakeholders by aligning them towards a common mission, which is achieved with a shared vision and program backlog. Prioritising and handling the backlogs content is the Product Management's obligation. The shorter iterations of work done by the ART's teams are combined into Program Increments (PI) that are set out to deliver value to the Large Solution every eight to twelve weeks. This value flow is the responsibility of the Release Train Engineer (RTE), which acts as the ART's SM.

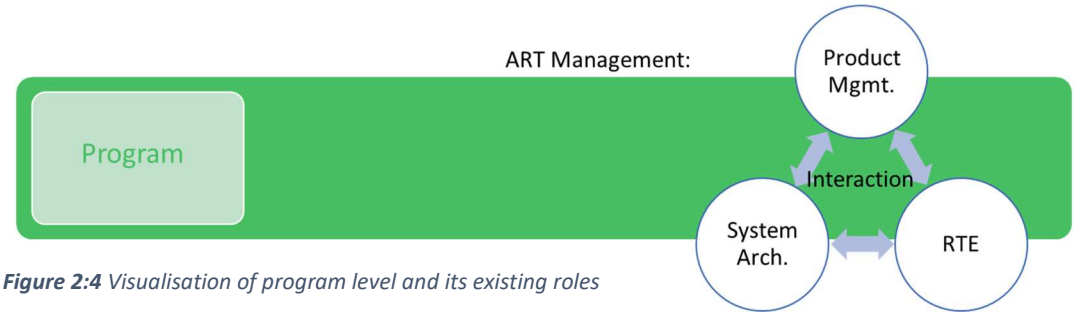

Figure 2:4 *Visualisation of program level and its existing roles*

The foundation of SAFe is the team level where the actual product development takes place. Development teams are organised using Scrum, which means that teams have their own backlog and support roles like a PO and SM. Teams working within the same ART have synchronised iteration and deliver features or sub-functionality to the ART at a weekly or biweekly interval.

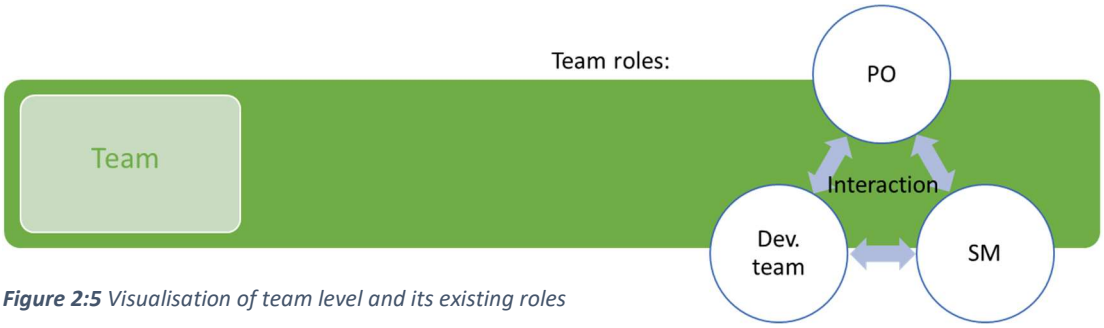

Figure 2:5 *Visualisation of team level and its existing roles*

2.2.2 Interaction points

Structuring an organisation using SAFe implies usage of several operational levels, which requires effective communication and interaction between these levels. ScaledAgile (2017) presents four central processes in order to achieve this: PI-planning, Inspect and Adapt, Communities of Practice, and Sync Meetings. The purpose and technical abstraction level of these interaction points varies, but the common objective is to promote collaboration, share information and skills among the participants.

PI-planning is the backbone of the ART aiming to align all the teams in the ART toward a common goal. This is achieved through a two day long face-to-face planning event allowing teams to identify dependencies towards one another and collectively plan the upcoming PI. This event is according to Scaled Agile Inc (2018) the most powerful event in the whole framework, providing a rhythm, common goal and purpose for the ART.

Inspect and Adapt (I&A) can best be described as the ART's equivalent of a Sprint Retrospective (presented in section 2.1). Inspect and adapt allows the ART's teams to reflect and identify shared improvements of their backlog items and work processes for the next PI. The purpose of the I&A is to improve the ART's collective output in terms of velocity, quality and reliability. However, I&A is not the only time for organisational improvements, SAFe encourages reflection and development to take place persistently trough the PI. System Demo is an activity during the I&A workshop which give the teams a chance to demo what features that they have implemented during previous PI. Further, this event provides the ART's stakeholders with an objective measure of the progress.

PO-sync is a meeting held weekly between the POs to distribute knowledge among teams and coordinate dependencies. Its purpose is to increase transparency and evaluate the ART's progress towards the PI objectives. This include discussions of potential problems and opportunities that might result in reprioritising the scope or backlog (Scaled Agile Inc, 2018). A weekly meeting with similar purpose called *Scrum of Scrums* is held for the Scrum Masters. The Scrum of Scrums and PO-sync may be merged to one meeting, in that case is meeting called *ART-sync*.

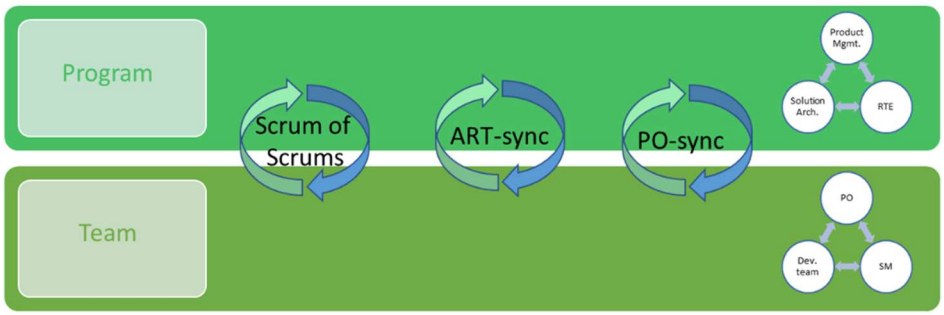

Figure 2:6 *Visualisation of sync meeting levels*

Another sync meeting with a slightly more technical approach is the *Communities of Practices* (CoP). This meeting is used to improve and distribute technical skills among a group of people that have shared interests within a certain technical or business domain. The nature of the information is to a large extent the parameter that decides on which level in the organisation this meeting take place, but the interaction can embrace several organisational levels. Section 2.2 has presented a number of selected processes and roles from the SAFe that are relevant to the study. The entire Scaled Agile framework is visualised below to provide an overall view of how the organisation presents the framework themselves (see Figure 2:7).

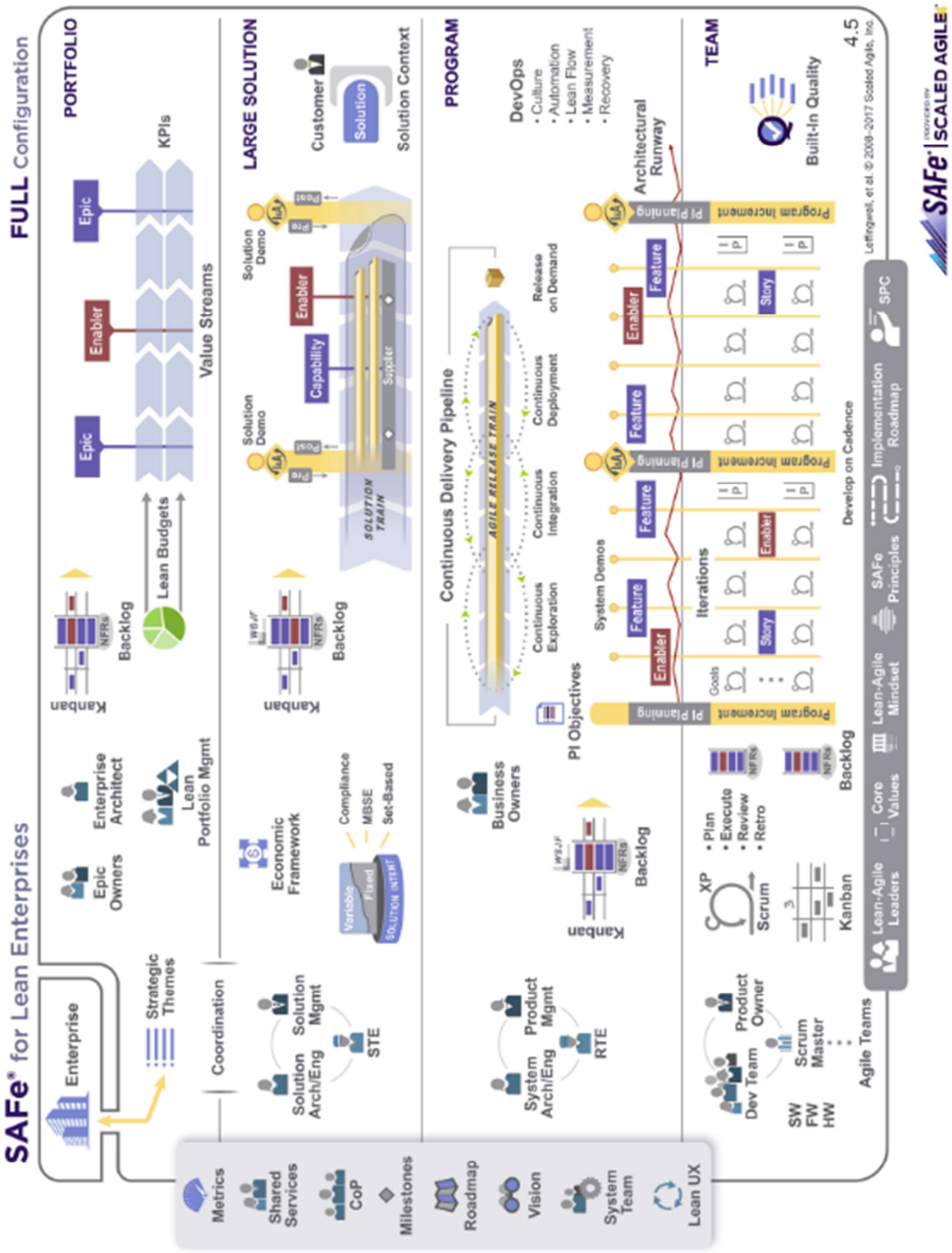

Figure 2:7 Overview of the processes and components of Scaled Agile framework (Scaled Agile Inc, 2018).

2.3 Supplier's role in SAFe

Suppliers can possess unique competence and skills within their area of expertise, thereby providing great opportunities to leverage economic benefits form their technical knowledge and ability to deliver solutions fast. Organisations incorporating SAFe

maintain long-term collaborative relationships based on trust with their suppliers, where they become an extension of the organisations culture and are seen as partners (Scaled Agile Inc, 2018). Thereby, most Solution Trains make use of suppliers depending heavily on their performance. This fact makes it more important with early supplier integration and continuous improvements, pressing for close collaboration and shared interfaces in order to have suppliers deliver continuously to the value stream. The authors further identify transparency about the characteristics of these interfaces to be important, which thereby should be documented and accessible for all participants.

Synchronising the cadence between the ARTs and suppliers is done within the Solution Train by the Solution Management allowing suppliers to participate on meeting like the PI-planning and the solution demo. However, Scaled Agile Inc (2018) mention challenges when integrating knowledge from suppliers varies depending on the methodologies and practises they use. A supplier that embraces Lean-Agile principles is easier to involve in the values stream than ones using more traditional methodologies. This also goes for having the same cadence, being easier when collaborating with suppliers following Agile methodologies.

Agile suppliers can be treated equally to an ART where the supplier work in synchronised increments and participate in all the PI's planning meetings, allowing them to present the intended deliverables for the upcoming increment. The author further mentions that synchronised increments makes it possible for the supplier to partake in the Solution Demo and I&A, thereby continuously contributing to the improvement of the value stream, work practise and solution.

Traditional suppliers on other hand are harder to integrate in the Agile value chain due to the differences in behaviour when it comes to the daily operations e.g. larger batch size and non-incremental development. Handling this type of suppliers, according to Scaled Agile Inc (2018), include more front loading initially of the design, allowing the supplier to plan and establish milestones for their deliverables. Working with traditional suppliers in many cases involves early and formal specification of requirements to avoid changes in late stages of the development. This approach is favourable when collaborating with organisations using traditional methodologies since the response time and cost of change is significantly higher. Prolonged adoption times and longer learning cycles are something the Scaled Agile Inc (2018) argues lead to that participation in the I&A is more crucial for these suppliers. They should be included in this process as early as possible so that problems linked to the collaboration can be visualised and handled.

3 Analysis Framework

In order to create a framework for analysis a general review of important parameters for collaboration is introduced. More on how come these parts were chosen and how the method to acquire them etc. is presented in the method chapter (see 4.3.1). The theoretical review and development of an analysis framework gives the foundation for understanding important aspects in line with the purpose of this report. A description of parameters important if wanting to succeed with inter-organisational knowledge combining in collaborations is described is therefore provided. These parameters add on to the following sections description of governance and integration of which knowledge combining is subject to. With the understanding of how these control and support systems interact the basis for the next part of the framework is set. To this the aspect of how knowledge combining can occur in different contexts is added and explained. Successfully doing so enables for collaborative improvements due to knowledge combining, which is proposedly analysed by the described model of how improvements derive from collaborations. This summarises to an analysis framework described and visualised in the final part of this chapter (see section 3.5), which is used in the analysis (see section 6).

3.1 Organisation for effective collaboration

Companies that collaborate with the aim to increase their collective output, need to combine their activities and knowledge in a structured way. Parameters for doing so evolve around establishing sufficient communication channels, but also practical issues like work processes and geographical location. This section will continue with describing these and thereafter some disablers equally affecting performance of collaborations, amongst which major parameters to consider, according to this section, are:

- Shared common goals
- Transparency, openness and colocation
- Over-bridging physical, organisational and cultural distance

There are several parameters affecting the efficiency and to what extent parties actually collaborate (Middel et al., 2005). One important aspect is if the environment in which the collaboration takes place supports or hinders collaboration. People's behaviour and the environment they co-create in can contribute as much to a collaboration's success as to its failure (Ferrazzi, 2014). In this way there is a distinct link between personal and organisational parameters to collaboration, as relationships can be between companies but the interaction is between people (Ford et al., 2011). Kanter (1994) argues that *IOC* are more effective when they are less formal and rational. Allowing less strict obligations and scope results in collaborations with transparent and rich communication, moreover this enables creation of a collective understanding of expected deliverables. There are according to Ferrazzi (2014), Middel et al. (2005) and Newell et al. (2009) a number of essential parameters for enabling effective collaboration.

3.1.1 Enablers

Middel et al. (2005) have identified especially four parameters that have a positive effect on companies trying to reach a state of their partnership where they continually enhance their overall performance: Goal sharing; Trust and long-term; Improvements and ICT; Openness.

Goal sharing within the collaboration

Alignment of objectives and priorities between the supplier and buyer is according to Middel et al. (2005) essential to deliver improvements and avoid conflicts. Having a common goal is a requirement to enable collaboration between involved parties, to not have certain parties with conflicting interests working in opposite directions (Johansson et al., 2011). Creating these kinds of common and long-term goals requires a lot of resources, but is a necessity for collaboration to work (Binder et al., 2008). Without a shared commitment chances are that people never become a team, but rather only a group of people, not truly collaborating (Katzenbach and Smith, 2015). For this boundaries and sub-optimisations have to be reduced and instead trust and commitment emphasised (Christopher, 2000).

Trust and long-term perspectives

For a successful collaboration it is crucial with long-term perspectives and trust. The business model needs to allow alignment and balance the political processes affecting the collaboration. Short term effects of an agreement are hard to balance, thereby bringing more benefits to one of the parties (Binder et al., 2008). However, it is important for the relation that the benefits generated from the collaboration are dual in the long-term (Middel et al., 2005). This is supported by Kanter (1994), further arguing that the foundation for trust is respect and the assumption that all parties are equal and contribute with something valuable for the relationship. Trust and common commitment in this way relates well to the necessity of shared commitment for teams to at all be well performing teams (Katzenbach and Smith, 2015), which only scales further when including more teams and a wider scope. Drawing this further Ford et al. (2011) shows that most IOC occur without explicitly formalised agreements. Doing so becomes useful as collaborations both involve a larger portion of actors and that complex interpersonal connections are what enable collaboration (Kanter, 1994), but is not easily formalised. Making use of these interpersonal networks and relations also lead to enhancing the learning possibilities.

Organisational improvements and ICT support

Information Communication Technology's (ICT) importance for collaboration is recognised by a large portion of authors, amongst them both Middel et al. (2005) and Ferrazzi (2014). These are allowing activities and interactions like knowledge sharing to take place regardless if the participating parties are colocated or not (Newell et al., 2009). ICT's fundamental role in effective IOC is further strengthened by Chapman and Corso

(2005) stating that it is essential when bridging gaps between organisations. Nevertheless, one should not put too much trust in the capabilities of ICT. Ford et al. (2011) highlight the connected role of technology and relationships in order to be successful, with both necessary for truly seeing the effect of either. Reviewing and improving the organisation on a managerial level is vital to leverage collaboration (Chapman and Corso, 2005; Middel et al., 2005). These improvements can come from technology, but it is also crucial to consider that people and the organisation is the origin for influencing choices regarding both improvements and technology, making them even more important (Newell et al., 2009). Even so Morris et al. (2014) emphasise that proper use of ICT can make information widely accessible and that Wikis and blogs are becoming important tools to aggregate individual competence and ideas.

Openness

Transparency and openness is restricted as a natural consequence in some industries, a case which to a high degree is true for the automotive industry (van der Valk et al., 2018). However, Middel et al. (2005) stresses how openness allows for good collaborations with suppliers that are expected to generate continuous improvements. The authors further emphasise the importance of openness not only including open knowledge sharing with suppliers, but also open communication and discussion of problems. This kind of openness has to both involve high levels of shared information and adapting processes towards each other (Christopher, 2000). van der Valk et al. (2018) have found these aspects very positive for continuous integration and delivery, making it possible to collaborate well. This must also be supported by legal contracts, open for ongoing collaboration, even though they only go so far in enabling collaboration (Fowler and Highsmith, 2001). Only through continuous interaction can true performance from collaboration occur, so the contracts should according to the authors be considered more a starting point. When these are in place Deichmann et al. (2017) argues that it is important to also have openness in the forming of function and task definitions, so as to innovate and improve together. They emphasise that concepts should initially be open for shaping together, to get both innovation to occur and the results of collaboration spread.

3.1.2 Disablers

All previously mentioned parameters could hinder and complicate successful collaboration if not properly managed, whilst there are also other crucial parameters mentioned in literature. This is not a comprehensive list of all disablers, but some important parameters to regard in order to increase the extent and willingness the collaboration parties can and desire to collaborate. One of these is the, by Ferrazzi (2014), stressed importance of colocated teams. He identifies distance between teams as one of the main disablers for effective collaboration. However, the source of distance between people is not limited to geographical location, he further describes the danger of different types of distance in collaborations:

Physical: is caused by geographical or time differences. A source of physical distance could also be the case that parties are associated with different organisations.

Operational: is the distance caused by how the company is structured, varying team sizes and extent of face-to-face interaction. Diffusion of technical knowledge and support also affects the operational distance.

Affinity: is the hierarchical distance and level of interdependencies. Cultural differences can also be a source of distance in the collaboration.

Problems due to affinity and operational distance can impact both colocated and remote team workers. Ferrazzi (2014) states that the negative effects that physical distance entails can even affect team members working in the same building but at different floors. To this there is also an aspect of contracts role in creating or reducing distance between teams and organisations, that must be controlled.

Johansson et al. (2011) presents the conflict of interest have been identified as a potential cause of inter-organisation problems of collaboration. The underlying cause of this is misalignment of objectives and self-interest of the participating firm, which derives from competitive reasons. The risk of misalignment and this problem in general is bigger in horizontal collaborations where the parties are competing directly on other markets. Competitors are less likely to cooperate and share knowledge in one setting/context if they are competing on the overall market. Studies have shown that this problem gets amplified in collaboration with heavy asset investments made towards it, which could be explained by the potential financial damage at stake. This urges the participants to grasp as much control as possible over the collaboration, thereby dampen the innovative and collaborative spirit (Johansson et al., 2011).

Some of these aspects are also tightly linked to cultural differences, especially by Hofstede et al. (2005). He emphasises several different aspects of distance, particularly when regarding organisations stemming from different cultural backgrounds. This agrees with what Kanter (1994) states as important integration points to manage for successful collaborations, involving interpersonal and cultural connections. These not only affect affinity, but also other aspects of collaboration as a consequence of different preferences and prioritisations. To be able to manage collaboration in a multi-cultural market the organisations therefore have to acknowledge this and consider how they, regarding these effects, should perform business. Doing this according to Neeley (2018) involves both creating trust to and knowledge of each other and the differences. This as understanding each other and the background to why you do what is important to increase the possibility for effective collaboration.

3.2 Working together with multiple parties

For collaborations to work well the previously mentioned parameters are required to be monitored. With increase of what the collaborations include in terms of number of people,

scope and locations, also come additional important parameters to regard and work with. Some important aspects of these are:

- Understanding the joint win-wins of successful collaborations
- Enabling internal organisation to absorb the combined knowledge
- Motivating commitment from all involved organisations
- Organising to increase the inter-personal trust and knowledge
- Continuously improving and aligning towards the collaboration

3.2.1 Potential pitfalls of multi-party collaborations

Even though collaboration within a team can be regarded as difficult, there are even larger degrees of complexity when scaling it to involve multiple teams, possibly from different companies, cultures, countries and competence areas. Even so the benefits from successfully mobilising collaboration across these borders are widely acknowledged (Ale Ebrahim et al., 2009; Araujo et al., 1999; Ford et al., 2011; Newell et al., 2009; Rosell et al., 2014; Schadel et al., 2016), see Figure 3:1 for conceptual description of collaboration between multiple parties. These range from accessing competence otherwise not being possible to hold within a single organisation, making it possible to link areas of knowledge and often enable innovations in the borderland, leading to competitive advantages. Also noted are quantifiable parameters such as product quality, reduced lead time and cost, increased flexibility, improving processes and better understand the possibilities of different technologies and techniques. They also include such things as improved management and improved decision making. Joining together several organisations and people from a wide range of competence and background also support handling complex tasks. Managing this increase in complexity is an ever more prevalent situation that business find themselves in, according to Snowden and Boone (2007), making joint efforts important for continued business.

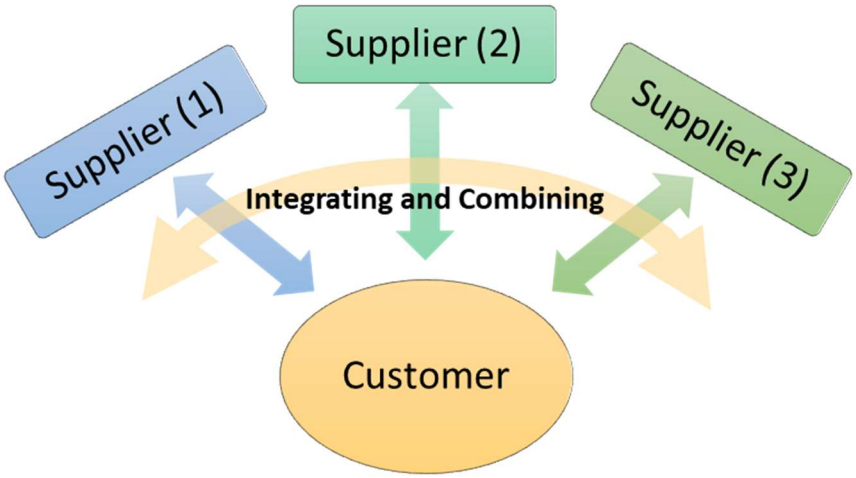

Figure 3:1 *Understanding the role of collaboration between multiple companies, adapted from Middel et al. (2005).*

Collaboration between multiple parties is problematised by Christopher (2000) and Ford et al. (2011), emphasising that they have to be sufficiently managed and required to be handled with considerable care. There is at the same time a need to rationalise with whom organisations partner, rationalising and strategically prioritising partnerships (Araujo et al., 1999; Christopher, 2000). Complexity of individual organisations also has an impact on inter-organisational work, making it harder to exploit knowledge throughout the organisations (Newell et al., 2009). As a consequence of this, knowledge is lost between organisations, adding to the fact that how close the relationships are also determines how well joint contributions and combined learnings will work (Araujo et al., 1999). Webb (2018) continue by arguing that relationships must exist not only for the sake of it, but be valued and committed towards. There is also issues with that pure dependence on another organisation's competence is not sufficient, as some knowledge about the desired outcome is needed from all parts (Araujo et al., 1999; Binder et al., 2008). Companies therefore have to make sure to both enable open knowledge sharing and combing, along with supporting and improving their individual competencies.

3.2.2 Motivating, organising and improving the collaboration

Enabling the collaboration to perform well and increase its contribution to the joint development and work is important but not easily done. Ford et al. (2011) propose that doing so involves three different steps of managing the suppliers or collaborative partners: *Mobilising and motivating*; *Organising and interacting*; *Monitoring and modifying*.

Starting with creating a common interest and commitment to the collaboration for all parties is especially important as relationships are exclusive as an effect of resource limitations (Ford et al., 2011). Doing this involves both creating a trust between parties and knowledge of how each organisation and person in the interaction perceives the situation (Neeley, 2018). This does not mean that it has to be comprehensive, but well working collaborations require some underlying understanding to interpret each other correctly and help make them high performing and reducing distance between the parties. That several suppliers often are involved in the same projects and processes increases the complexity of this, but it is likewise important to create a commitment between them for collaborating (Ford et al., 2011). Doing so is according to Ale Ebrahim et al. (2009) one of the keys to enabling knowledge sharing and combining.

This part of enabling collaboration requires the parties to organise sufficient channels and interactions to create a smooth relation (building upon what is presented in section 3.1). Neeley (2018) explain that this is done by supporting trust to build quickly (*swift trust*) and passing it on (*passable trust)* and both establishing *direct knowledge* (of how the other parties think, work, prioritise and act) and *reflective knowledge* (what characteristics of thoughts and priorities that I am subject to). Building these kinds of trust is done by setting foundations and expectations for collaboration (swift) and transparently showing recommendations between people, so they can build trust on someone else's experience (passable). The role of initial foundations and clear responsibilities for efficient

collaboration is also supported by Binder et al. (2008). Rosell et al. (2014) emphasise that trust based on relational aspects enable joint learning and competence-based trust is a foundation for absorbing knowledge, showing that certain degrees of trust enables certain degrees of collaboration. Accompanying this Neeley (2018) argues that knowledge of each other, both direct and reflective, supports collaboration across both organisational and cultural borders. Ways to build this understanding is meeting each other face-to-face and allowing for building inter-personal relationships, through e.g. social events during conferences or unstructured time under conference calls, encouraging casual conversation.

Lastly Ford et al. (2011) return to the importance of continuously developing how the interaction is done and adapting processes and knowledge towards one another. In doing so the borders between organisations are reduced from having a negative effect on the collaboration. Binder et al. (2008) discuss that this should be wisely managed in order to still improve the own organisation and actually learn from each other, rather than just letting someone else do the work. For this continuous involvement and competent leadership is required, also including cross-functional interfaces. Successfully adapting and improving practices and inter-organisational processes, to work better together, leads to strengthening the relationships and collaboration (Middel et al., 2005). This can result in improving capabilities both within the individual firm and the IOC.

3.2.3 Framework for collaboration parameters and structures

Based on the framework developed by Johansson et al. (2011) the previous two chapters are adapted and fit suitably into different areas of their framework, foremost regarding the relationships characteristics. The parameters for collaboration to be perform well are defined as different types of characteristics. *Governance* to a large extent relates to the role of contracts in collaboration, but together with *integration* it is also covered by the Agile context (see description in section 2.2). Together this can then be linked as shown in Figure 3:2.

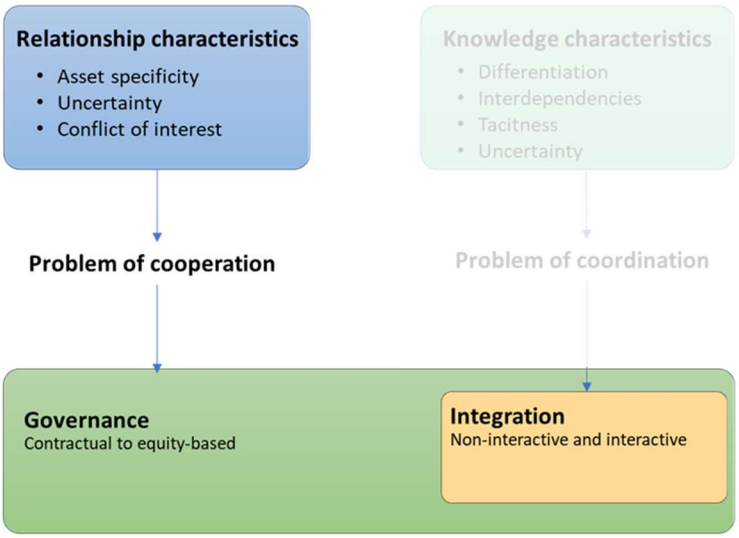

Figure 3:2 *Johansson et al. (2011)'s conceptual framework of inter-organisational collaboration, here focusing on relationship characteristics and the organisation for successful collaboration.*

Johansson et al. (2011) explain that the relationship characteristics create uncertainty to how and to what extent collaboration can be done, becoming a *problem of cooperation*. Different expectations and interests also come into play in this parameter, with a need to align them through *governance* in some way. With the different sets of knowledge contributed by each individual team and organisation it then also becomes a matter of understanding what can and should be done by whom and how it affects related areas, noted to be the *problem of coordination* (Johansson et al., 2011). The ability to succeed in suitably dividing tasks, handling dependencies, understanding the current developments happening and managing to interact within the given format, depends on suitable *integration*.

3.3 Allowing for successful knowledge combining

Building from the important parameters and governance structures of collaborations, high performing collaborations can come. For this to occur it is important to understand how to share, combine and integrate the individual knowledge in order to create synergies and a higher collective output. This understanding is well in line with the purpose for this study and the following part will further outline and define important aspects mentioned by other authors. Successful knowledge combining in summary relates to:

- Not just sharing information, but working together with problems to combine and integrate knowledge
- Understanding knowledge as tacit, complicated, explicit and degree of novelty
- Commonly addressing knowledge in a suitable way

3.3.1 Understanding the role of sharing, combining and integrating knowledge

For collaborations to be truly valuable it is important to efficiently mobilise and organise for combining the knowledge that comes as valuable input from each individual member. Enabling this to happen is not only about getting a specific task done or sharing the final results of a development project, but rather about building a common understanding. This regards both sharing, integrating, combining and jointly further improving and developing, based on the common knowledge (Ahlskog et al., 2017; Chapman and Corso, 2005; Rosell et al., 2014). Basically, this is about taking each individual contribution and seeing synergies, with common output larger than that of the combined input. It's about, not only the processes for sharing knowledge, but how multiple parties can redefine and combine their collective knowledge base to increase their collective output.

Knowledge combining goes beyond just sharing knowledge and according to Ahlskog et al. (2017) refers to combining individually held knowledge in order to create new knowledge. This is further described as a learning process with collaboration, sharing and combining as crucial parts to create new knowledge. Rosell et al. (2017) emphasise that this builds upon sharing knowledge, but goes further in order to commonly combine and generate a more developed knowledge. The authors argue that sharing and combining are therefore two sub-processes within the entire act of knowledge combining (or integration as they call it). Combining of knowledge is stated to be a more complex process relying on large degrees of working together with problems, daring to ask and answer questions. It also involves making use of knowledge within the own organisation, sufficiently communicating learnings internally and understanding what is relevant to different parts of the organisation (Kanter, 1994). Managing this act successfully both leads to sharing knowledge and combining it to see new knowledge emerge, to a higher degree according to Ahlskog et al. (2017).

3.3.2 Sharing knowledge of different characteristics

To understand how knowledge combining can be done, it is also important to understand the different characteristics that knowledge is subject to (Rosell et al., 2017). This impacts the way sharing and combining can and should be done for the collaborating parties to successfully learn and understand each other. A traditional division of knowledge is to that of explicit knowledge (i.e. knowing what; possible to communicate) and tacit knowledge (i.e. knowing how; underlying and not easily communicated) (Ahlskog et al., 2017; Rosell et al., 2014). To this also comes the aspect of novelty, e.g. of the technology (Ahlskog et al., 2017), and aspects of incremental or radical input (Rosell et al., 2017). Gathering these parameters together this study formulates knowledge into being either *explicit* (that which is already known, where specifications can easily be set and mainly involving incremental development) or *complex and tacit* (often involving radical development, high novelty and knowledge deeply rooted in actions and experience).

Transferring knowledge that is explicit can be exemplified as an expert's answer to a specific problem within the collaboration (Rosell et al., 2017). Such can be communicated in a sufficient manner without having to meet. More complex information and tacit knowledge has to be subject to selection and interpretation according to the Rosell et al. (2017), but also that it often can only be transferred by prolonged interaction and physically meetings (Newell et al., 2009). This as it must be made relevant and beneficial for the receiving party, in order to easily translate into that context, and therefore understanding of each other must be present (van der Valk et al., 2018). Newell et al. (2009) even state that for knowledge to be valuable and recognised it must be applicable in the recipient's context. It therefore cannot be transferred entirely and more communication may not lead to better effect (Newell et al., 2009), but rather could reduce its potential benefits.

Sharing and combining tacit and complex knowledge is also made even more complicated as the possibility of misinterpretation and what is needed to be understood, is not clear. Such issues are made more clear by understanding tacit knowledge as "*we can know more than we can tell*" (Ahlskog et al., 2017), a definition also used for understanding knowledge workers (Rosell et al., 2014; ScaledAgile, 2017)(i.e. employees working with complex tasks, solving them using knowledge as primary tool). This adds to the complexity of knowledge but is according to Snowden and Boone (2007) also what is required to solve complex tasks. The authors emphasise bringing together the knowledge held by individuals and together in a flexible and adjustable manner trying out different ways of understanding complex problems and by a combined effort solve them. There also has to be a degree of transparency to actually share knowledge, which is impacted by many parameters. Leading to increase in complexity of knowledge combining, as it is affected by e.g. your partners relationships with competitors, complexity of the solution and the characteristics of shared information. Increased transparency will however have a positive effect on IOC, the collective output, ability to deploy and integrate new solutions continuously (van der Valk et al., 2018). Johansson et al. (2011) also add to this the impact that tacit knowledge has on limiting the amount of people interacting, as a too large group will not be able to share and combine such knowledge.

Different degrees of novelty and complexity thereby affect the possibility to collaborate. Rosell et al. (2017) therefore state that purposeful choices of how to share and combine knowledge, depending on its characteristics must be taken. More complex tasks will rely on more tacit knowledge and there must be a larger knowledge overlap, enabled by working tightly together. For these kind of problems and tasks Rosell et al. (2014) emphasise high degrees of interaction in the collaborations, with joint problem-solving and decision making. Thereby there is also a crucial impact from the collaboration itself; how it is governed and which processes for integration that are present. Newell et al. (2009) argue that occasional contact is not enough for successful collaborations, either within organisations or between organisations. Only through a interaction processes will the organisations learn how to utilise the knowledge and skills from each other and

together develop joint learning (Araujo et al., 1999). Snowden and Boone (2007) also state that an insufficient type of organisation for complex tasks will lead to poor performing attempts of managing them.

The previously mentioned parameters (see section 3.1) must therefore be worked with for knowledge combining to be successful in collaborations. For enabling knowledge combining it is also of importance how tasks are divided, recognising available learnings and integrating knowledge into the process rather than product (Newell et al., 2009). Sufficiently understanding these knowledge characteristics and how to coordinate and integrate them is the second part of enabling knowledge combining (see Figure 3:3), joined together with that of relationship characteristics (see section 3.2.3).

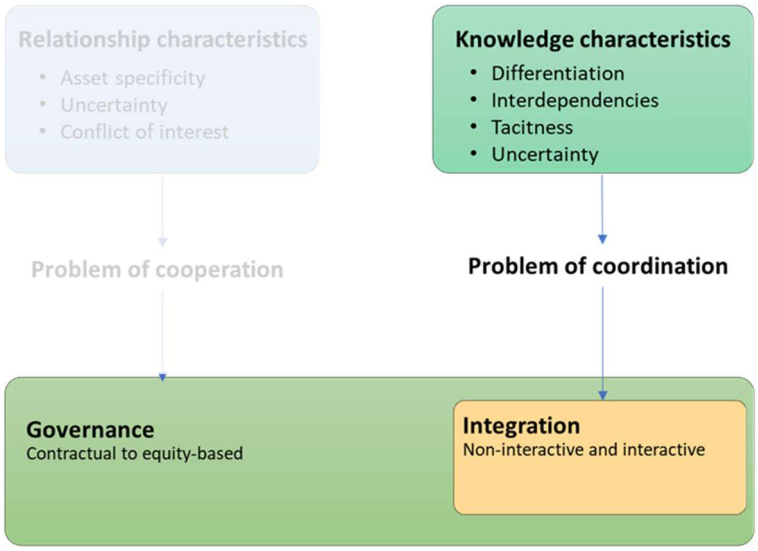

Figure 3:3 *Johansson et al. (2011)'s conceptual framework of inter-organisational collaboration, here emphasising knowledge characteristics.*

3.3.3 Combining and absorbing knowledge from the collaboration

A crucial part in collaboration and combining knowledge is not only attempting to learn from each other, but to integrate and absorb the learnings within the own organisation (Ahlskog et al., 2017; Kanter, 1994). This capability of absorbing external knowledge, interpret it and apply, highly impacts the benefits from joint learnings and combining knowledge. Rosell et al. (2017) identify two approaches for integrating external knowledge in R&D collaborations (see Figure 3:4) with a slightly different approach of how knowledge is accumulated and combined to benefit the co-developed solution: *coupled* and *decoupled knowledge integration approaches*.

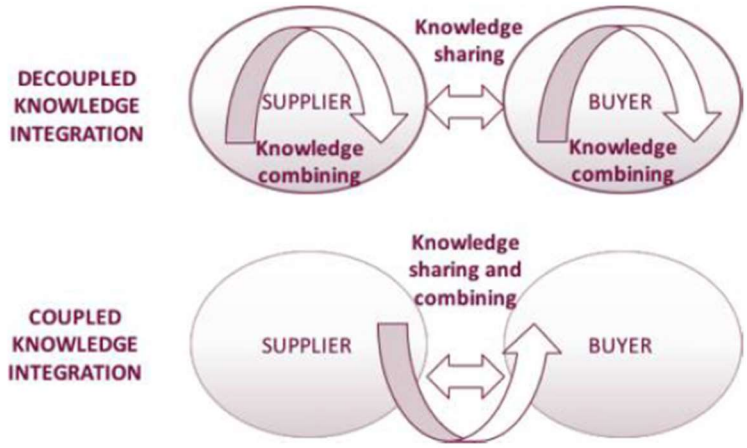

Figure 3:4 *Description of the two knowledge integrations approaches (decoupled and coupled), as identified by (Rosell et al., 2017).*

Decoupled knowledge integration is comparable to that of developing internally and then knowledge sharing in the final stages of the process. A distinct division between organisations allows for small-scale commitment and a sufficient openness whilst still mitigating risks of knowledge leakage, according to Rosell et al. (2017). Generally, this kind of approach is identified by the authors when doing incremental development projects. These kinds of projects relate closely to more explicit knowledge bases and decoupled knowledge integration also works best when having limited technological and design changes.

The approach of coupled knowledge integration is in contrast linked to more radical improvement projects. It relies heavily on joint processes and a high degree of interaction (Rosell et al., 2017), showing a clear connection to that of complex and tacit knowledge. Successfully managing this kind of highly intertwined collaborative development projects requires open boundaries and teams working together for problem solving, according to the authors. For this kind of knowledge combining Rosell et al. (2017) emphasise the need for a high degree of knowledge and trust in the collaboration. Managing to do this approach of knowledge combining allows for continuous learning and seeing synergies develop and generate new knowledge and improved products and processes.

Building this further, and returning to the introduction of this section, Ahlskog et al. (2017) emphasise the need for not only jointly learning and collaborating with a partner filling the right competence gap. Knowledge combining should according to the authors go beyond only combining and sharing between supplier and buyer, into actually absorbing the learnings into the own organisation. This also counteracts the negative impact of knowledge leakage, as it continuously develops the internal knowledge. Iteratively spiralling between all these processes allows for continuous improvement and combined developments (Ahlskog et al., 2017). All this occurs within both the context previously described and the characteristics of knowledge (visualised in Figure 3:5).

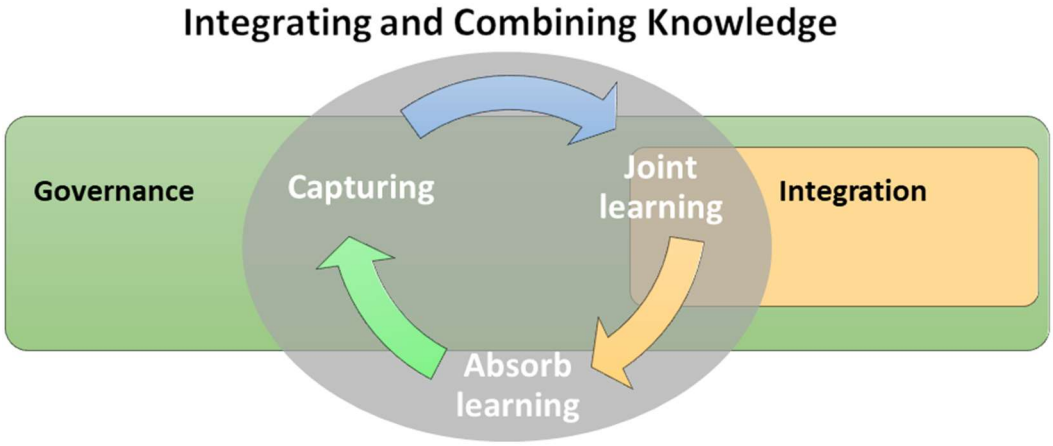

Figure 3:5 *Understanding the role of the context and approach to combining and integrating knowledge within a collaboration. Adapted from Ahlskog et al. (2017) and further developed from the framework in section 3.2.3.*

3.4 Categories and Levels of Improvements stemming from successful collaboration

The need for collaboration not only stems from being able to combine knowledge, focus on core competence and create products together as a network. They also include doing collaborative improvements, where the joint learnings and combined knowledge enable innovation and improvements in many levels (Webb, 2018). According to Kanter (1994) this can take place when the right mechanisms and organisation is in place, as described in the sections leading up to this part. Collaborative improvements can according to Middel et al. (2005) be categorised three different levels of collaboration degree and commitment (see Figure 3:6).

The first level (P*erformance*) of collaborative improvements regards having a place or process of meeting and working together. There is an understanding that this is important to not sub-optimise and the organisations work and meet continuously together. Interaction thus occurs, but commitment and the overall alignment can still be low. Improvements stemming from this kind of collaboration generally relate to product

improvements or those characterised by being able to distribute explicitly (Middel et al., 2005).

Second level (*Process*) collaboration regards having established common commitment and goals for the interactions. Collaboration does not only occur on a transactional level, but transcends into wanting to create something better together. There is a defined common goal with the sync meetings and reasons for meeting. Here not only sub-optimisation is avoided, but collaboration allows for long-term alignment and improvements. In this collaboration setting it is possible to generate, implement and evaluate improvements (Middel et al., 2005). These improvements regard those of alignment and process improvements that enable further developments and improvements by themselves.

For the third level (*Capability*) of collaborative improvement, focus further into building capabilities to increase the improvement ability, according to Middel et al. (2005). In this way it regards setting up the own organisation in a way that the collaboration can achieve better results together and building individual capabilities that can be transmitted into the collaboration. This is done to accelerate the building, identifying, and applying of collaborative improvements (Middel et al., 2005). Together the organisations in this manner aim to be active parties in the collaboration and attempt to take responsibility for driving the overall improvements in collaboration. From this stem a large variety of improvements, foremost related to improvements in areas such as methodology, values, and practices.

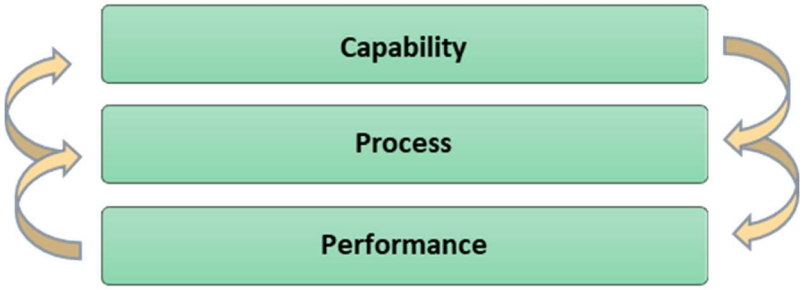

Figure 3:6 *Improvements stemming from collaboration managed correctly, adapted from Middel et al. (2005).*

3.5 A framework for analysis

Together these previously outlined sections of theory create a good foundation for being able to analyse that empirical data gathered during this study. Using the different theoretical contributions from these sections and the visualisations (described in Figure 3:2, Figure 3:3, Figure 3:5 and **Figure 3:6**) makes it possible to create a general analysis framework. This framework links together the different parameters and organisations necessary for successful collaboration, how knowledge combining can occur within this setting and what improvements can be the result. Doing so also relates to the research questions (see section 1.2) for this study and is well aligned with the purpose.

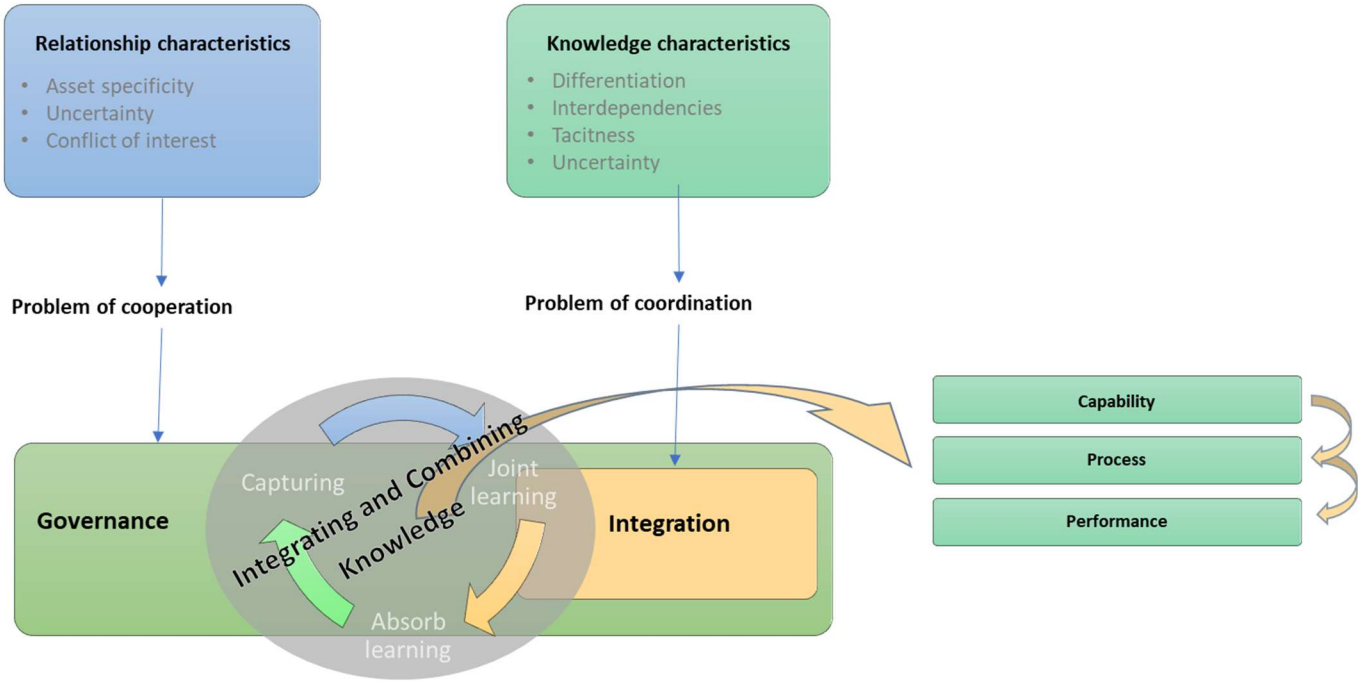

Figure 3:7 *Analysis framework derived from the combination of theoretical sub-sections mentioned in this chapter, combined to a model used for the analysis.*

4 Method

This section describes the methodology used during this study and how data gathering, analysis and drawing conclusions was done. Methods of ensuring research quality and ethics and guidelines for how interviews and empirical material was handled is also presented.

4.1 Research approach

Starting with discussions of interesting subjects and potential contexts, an initial purpose of the report was defined and contact with Knowit was initiated. This was done whilst also beginning building basic theoretical knowledge within the subject. Defining the context company (VCC) was then done from discussion with the supervisors at Knowit and Chalmers, and other subject experts (both of Agile methodology and the Agile organisation of VCC). Through specifying the research subject early and developing knowledge simultaneously as establishing contacts within the context, objectivity of research and control over development was attempted. To this the development of a basic theoretical foundation and context at the same time, also balances the problematic issues with personal values, perception and dependencies on other people as "gatekeepers" to the context (Bryman and Bell, 2015). Following this process made it possible to define VCC as a context well suitable for the study.

A well planned initial approach was conducted, using both a tight and specific initial aim, whilst keeping it flexible to emerging situations. With changes and developments recognised as prone to occur during the study, this flexibility allowed for adaption to them. The potential subjectivity of this approach is problematised by Bryman and Bell (2015) when basing studies on what is defined as "emergent-spontaneous research". The intentional choice of direction, delimitations and context in the initial faces of this study attempts to control this though, which is backed up by Dubois and Gadde (2017). Even though the issue of emergent-spontaneous situations is mentioned, Bryman and Bell (2015) also recognise that there has to be iteration between empirical sources and literature. Within VCC we were able to define areas where evidence of challenges related to the desired collaboration most likely would be found, with this method. These early specifications also defined the subjects under study to be people, their interactions and their understanding, making a qualitative research approach appropriate to follow (Bryman and Bell, 2015; Doody and Noonan, 2013). The use of qualitative research also makes it possible to generate deeper understandings of social phenomena (Whiting, 2008), which aligns with the aim of the study.

4.2 Research method

Research was conducted using an iterative approach consisting of four phases in iteration (see Figure 4:1): scope definition, study of theory, empirical data collection and analysis of the theory and empirical findings. Through the tight initial specifications built on the anticipations and perception of the researchers, described in the preceding section, the aim was defined and the study started. This approach enables continuous redefinition of the scope based on the theoretical and empirical findings throughout the research and making the study well adapted to the case analysis (Bryman and Bell, 2015; Dubois and Gadde, 2017). For this to be beneficial the tight and specific "pre planning" and focus is found to be crucial (Eisenhardt, 1989; Gioia et al., 2013). Combining empirical insights with theory in continuous iterations is a key characteristic of the systematic combining approach (Dubois and Gadde, 2002). Following this methodology was thus found to be well suitable for this study, as the characteristics aligned well, thereby using a systematic combining approach, as presented by Dubois and Gadde (2002).

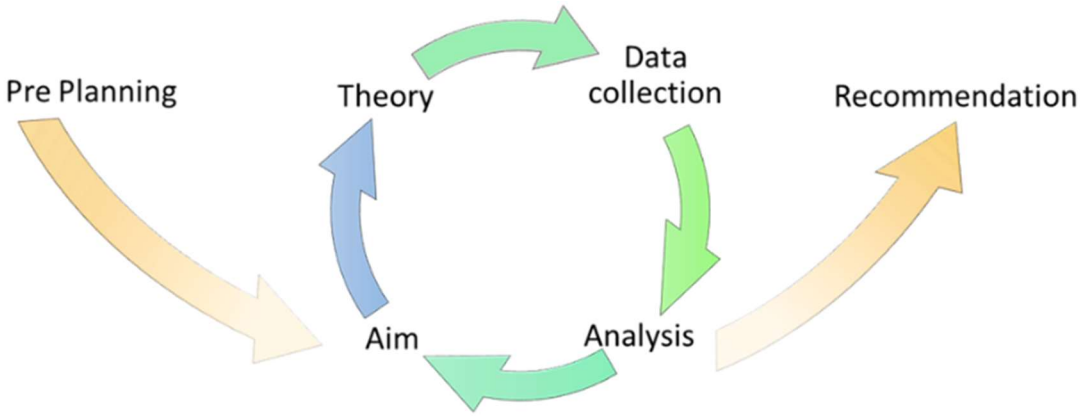

Figure 4:1 *Conceptual description of the Systematic Combining approach used in this Master Thesis study. Tight pre planning to set the scope is conducted, then a high degree of iteration and finally conclusions can be drawn from the study.*

Systematic combining also allowed for following up on spontaneous empirical data and findings in an intentionally identified context, allowing the scope, analysis, and findings to emerge from the context in a controlled way. Working in this way follows Dubois and Gadde (2017) recommendations and acknowledgement of the necessity to return to building a theoretical framework well suitable, evolving from unanticipated empirical findings and theoretical insights. Bryman and Bell (2015) join this reasoning and encourage back-and-forth engagement between empirical data, theoretical ideas and literature.

Doing all this we recognised a need for returning to the initial thoughts and purpose, loosely controlling the situations as they develop, to not be overwhelmed by data or emergent situations. This is according to Dubois and Gadde (2017) an important part of validating the study, not trusting only the process, methodology or context. Instead combining own reasoning and transparency for other researchers to add input, question

and discuss, so that objectivity is controlled and openness for the actual case and purpose is kept. This discussion with other students and the supervisors was enabled through regular meetings where peer-review occurred at several occasions. Along with this, spontaneous exchanges of thoughts and drafts occurred with other master thesis students at Knowit.

4.2.1 Defining the context cases

Following the chosen context of this study a single company (VCC) with its collaboration across and within organisational borders was used. Within this context several teams, groups of teams (ARTs) and collaborations with suppliers were studied, also involving teams collaborating with teams across department borders. The empirical context was thereby set out to be a single case study with embedded multiple subunits of analysis (Yin, 2017), being beneficial with the complexity surrounding this specific study (Stuart et al., 2002). Using a common context and viewing several cases within this allowed for deeper analysis and understanding, according to Taylor et al. (2015). These theoretical findings thereby support this setup, as the purpose is to view collaboration between several contexts and over company boundaries.

The subunits were identified with the purpose to gain understanding of the situations from two different ARTs and their teams. Comparing these two subunits and possibly viewing any interaction made between them would also add to the depth of understanding how knowledge combining is made and organised (Yin, 2017). Using input from several teams of each ART also allowed for deepened analysis and understanding of the overall context and its characteristics. Together with these the input from the procurement function enabling collaboration between the internal and external teams, was also added. Investigating this dimension was suggest by field experts, theory's and previous studies at VCC's emphasis on contracts role in collaboration and our own perception. Contributions by field experts from Chalmers and Knowit as well as a VCC representative working with architectural systems for ART/Solution management gave additional overview and understanding. Gathering all these inputs to an analysis gives a possibility for deeper understanding of the single case (Yin, 2017) and supports reaching closure and making a theoretical contribution (Eisenhardt, 1989).

4.3 Theory and Data collection

With the systematic combining approach as base, both theoretical and empirical data collection was done iteratively during the study. This meant developing understanding and seeing a need for theoretical understanding during the evolving study of the case and as tendencies within the data presented themselves. Working in this way required building a "loose framework" with great flexibility for emergent directions and findings, following the recommendations of Bryman and Bell (2015); Dubois and Gadde (2017). It also required a consistency in following the initial tight specifications, to not accidentally fall away from the purpose. Whilst still finding a way to allow for developing the study in accordance to the context case and not only confirming our own perception. Intentionally

leaving space for the empirical data showing the direction is backed up by Gioia et al. (2013), emphasising the importance of not having "blinders on" and a "confirmation bias", from a too large literature focus. The initial focus also helps managing the amounts of data collected according to Eisenhardt (1989), which could become immense during this case study.

Combining of the gathered knowledge was enabled during regular booked meetings between the authors of the master thesis. Continuously working with discussion and analysis of theory and empirical data allowed for acknowledging where there was a need to expand the study and for building suitable knowledge. Reflections regarding each theoretical contribution's impact on this specific case were done during these meetings. Documents with notes and linking all data with codes enabled this to function well (further described in sections 4.3.3 and 4.4). These kind of discussions both occurred within the research team and with other master thesis groups, through e.g. peer review sessions, which also adds to the possibility for proper understanding (Gioia et al., 2013).

The emerging practice and the systematic combining approach could be prone to own values and preferences. To balance this the objectivity obtained by coming from Knowit and the employees' networks when observing VCC helps critically analysing the case. There were no specific questions or analysis defined by Knowit for the Master Thesis, meaning that no specific evaluation was required, but rather they would benefit from our objective opinion. Reflecting on how we react and evaluate our research and findings in relation to possibly wanting to make some stakeholders happy, is according to Bryman and Bell (2015) a good way to ensure a reduced influence of own value on the study and results. Minimising the impact of both our background and the emerging network and stakeholders also involved reflecting on procedures for interviewing (explained in 4.3.2), emphasised by Whiting (2008). Deliberately allowing questioning of study process, choices and analysis by supervisors and peer reviewers also aimed to control this. Another way to aim for clarity and support objectivity was working in a transparent and clear manner by intentionally using simple and hands on approach for analysis and building theory.

4.3.1 Gathering a theoretical foundation for the study

Literature relevant to this subject was searched for by using keyword search in the databases "Chalmers library's Summon", "Google Scholar" and "SciVerse Scopus". Recommendations by the supervisors were also used and following the references cited by the first read literature. Trying to understand the subject early on lead to initially defined four sections of theory to be reviewed: Agile methodologies; Collaboration in Business Relationships; Knowledge Management Frameworks; Enablers for Successful Teamwork and Collaboration. This developed into what is presented in the description of Agile and the analytical framework (chapter 2 and 3).

Summaries of and important quotes from each paper were stored in a common document. This allowed handling the amount of theory used for the establishing a theoretical

understanding and increase knowledge combining between the authors of the master thesis. Reviewing and expanding this material was a reoccurring process throughout the master thesis, adding keywords to each summary so to make it searchable. Bryman and Bell (2015) argue that working in this way allows increasing the understanding of the data gathered. Deliberately gathering theoretical input and then postponing the thorough study, analysis and choice of literature to build a framework from, allowed to conduct a better study (Gioia et al., 2013). It also makes sure that empirical data is not treated only to confirm either theory or empirical data and the presumed links between them. Instead it can be gathered and analysed free from preconception, as theory is collected and analysed individually as well as in the meetings. Doing so also follows Dubois and Gadde (2014) proposal, making it possible to repeatedly analyse and understand theory through the empirical data and if needed further expand it.

In order to build a suitable knowledge base, allowing analysis of the empirical findings, both contradicting and supporting literature was studied. This included examining and summarising both research of similar setups and situations as the studied cases, and that which differed. Doing so is, according to Eisenhardt (1989), important as it ties together underlying similarities in phenomena normally not associated with each other. The author further argues that the result more often becomes theory with stronger validity and which can be understood from a more general and conceptual perspective. Subjects were aimed to be explored from several perspectives to allow for not creating a bias, but rather explore differences that could be compared with empirical findings to see where they are to be categorised.

4.3.2 Empirical data collection

As the contacted and interviewed people within VCC were a result of the contacts at Knowit and their networks the research could be subject to their interpretation and choice of interviewees. Defining the desired roles and contexts of the individuals ahead of receiving potential names, made it possible to take an objective stance and control the development through tight specification and following a process for the case study (Taylor et al., 2015; Yin, 2017). By doing so the following functional roles of interviewees, preferably with supplier contacts, were found to be of interest for the study: Project leaders; Line manager; Technology Engineer / Developer; Agile support or management functions; Supplier Representatives. These were present within different parts of the Agile organisation and as different roles (see Figure 4:2).

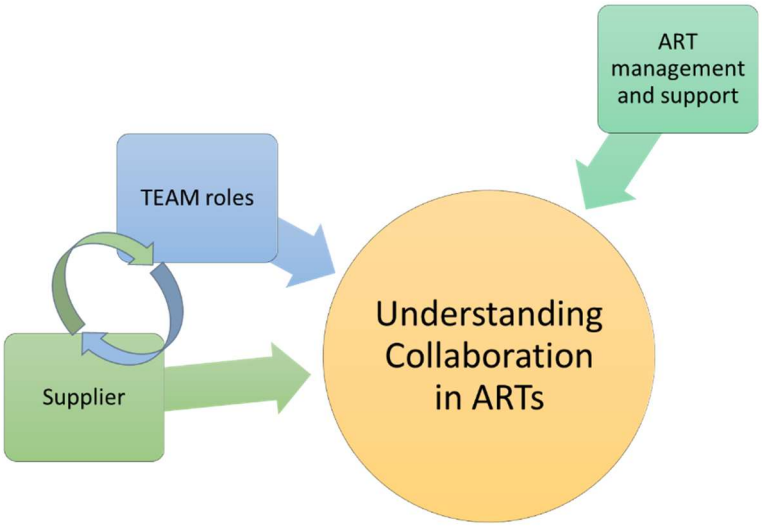

Figure 4:2 *Organisational roles interviewed during empirical data gathering and a conceptualisation of their relation towards each other and the studied subject.*

Purpose and preparation of interviews

The interviews aimed at exploring mainly the intention behind Volvos use of Agile methodologies and the setup of organisation and processes to support this. Taking the teams perspective, with both individual engineers and managers, allowed to evaluate how this really worked. Several interviews representing the different teams and ARTs, with different people over a stretch of time were planned. Taylor et al. (2015) argues that this allows grasping a better picture of the situation and building a better analysis. The intentional choice of different teams also allowed for reducing individual opinions and bias (Eisenhardt and Graebner, 2007).

This was as previously mentioned achieve by presenting a list of desired roles to interview, which then was presented to the supervisors at Knowit, helping us locate the right interviewees. Contact was done through an email describing the subject, why they were identified as interesting and what amount of time was needed. This was done by us, in order to not put unnecessary pressure from a manager or likewise on the interviewees. In the contact it was also seen important to create transparency regarding the purpose of interviews by sending notes on the intent and scope prior to meeting, as described by Taylor et al. (2015); Whiting (2008). To not describe the process in to large extent is further highlighted by Taylor et al. (2015), avoiding interviewees becoming cautious and reluctant, and the intentions were therefore only to provide a general outline.

A few peopled responded that they lacked time for an interview, but the main part were able to take part in an interview and answer additional questions afterwards (if found necessary after the interview). During these first interviews they were also asked to propose team members or colleagues suitable for similar interviews. Using a networked approach in this way allowed us to gain a large difference of people to interview, not depending on our first contact or Knowit. An iterative interview approach also became a

consequence of this networking, with contacts to suitable teams and suppliers coming from the first interviewees. This was necessary as not all teams worked together with suppliers or could be said to have experience of the needed cases, to contribute to the study. The used iterations represent different levels of the organisation, with first contacts representing the ART management. From this came a second iteration containing representatives from Teams and Suppliers. Interviewing from all the described levels and using additional input from support functions such as procurement, was important to do an accurate analysis. When interviewing all these levels it was, according to Yin (2017), possible to find answers to the asked research questions and actually study how *IOC* finds its expression in this context.

Standard data from company

In order to gain an understanding of the context prior to conducting interviews, we set out to both do some explorative interviews and gained access of internal documents, getting to know the actual and intended setup and situation. This was done to further increase the quality of the conducted interviews and understanding of context. Interviewees and the Knowit supervisors were therefore asked to distribute available standard information of the company structure and managerial processes at or before the first interview. The purpose of this was to aid the interview preparations and speed up the initiation of interviews by allowing better understanding and accurate probing questions regarding the company specific context immediately. To this material came e.g. organisational structures, process descriptions and whitepapers for SAFe. Some of the material is presented during the previous chapters, but some material is left out due to non-disclosure agreements.

Making use of internal documents from the organisation to understand the context and see developments is useful according to Bryman and Bell (2015). Even though these do not necessarily give a description of the actual situation, they do according to the authors, give a trustworthy understand of what should be. Therefore, the use of these sources is well in place for this report. Balancing these documents with qualitative interviews gave a good chance of truthfully grasping and evaluating the intended and actual situation (Bryman and Bell, 2015).

Conducting the interviews

The primary method for data collection was semi-structured interviews with representatives from the studied intercompany collaboration, conducted by us as a pair. A qualitative approach of data collection was used to gain a deeper understanding, of the context and practises related to the companies' collaboration, as supported by Chadwick et al (2008). The interviews conducted during this study are presented in a complete list, shown in Table 4:1. They consisted of people from different parts of the organisation and represented different roles and organisations in both the ARTs. It was also possible to sort them according to the degree they were familiar to Agile methodologies, as identified by themselves or us, showing that the more part showed rather large competence. The

distribution of interviewees included Team members only in ART 1 as time and contacts were limited for ART 2. Even with a smaller amount of interviews it was possible to gain a good overview and understanding of the context and characteristics of ART 2, as the people interviewed had both high operational and managerial insight.

Table 4:1 *Complete list of interviewees, their affiliated ART and work roles.*

Inter-view no.	**Works in ART**	**Agile competence** (relative workarea)	**Work role**
1	N/A	Expert	Purchasing representatives
2	ART 1	Familiar	TEAM member
3	ART 1	Familiar	TEAM member
4	ART 2	Familiar	ART management
5	N/A	Familiar	ART management
6	ART 1	Expert	ART management
7	ART 1	Familiar	TEAM member
8	ART 1	Expert	TEAM member
9	ART 1	Familiar	TEAM member
10	ART 2	Expert	ART management
11	ART 1	Expert	ART management
12	ART 1 - S2	Novice	Supplier representatives
13	ART 1	Familiar	ART management
14	ART 2 - S3	Familiar	Supplier representatives
15	ART 1	Expert	ART management
16	ART 1 - S1	Expert	Supplier representatives

The empirical data was mainly gathered through face to face meetings with the participants conducted at their preferred location. Two of the interviews were conducted via Skype as it was not possible to meet in person. Meetings were introduced, both during first contact and in beginning of interview, by clarifying the interview's purpose, estimated duration and used practises for handling the participants identity, following proposals by Doody and Noonan (2013); Whiting (2008). This procedure clarified that interview recordings only were accessed by the researchers, and only recorded if

approved. Thereby also keeping the participant's identity anonymous and creating a comfortable situation for the interviewee (Whiting, 2008). Data from the interviews were documented using recordings, the person conducting the interviews taking bullet points on paper and the other person taking notes digitally in higher detail. These were automatically linked to the recording by software support (Microsoft OneNote), making it possible to return to the interviewed recording for validation and additional input. Doody and Noonan (2013) advocates this approach since it enables the researcher to keep eye contact with the interviewee and focus solely on gathering as much information as possible.

Meeting representatives from procurement or ART management made it necessary to reflect around the way questions needed to be asked in order to be interpreted correctly and give a through and proper explanation from their point of view. This development is supported by Gioia et al. (2013); Taylor et al. (2015), emphasising a need to adapt and ask different probes also during the interview, as the exact suitable questions for that interview is not able to be known in advance. The interview guide (see Appendix A – Interview Questions) was created in order to explore the subjects needed to understand and analyse the context for the research questions, based on the initial theoretical and context knowledge. These questions were formulated together and reviewed thoroughly, with input from supervisors, to increase the interview guide's quality.

Subjects regarding the creation of each interview guide evolved around phrasing of complex questions and making participants comfortable to discuss collaboration aspects, being potentially sensitive topics. Questions were formulated to be open-ended, clear, and neutral which according to Doody and Noonan (2013) is favourable in qualitative research, allowing the respondent to answer the question freely. The use of semi-structured interviews required predefined structure of questions and allowed researchers to ask follow-up question to seek clarification. This characteristic is one of the factors why semi-structured interviews were considered the most suitable approach for the study. Using of semi-structured interviews allow researchers to probe deeper into subjects relevant to the study, thereby generating deeper understandings which aligns with the qualitative research approach Doody and Noonan (2013). Moreover, the semi-structured interviews' construction ensures comparability of interviews and consistency of gathered data. The interviews also allowed for large reflection by the interview and only guiding the interviewee forward into the subject, not forcing them to answer questions in a certain order or manner, emphasised by Whiting (2008). This was done because it was seen to be more important to get the interviewee to state his/her opinion, than to confirm the theory or our prejudice.

4.3.3 Structuring of data

Following the method used to handle the theoretical data (described in section 4.3.1) the interview notes were summarised after taking place. Critical information for this study, that were noted from the interviews, was afterwards sent back to the interviewee in short

bullet points, to control accurate understanding and interpretation. As proposed by Bryman and Bell (2015) the notes were regularly reviewed and categorised with keywords that were standardised during the study. This was done by first briefly summarising the interview in a word document a short time after conducting it, to gather an as complete picture as possible (Taylor et al., 2015). Doing so allows to revisit the interview situation later and make use of the data and interpretation (Eisenhardt, 1989). It also assured that data collected early can contribute fully to the study as knowledge and understanding is developed throughout it (Taylor et al., 2015). After this a definition of keywords that explained what had been explored during the interview was done in a data sheet. Common sessions of going through the empirical data were used, discussing and establishing possible links to theory, initial analysis and call for more theory. Working in this way made it possible to manage the amount of data gathered and make use of it in a sufficient way (Taylor et al., 2015). It also gave a chance for second opinion on the notes and thoughts gained during the data gathering. Analysis and data collection has to be conducted simultaneously according to Gioia et al. (2013) as all else would be an artificial after construct. Iteratively doing analysis and data collection also allows to make use of the findings in the coming interviews and more purposefully using the method of case analysis (Eisenhardt, 1989).

Linking theory and empirical data with perceived keywords and setting a standard keyword choice early on, increased the possibility to analyse the empirical data iteratively and make use of and review the entire theoretical base. Coding data in this way, starting early on, enables the search for patterns in the data and give base for good analysis according to Taylor et al. (2015); Yin (2017). This first led to a large amount of codes, which later was limited to a more suitable amount, following the proposal of Gioia et al. (2013).

4.4 Handling data

The previously described combination of data collection and analysis also regarded the development of the report and the research method as described in Figure 4:1. To allow for this the report was used as a place for emerging thoughts, “recorded in the moment”, along with paragraphs being near to finalised. Through doing so the researchers were not subject to certain directional choices during the duration of the case study (Dubois and Gadde, 2002). Instead iteration and analysis could still be conducted in the end of the project, following up on thoughts and observations gathered along the way. These might not have been part of that moments current delimitations, but still make valid and important contributions to the final product (Taylor et al., 2015).

Allowing thoughts and notes be part of the entire process also supported discussion and reflection in the research team, emphasised by Taylor et al. (2015) in order to gather and remember data accurately. Working in this way was an important way to let emerging observations and the case itself guide the way. Using this process made both the process of the report, empirical data findings and literature study, iterative and open for constant

development. According to Dubois and Gadde (2002) this sustains the case as the tool for conducting the study and not only the object of it. Letting the case take this place in the process and develop it iteratively allows following the development of the case, along with theory and method, throughout the entire project.

4.4.1 Presenting Empirical Data: Case studies

To create an understanding of the observed cases through empirical data gathering, they are presented using a story-telling model. This allows for a clear description of the necessary aspects and gives possibility to follow the reasoning and context (Bryman and Bell, 2015; Jonsen et al., 2018; Taylor et al., 2015). These are presented using direct quotes from the interviews that exemplify the described phenomena's. Which interviewees are quoted in connection to the stories is also presented in the beginning of the empirical data (see chapter 5). Doing so makes it possible to get an overview of main concepts and the frequency of their mentioning in the interviews, giving a clear overview (Eisenhardt and Graebner, 2007).

Working in this way allows to show the situations described throughout the data collection in a way that becomes more clear to the reader (Dubois and Gadde, 2017; Gioia et al., 2013). Using the story as language allows for more precise understanding and rich description of the case itself (Eisenhardt and Graebner, 2007), which is the important part of this study. Gioia et al. (2013) continues with emphasising the choice of a narrative that becomes a highly informative description of a phenomena. Adding the clarity of tables allows following the data throughout the report and understanding the foundation for the stories and the following analysis.

4.4.2 Data analysis

Building upon data structuring done with both the empirical and theoretical material (presented in previous sections 4.3.1 and 4.3.3), allowed for purposely building accurate case descriptions. Recommendations could also be derived from the data using the structure of the case descriptions and the theoretical framework. The analysis aimed to identify patterns in the empirical data from the cases through coding, analysing and relating it to theory. This gave the possibility of generalising the data to theoretical propositions and a thorough understanding of the specific context (Yin, 2017). Doing so from an embedded single case can according to Eisenhardt (1989); Yin (2013) lead to correctly interpreting and building knowledge around the phenomena's studied and their impact on the specific case context. Dubois and Gadde (2014) also follow this reasoning and emphasise that single case descriptions enable taking rich context descriptions and surroundings into consideration.

Doing the analysis by cycling between empirical data, literature, emerging themes and thoughts, allowed working toward a theory which closely fits the data (Eisenhardt, 1989; Gioia et al., 2013). Using the coding, discussion and analysis for both the theoretical and empirical dimensions allows the links to become clear and to analyse data in a proper

way. Working in this way and pulling aggregated themes out of it, their impacts and the developed knowledge that led to the presented conclusions (se section 6.4 and chapter 7), is a good way to create high quality and valid research according to Gioia et al. (2013). Making the highly iterative approach necessary throughout the entire report. Including the discussion of the gained material in the process also allowed making use of the analysis from both of us (Ravenswood, 2011). This could lead to a more reflective and creative analysis, making use of our own understanding, which according to Mantere and Ketokivi (2013) creates validity for the study. The discussions and analysis sessions allow to critically evaluate what is tried to be showed and how this has come to be known.

Using the developed analytical framework (see section 3.5) and the developing phenomena from the empirical data, made it possible to answer the research questions and fulfil the purpose in a proper way. The analysis framework was divided up into three parts that focused on different research questions and made it possible to thoroughly compare the related theoretical sections, of the report, with the empirical data.

4.4.3 Drawing conclusions and building recommendations

As the conclusion is acknowledged to not build itself, supported by Bryman and Bell (2015), we make large use of the discussion and analysis to build this out of our own analysis and perspective. This is done to create value out of the research and make a contribution. The aim of this study is not to build generalised knowledge, but rather to give deep case study examples of a general phenomenon and issue that companies need to manage. In doing so this thesis attempts to use the case study as a single source of context to build a valid recommendation within (Dubois and Gadde, 2014; Yin, 2017). Deeper understanding is enabled by this approach and also the use of systematic combining, according to Dubois and Gadde (2014). Only lastly linking it to theoretical implications is intentionally done as this is not the purpose with the study. The report thereby lands in a proposal of managerial implications and call for future research, where the theoretical link is made.

From this single case study and the contextual understanding and implications could come the common arguments of limited possibility for generalisation, which is only a partial aim. But as emphasised by Dubois and Gadde (2017) the growing need to widen boundaries of research and see into specific context makes the single case study preferable. Through such a case it is possible to look more into the specific inter-personal and inter-organisational relationships that define the context, which would be overlooked if wanting to generalise. Acknowledging the shortcomings in terms of generalisation and balancing them through context specific analysis, is an attempt to increase validity, also for applicability to other contexts. This reflection upon the context's impact and the researchers own perception follows Bryman and Bell (2015) recommendations. Exploring the situation from other perspectives in the analysis of the case, making learnings further applicable, most probably also leads to trustable learnings for other contexts.

5 Empirical findings

Throughout the data collection of this study five phenomena developed themselves as a combined understanding of the input from the sources (see Table 5:1). To understand these the first part of this chapter gives a more detailed description of the cases and ARTs studied, along with their different characteristics. Following this come five phenomena regarding different interesting aspects that come from the data collection and relate to the purpose of this study. These stories build upon the combined data and general observations from all interviews that have mentioned this phenomenon. Links to specific interviewees (see Table 4:1 for full list of interviewees and Table 5:1 for specific phenomena) have for the most part been removed, although the phenomena are strengthened with actual quotes. For the analysis (see chapter 6) the input both from these phenomena and more detailed data is used.

Table 5:1 *Five stories developed from the described phenomena by interviewees, here also showing which interviewees mention data that categorised under the stories.*

Empirical Story	Interviews mentioning this phenomenon
Becoming a we-ART	I2, I3, I4, I6, I7, I8, I9, I10, I11, I12, I13, I14, I15, I16
When we have managed to learn from one another	I1, I2, I4, I5, I7, I8, I9, I10, I11, I12, I13, I14, I16
Reducing barriers between organisations – even if they are in fact competitors	I2, I3, I6, I7, I11, I12, I13, I14, I16
The right info in right channels	I2, I3, I6, I8, I9, I10, I12, I14, I16
Enabling collaboration through contracts, legal and procurement	I1, I2, I4, I8, I9, I10, I11, I12, I13, I14, I16

As part of the scaling of Agile methodologies to capture entire organisation at VCC, certain product lines and functional departments have been identified as good to start the transformation within. Two of these were the ARTs that have been sub-units of analysis

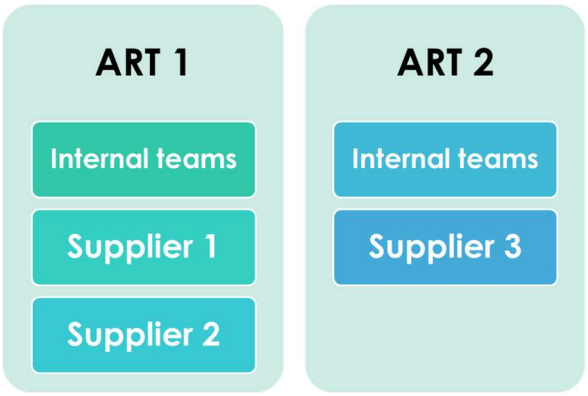

Figure 5:1 *Conceptual description of ARTs within the case.*

in this case study (see section 4.2.1). Reasons for choosing these as starting points for the scaling of Agile is the importance of Agile ways of working within their dynamic and fast evolving field. Both ARTs also have a majority of their product within software development, with some interaction towards hardware. Within this study the ARTs are named ART 1 and ART 2, consisting of several internal *Agile Teams* and supplier teams (see **Figure 5:1** for conceptualisation of context in this study).

For ART 1 the product regards an internal support function for a large part of the R&D department at VCC. To develop this the ART collaborates with several suppliers, delivering certain parts of the software. These functions are then integrated at VCC and adapted to suit the context, taking both supplier, company and user perspectives and applying them within both the supplier and ART. Three of the teams within this ART have a large degree of interaction with Supplier 1 and Supplier 2 (see Figure 5:2), varying in intensity between the teams and suppliers. There is also other suppliers and teams that either rely on the collaborative developments of these teams or deliver important parts to them. Both the collaborations with Supplier 1 and 2 go back to before the transformation to ARTs and there is a history of collaboration with VCC. Within the ART the teams from Supplier 1 and 2 are highly dependent, but their organisations are competitors in the overall market.

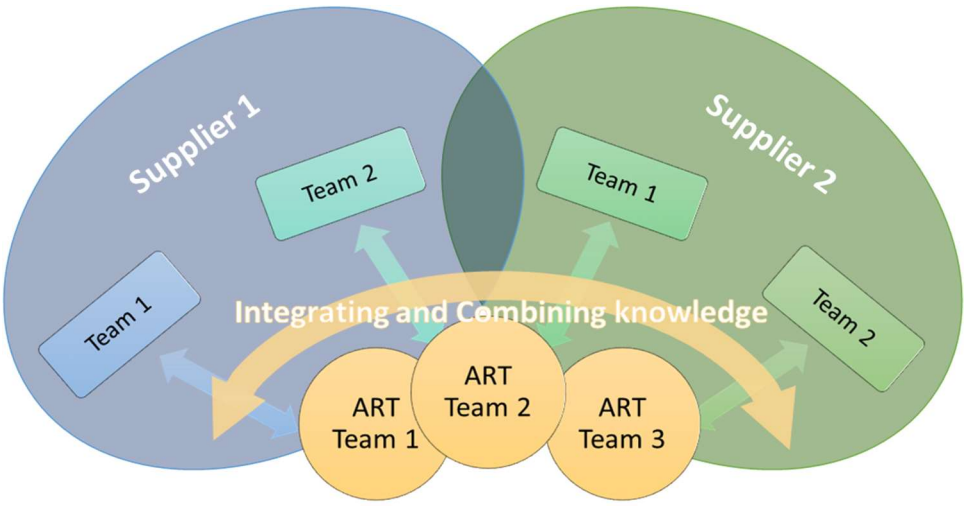

Figure 5:2 *Visualisation of how the teams in ART 1 interact with Supplier 1*

Some of the details at ART 2 show resemblance to those of ART 1, which is a consequence of them being chosen as suitable first organisational parts to transition towards SAFe. ART 2 consists of a rapidly growing internal organisation at VCC, with approximately 70-100 developers currently employed. To this also comes several suppliers and especially the collaboration with Supplier 3, having approximately an equal amount of employees dedicated towards ART 2. The product under development is a strategic software that interacts with several hardware products. Currently the development foremost regards replacing an old version of the product and developing up to basic functionalities and requirements. This, as the platform used for development has

been changed due to strategic decisions. In the coming periods the development will shift to more radical improvements, creating and implementing new functions.

5.1 Becoming a we-ART

This phenomenon highlights the necessity of becoming one aligned group that works towards a common goal. How can such an environment be created at VCC and which parameters are vital for creating an inclusive atmosphere?

The need to create an environment that supports open communication and a collective identity as one group has shown to be essential for enabling collaboration within the ART. However, this is yet not the case, there exists a "they and us" feeling between teams that appears to be caused by operational and physical distance. ART members talk about people in other teams as external competence and not as collective know how that we possess internally. Interviews indicate that colocation is considered the best solution for handling this problem. Nevertheless, it is not enough to be in the same building, teams need to be truly colocated at the same area and floor. There is a great need for face to face interaction, which is choked by being in different office spaces, resulting in a lowered team productivity. The same phenomenon is true for the suppliers' teams were their ability to share and combine knowledge worked better when suppliers were represented inhouse. Both operational and cultural changes are needed to reduce this type of distance and enable people to meet face to face or call one another more.

"There is that 30-meter rule, which appears to apply." / ... / "sit is a hassle to walk up two floors, therefore you send an email or call instead and in that case you can as well sit in Italy." - **I10**

"*We are the ART, we should achieve it collectively.*" **– I15**

"There was a lot more interaction point and other type of communication when they [supplier's developers] were located in the team. Now it is more of a handover between the teams, even if the collaboration and dependencies is a lot tighter now" **-I14** *(Supplier Representative)*

"After the first I had the feeling that I could do [PI-planning] *remotely, but this cannot replace the meeting personally."* **- I12** *(Supplier Representative)*

Another enabler for good collaboration is long-term relations and workshops with all parties at both the buyer and supplier. They are currently meeting at least a couple of days, 4 times a year, to plan the upcoming PI. These workshops have shown to be a great opportunity to get to know one another and create a common understanding of the features that should be implemented the upcoming PI. The main strengths with the PI-planning is that it aligns members of the ART and sets aside time from the daily work to collectively focus on planning. It is important to not underestimate the value that face to face interaction can bring to a collaboration. PI-planning was at first received sceptically by the suppliers due to taking resources from development. A change

"I usually say that it is important to meet face to face because it makes it easier to agree upon things, which is good. However, it is even more important to meet face to face to sort out disputes" **- I14** *(Supplier Representative)*

has though taken place and they today see benefits of meeting and establishing a high level common target and vision for the PI. They also mentioned the effects of having a personal relation has on smoothening the remote communication, especially at times when members see differences in how to handle a certain issue or have divergent opinions. However, the reality makes it hard to always interact face to face.

Avoiding communication to go through one single point of contact has shown to be beneficial for the collaboration. Allowing developer to speak directly to one another over organisational boarders is desirable to avoid misunderstandings and filtering by a gatekeeper. This type of communication already exists with suppliers, but it calls for a high degree of transparency, language skills and adoption towards Agile methodologies. These parameters are the main reason to why direct communication is not yet present with some suppliers. Something that is likely to change in the future since suppliers show willingness to invest in the relation by improving their staff's language skills. Nevertheless, reaching this environment was not done over one night, VCC have lobbied towards working more transparent and Agile with their supplier for several years.

"I really press this, as a first step I try to organise some language training in the company and I hope this will help to give confidence in this part. [participating in system demos]" **- I12** (Supplier Representative)

"That has changed a lot, [supplier's opinion on dev. to dev. contact], I would say that we have been nagging about this for a long time, we have influenced them and stated during a long period of time, we think this is important, we think it is good" **– I13**

ART 1 have worked with their suppliers for several years to make them more agile in their approach of interacting. The suppliers have shown a genuine interest for this way of working, since they believe this to be a trend soon impacting the entire industry. VCC are today working Agile with Supplier 1 which already have transformed its teams towards working in Sprints. Because of this change the interaction is today conducted more frequently with Supplier 1, both trough video conference calls and face to face meetings. A change well needed when the supplier has increased their delivering frequency from releases 2-3 times per year, to deploying functionality every other week.

"Basically, the reason why we changed to Scrum was some pressure from Volvo Cars." **- I12** *(Supplier Representative)*

The same process has been initiated with Supplier 2, but interaction is still rather traditional, releases are delivered a few times per year and procurement is based on rigid predefined specifications. However, this is about to change the supplier is currently conducting a pilot collaboration with VCC where two teams work Scrum based towards VCC. Supplier 2 have shown great interest in changing their entire organisation towards working more Agile with their customers. A process not only encouraged by VCC, other OEMs are also starting to request collaborations with more flexible specifications and frequent releases.

Transparency and low prestige encouraging honest conversation

Group dynamics and honest feedback becomes more important to solve problems, share and combine knowledge. ART 1's interactions externally seem to work sufficiently, especially with Supplier 1 where they have a very open and transparent communication. Low prestige has shown to have a positive effect on transparency and thereby characterise successful meeting regardless of the participants. This is something that has been observed in the CoP workshops (*Community of Practices*), where interviewees consider low prestige as the main enabler (discussed more in section 5.2). Transparency regarding work progress is essential, suppliers having problems and risk delivering late is normally not a huge problem if it is handled at an early stage. Thereby putting large responsibility on VCC not to be too harsh on the suppliers when they present problems. However, this does not mean that they should accept all problems and not hold the supplier responsible for not performing in line with their agreements. Yet, they need to promote transparency so that they collectively can learn from the mistakes made. VCC's goal has been to create an open discussion atmosphere where problems are solved together, it is more important to focus on the solution and discuss learnings from the failure than discuss details of how's fault it was. Focus on how to learn and improve from the problem and making sure what it will not happen again.

> *"Transparency for progress and allowing to say that 'we did a miss-calculation of the time needed' is important to plan, prioritise and support with resources. This can be a cultural issue, which has been helped by the [daily deliveries]"* – **I3**

One can see from the study that more frequent releases have a positive effect on transparency and prestige. VCC has in some collaborations requested daily deliveries of the software produced by its supplier teams. Allowing releases of 'work in progress', not yet fully functioning features, has lowered prestige and fear of delivering functionality to VCC. Moreover, this allows for continuous testing and feedback between developers during Sprints. Tighter communication has shown to have a positive impact on the relation's transparency and prestige, most likely due to more evolved personal relationships.

> *"When it although comes to this* [finding faults and issues] *it is actually better to say it early, ask or say that it has gone wrong and then correct it. Then you have come a long way."* – **I13**

5.2 When we have managed to learn from one another

Through this phenomenon a trend of when learning and knowledge combining is occurring in the current collaborations is developed. There is a willingness to collaborate between all the involved parties, they are improving and learning from each other during these processes and see benefits of the joint efforts.

Learning from each other, taking inspiration and combining knowledge from the different parties and making something greater from it occurs within the observed collaborations. There is a large degree of emphasis on sharing information to build better products and establish more suitable processes. One such thing has already been mentioned is how the suppliers have drawn upon the experience from VCC turning Agile, and themselves implementing or starting to become Agile. All suppliers highlight that either pressure from VCC, necessity to transform their own processes or other OEMs interest for such things as Agile has been crucial for the transformation to start. Through this, pilot projects have been started at the suppliers with the VCC collaboration as basis, possibly to be implemented elsewhere later. VCC is also in one collaboration invited to take part in an event with the entire supplier organisation to communicate general learnings and improvements from the transformation. This as the benefits are regarded wider than the individual collaboration and suppliers see an interest for these pilots also from other OEMs.

"Good for everyone if we can coordinate, so they can avoid doing the same work twice as well" – **I4**

"Why should we do this again for us? If we could somehow coordinate this analyse tasks [that VCC already have done], to not do it double" /.../ "But this would be somehow vice-versa" /.../ "We should do the same as well." [give back knowledge to VCC] **– I12** (Supplier Representative)

Both from the supplier and VCC side these distributed learnings regarding Agile and the transformation of the own organisation have come easier than first anticipated. In combination it has created a move from suppliers having responsibility for products and issues, paying fines for faults, to now commonly holding the responsibility (which calls for new contracts, as is described in section 5.5). Transitioning to a common issue management system (*JIRA*) has for both Supplier 1 and 2 aided the transformation. The use of technology led to more developers wanting to be part of the issue management system, and thus change from going through a single point of contact to access and update tasks. Now all developers have "visibility" but also use it to add and update issues. This direct developer to developer contact was confirmed in interviews with the teams and the result is accurate discussions of functionalities and the needs they see, along

"from the beginning it only was" /.../"the project leader"/.../ "but they only endured three months like that and then we received a list with 'add these people', they were supposed to start with just looking, but soon they started writing and asking, so it worked out really well." **- I2** (Supplier Representative)

with reduced amount of documentation. Technology and the push from VCC as a customer has developed skills at Suppliers that allow for further improvements and continuous developments. To some extent due to long-term relations and an architecture with functionalities that is agreed upon a at an overview level.

Transparency and openness is regarded as a way to increase the accuracy of developments and better understand both requirements and needs. Supplier 2 values VCC's opinion on their product and suggests features that might be useful for them. In the same way VCC is trying to be as transparent as possible with the feedback related to that suggestion. This results in a higher quality of Supplier 2's system and VCC gets more relevant functions through the development. ART 1 has in this way been able to set standards for how issues with the product are handled, aligning perception of problems, together learning which ones are to be prioritised and jointly understanding or solving problems. There is also a better possibility to adapt the developments when widening this to include the other suppliers in the collaborations, as is the fact in ART 1.

> *"So we see them as partners. And they start to mention things: 'you wouldn't want to take a look at this function?'" /…/ "I always try to give feedback in some kind of way, why we aren't ordering that feature today. Trying to be transparent even towards the supplier."* – **I7**

> *"We are trying to not hide how we are trying to achieve a new feature, because I [don't] think we in any other way, we will not know what is the use cases from the users"* – **I12** (Supplier Representative)

There is also a lot of stakeholder communication, even involving the suppliers, at a format that is comprehensive and where tasks are simplified and split into a format that can be communicated. Going from project to product focus allows for this kind of increased transparency and common long-term targets. In this area there has been a shift from previously a lot of secrecy around projects and which cars would be using the result of it, to more transparency and communication. This previous setting decoupled the engineers from the product and end-user which had a negative effect on the overall quality of the product. Increasing transparency has now allowed for a greater understanding of the context, what learnings can be seen and how this affects the current developments. For VCC this impacts how they can use technical expertise at the supplier sites better. In one case the expert's combined knowledge of the industry and VCCs context enables him to only present changes in the product and standards that will be useful for VCC. Working in this way has impact on the business model, how value is perceived and exchanged, and increases need for long-term perspective.

> *"[Supplier 1] and [Supplier 2] have not been* [restrictive about transparency and communication], *because they understand that they are both in the same dependency situation, so there it's quite open." /.../ "We have had bugs that just don't work. Then you have to sit down together and find out why and how to solve it fastest and best. Perhaps it's something that [Supplier 2] has caused, but it is easier to solve within [Supplier 1]'s product and vice-versa." /.../ "It becomes a bit of win-win."* – **I2**

Managing to properly break down tasks to smaller ones with higher detail and working Agile together has contributed to more accurate functions and better performance even though a lower total amount is delivered. Using experts when necessary to increase detail accuracy and better understanding tasks and dependencies. This work breakdown is a possibility deriving from continuous feedback between developers, as well as having been a stated requirement through retrospective. Together with the retrospectives the sync meetings and backlog refinement allow for faster feedback loops and to share information frequently, leading to continuous updates.

> *"summarising this first [period] we haven't delivered as much functionalities as we used to" /…/ "but it is the right functionalities we have received [from supplier]"* **- I9**

> *"the biggest improvement is that we are working on the things together in a short period of time. So if designer works on an item more or less the VCC guy is looking in to that 2 days later and then they can have a call or get feedback via email. They can say it is [bad] or if it is good directly when the designers is working on things and his head is not on other things"* **– I16** (Supplier Representative)

Interactions where learning occurs

Learning also occurs in other areas, e.g. regarding development of certain features and functions. Important processes for this was agreed to be the PI-planning, CoP and common workshops, either scheduled regularly or on demand. These include meeting face to face and working with shared commitment to solve problems or take decisions and handle dependencies. Some team members have expressed concern regarding the meetings as being a waste of time and not functioning well, but the majority of interviewees were highly positive. Currently though, retrospectives conducted jointly are not working well enough to be efficient, much due to the newness of the processes within the organisations. This also goes for the sync meetings and demos, which are found important to distribute knowledge and align teams, but the full supplier teams are not invited to VCC demos yet, much due to the new processes and space limitations. There is also an expressed concern that learning only goes from the suppliers into VCC in some aspects (e.g. high frequency deliveries of products and updates), whilst other interviewees state learnings derived from VCC.

> *"When we had [Supplier 3] here at the CoP we had a lot of exchange and learnt from each other, established some practices and processes together. So we want to return to that" /.../ "I would say that the CoP was the place where we had the most overlap between our organisations." /.../ "Some teams speak a whole lot with other teams and then there is some overlap" /.../ "but the common knowledge has disappeared for now."* **– I10**

> *"There is a give away to VCC every day with a lot of knowledge, but the channels don't flow in both directions."* – **I14** (Supplier Representative)

One crucial aspect for the CoP to work especially well and be important for knowledge combining is the

> "[Speaking about the CoP and what the key was] *That they were so open I believe. We were very clear in the beginning that you can come and go as you want, stop us whenever and having an openness and room for anything, it is not about having everything in place."* **– I10**

openness for discussions and low prestige when it comes to participation. These occasions are open for anyone to participate in, external guests are invited and sometimes hold guest lectures (from other ARTs and suppliers) and previously suppliers were a regular part. Rules are that everyone should be invited always, open invitation and climate.

Much of this openness comes due to the long-term collaborations with the three suppliers, with e.g. ART 1 having built a lot of trust that Supplier 1 can deliver and learn the organisation how to handle usability. As a consequence they exchange learning regarding formats due to the automotive standards, testing and documentation. This kind of trust also involves the other supplier collaborations. On a technical level it works very well and all parties seem positive to helping each other become better and more aligned. But there is some expressed scepticism towards learning too much, or rather using and being dependent on a product developed elsewhere. This leads to developments being redone rather than reused even possible in many cases. Other examples from the collaboration of ART 1, Supplier 1 and 2 show a larger willingness to reuse improvements. In this case one of the suppliers has understood the benefits of how the other supplier is collaborating and meeting with VCC and wants to start doing the Sprint Reviews together with VCC as well. They also see a large value in meeting with all three parties gathered, as this increases the learnings and performance of the individual organisations.

> "*we want to have separate meeting, if we can have the joint one*" – **I12** (Supplier Representative)
>
> "[On receiving input from suppliers] I feel it works quite well, they come with proposals quite often." /…/ "[When and how?] *continuously, skype meetings often, once every week we have new issues coming in, everything from new ideas to having identified bugs." /…/ "We also probably get better features."* **– I8**

Collaborating between suppliers and VCC is seen as a good step towards continuously improving and learning, as what is done elsewhere is improved and implemented in the own processes and products. It also helps to correctly prioritise issues and tasks in an order that seems appropriate for the overall development and with regards to dependencies, that might not have been foreseen by one of the parts. For this the Sprint Planning works well, but use of backlog refinements and other interaction points were also mentioned to be vital.

> "[about supplier knowledge] *Sometimes there comes things that /.../ you should do this together with that, maybe because there is [highly related development] and we don't know that, but they do."* **– I8**
>
> *"worked out by our expertise and by our developers, then we shared the knowledge with Volvo cars and they got the training, and they started to use it in this way. We got a lot of feedback of course" /.../ "and then we refined internal methodology. And that was the base for the implementation in* [Supplier X]*, what to get out from* [Supplier X]*. I think it is not finished yet, this internal part, we still need to refine our methodologies."* **– I12** (Supplier Representative)

For ART 2 the trends have also gone towards even more trusting Supplier 3 in delivering a product well suitable towards their end product and in line with what the supplier sees suitable. Collaborating in this flexible way allows both Supplier 3, and also Supplier 2, to build a more generalisable product with features also applicable with other OEMs, benefiting VCC largely as the product is more rigorously tested. This also allows for greater knowledge combining and learning between OEMs, through the suppliers. Doing so they can see a generalisable model of business, being able to deliver also to others, and merging specifications from different OEMs, delivering the optimal product to all in the degree that this is possible. Working together as several large customers or users could also lead to a gaining some leverage towards large suppliers, mentioned by an interviewee. But it has to be balanced to not regard to high detail in technicalities.

"We see other OEMs moving towards being Agile and say that lets start work like this now, here are a set of requirements for starters. We look at them together and develop the project after hand. We speak more about features than detailed specifications then." **- I14**

"*OK, we have a new functionality, you can use it." /.../ "So it happens actually. But for the exact usage of how they are using it and what they are designing, I think it is not a good idea to share it, at least it is not our task."* **– *I12*** (Supplier Representative)

The parties are also seeing large benefits of creating and combining knowledge between different internal teams. But this has not yet been truly realised, as time is lacking and this leads to not being able to do the improvement Sprints (last part of a PI) or retrospectives. Eventually this might lead to technical debt and not being able to continuously improve. Some of this is due to the teams misjudging their capacity and thus lacking time in the end of an increment. According to the interviews this also somewhat affects the flexibility allowed within a PI-planning, as it isn't possible to take any major decisions in that forum if not pre planned in detail. Dependencies between teams are identified, communicated and aligned in these PI-plannings, but there is limitation in how much collaborative development work can be made during them. Instead there is a need for other meetings and workshops where the teams can take such things.

5.3 Reducing barriers between organisations – even if they are in fact competitors

With a need to collaborate with several suppliers, what happens when the suppliers are competitors and what are their view on collaborating? VCC is struggling with how to best solve this but are still seeing suppliers wanting to work together, if the relevance in meetings is kept high.

The circumstances for ART 1's supplier collaboration is not entirely simple to manage, having key suppliers that are competitors restricts the willingness to share expertise in certain areas. Management representatives for ART 1 are actively working with reducing this effect and making the PI-planning more appealing for the supplier. This since they value the benefits of having a collective workshop where all expertise is gathered in one room with a common purpose, to plan the upcoming deliverables. However, it is not a trivial problem to get competitors to collaborate and they have not yet created a desired openness in that forum.

> "*How should we conduct our PI-planning, we have not really figured that out yet. Is it good to have the suppliers present? Or is it harder for them, does it limit them*?" /…/ "*This is one of these unsolved things so far, we want to accomplish an openness*" **– I13**
>
> "*Something we have noticed a bit when we have two suppliers present at the same meeting, then they are then less willing to open up because they do not want to reveal too much for the other supplier. So that is open problem*" **– I3**

The lack of a clearly specified long-term plan makes is more important to conduct workshops to plan the PI together. Interviews shows that transparency is required in the PI-planning, no matter if the competitor is in the room, in order to provide a collective top down picture of the deliverables. A more direct collaboration where the involved parties handle dependences directly minimises the need of a formal handover which is desirable from VCC's side. However, looking at the PI-planning from VCC's perspective they indicate that it might not be transparent enough. Resulting in a lack of shared vision and a situation where it is harder for the suppliers to take complete responsibility for a feature due to unidentified dependencies.

> *"Leading by example is important to influence developers to increase the benefits from common meetings, keeping information transparent independent of recipient."* – **I14** (Supplier Representative)
>
> "[why the suppliers should be integrated into the ART] *it is once again linked to transparency and not having the handover*" /…/ "*you want a closer collaboration*" /…/ "*you identify a dependency and assign that dependency to the other team. Then you avoid having a handover, it [the dependency] is included in the feature making sure that the overall picture becomes good*." **– I6**

VCC has in addition to the collective PI-planning incorporated separate sync meeting with its suppliers (backlog refinement), after indications from them that they had more relevant information to share after the PI-planning. This information was usually of a slightly more technical kind which VCC interpreted as if they were unwilling to share it at the collective meeting. The individual sync-meetings have more of a process focus for the individual features affecting that supplier. Whereas the PI-planning focuses more on understanding the functionality and identifying its dependencies. Nevertheless, Supplier 1 mentions the collective meeting with Supplier 2 as an important part of their collaboration, a perception shared by Supplier 2. Especially since all other communication between them is done through VCC's *POs*.

> "*The suppliers indicated that they had more ideas that they wanted to share with us.* [Indicating need for separate meetings]" – **I3**

> *"So I think it is still a good thing that we have the separate meetings, if we have the joint one, where we can discuss the common element."* – **I12**

Enabling meetings between competitors by sufficient structure

Suppliers are open to discuss things when the competitor is present, but many times it becomes a discussion of irrelevant stuff for the other part. These discussions are favourable to divide into two separate meeting with each supplier with a higher technical level and focus on product/system specific improvements. Thereby, showing a need to identify a suitable technical abstraction level for discussions at common meetings, focusing on distributing knowledge and creating a common understanding of deliverables. Some degrees of the irrelevance of certain discussed issues in the meetings derive to what interviewees state as "mentioning all you have done", rather than important "things you have achieved". Managing this kind of information better makes the interaction points more relevant to all parties. This will according to the suppliers have a positive effect on transparency between them as the things they are expected to discuss not relate to trade secrets. Further, VCC indicates that separate backlog refinements promote knowledge combining between the suppliers. This because of the ability to go back to a higher abstraction level and discuss findings from the separate meeting commonly.

> "*I think the most important [aspect for PI-planning to work] is stick to the agenda and don't go in to the technical details. I would say that it is preferable to have separate meetings for the technical parts*." - **I12** (Supplier Representative)

> "*not to talk to technical in your own area, then I think people lose interest a bit*" /…/ "*in some way to distribute knowledge you need to start at a level everyone understands and can feel involved*." – **I7**

The suppliers are not afraid to meet in a common forum and share knowledge with each other if it relates to elements of their common solution. Even if there is a risk for knowledge leakage at the PI-planning this can be reduced by having a technical

abstraction level at this meeting is high enough to allow an open discussion. Sensitive information like algorithms and product specific know how that the suppliers provide to VCC's platforms can be distributed in other forums like a supplier specific sync meeting.

"[Do you feel comfortable sharing technical details when Supplier x is present?] *Yes, so basically I think it is not a problem. Some know how I think we need to keep ourselves. Special algorithms we don't like to share, because they are our competitors as well. So we need to take care of not sharing things that can hit us back.* [Are they relevant to share in the PI?] *Actually, I think it is more interesting for VCC only. It is not to take big role in the PI-planning. That is not a problem. We rather talk about standards and how to understand them and try to have a big picture of the concepts and come back with some use cases which we can discuss internally. Not to have a full concept description on the PI-planning, but to see that which features will be needed in the upcoming 12 or 6 weeks."* – **I12** (Supplier Representative)

There is also a tendency among VCC and its suppliers to be less afraid of knowledge leaked when you are running in the forefront of technology. Nevertheless, there exists information that organisations are unwilling to share, but it seems like this information often relate to business strategies rather than core technology.

"There are some things you do not want to share, however, there are very few components of that kind" **– I14** (Supplier Representative)

"Sometimes hard to know and decide on what information is allowed to share [strategic changes]. More open in beginning or end phase?" **– I3**

One of the suppliers has previously been quite sceptic towards the PI-planning because it consumed a lot of time on things not relevant for his organisation. Moreover, this supplier had at that time not embraced Agile methodologies making it harder to implement changes addressed at the PI-planning. Nevertheless, he is positive that it will be more useful in the future when their current transformation towards working Agile is completed. Similar tendencies were mentioned by other parties much relating to the newness of the Agile processes and seeing that not everything is finalised in how the structures are to be. This is leading to that not enough representatives from the supplier organisations are involved in the common meetings. Reluctance was also present initially in the amount of time put into meeting face to face in the interaction points, but all suppliers agreed upon it being worth the effort.

"*Formally we had a lot of comments that [Supplier X] people spent a lot of time with things that are not affecting them [Supplier Y]. And also there are a lot of parts of the tool chain which we know they have to do something about, but it is not affecting the communication design and we know that they have developed it, but we don't need to discuss anything, then we don't need to take each other's time with this.*" - **I12** (Supplier Representative)

5.4 The right info in right channels

Having both collective and individual meetings with suppliers, how does then the information's characteristic affect what distribution channels are appropriate or not. Uncertainty and misunderstandings easily occur when people interact. How is information distributed in a sufficient way and how should the communication channels be used to create common understanding?

The situation in ART 1 and 2 where the supplier's team members are not colocated with the workers at VCC results in a situation where they are more reliant on remote communication. Most of the interviewees agree upon that face to face interaction and conference calls is most appropriate to avoid misunderstandings and conflicts. However, it would be very time ineffective to always interact in such a way, the study indicated that some type of information can be more suitable to share using other channels e.g. E-mail, phone calls or *ICT-platforms.* The key indicator of where and how to distribute information has shown to be whether a common understanding of the matter exists.

"One should not underestimate face to face meeting, but it is mission impossible to do it all the time."- **I8**

"There are so many advantages with having the ability to go and speak with someone face to face. All of these 'code-review wars' and emails that get misinterpreted, would not exists if one only would speak to one another." **-I10**

All type of communication is not equally effective, even if it involves the same individuals. Interviewees mention that using face to face interaction has been crucial when transferring this type of knowledge of complex matters, rather than turning to email. Further, they highlight how important the collective PI-planning is for the creation of a common understanding among the developers at VCC and its suppliers, since most of their interaction apart from the PI-planning take place through either emails or ICT-platforms. The interaction on the onsite workshops enable them to discuss complex tasks on a higher technical degree more efficient remotely. Something that has been done more frequently after introducing a common ICT-platform, where developers easily can communicate and clarify unclear features in the backlog. After a first meeting understanding each other is made easier and the developers

"for the understanding and the collaboration, the onsite workshops are really good. Because then we can work on a whiteboard more detailed if needed or we can put a question to get more in to the detail to get more background" – **I16** (Supplier Representative)

"The discussion we [Developer to developer] had this afternoon saved us three months of misunderstandings" – **I14** (Supplier Representative)

"The next problem with these issue management systems [ICT-platforms] are if one think that it is acceptable to do the documentation there. Then I think one could go wrong, because it [the documentation] will disappear in to cyberspace" - **I14** (Supplier Representative)

more often call or meet instead of e.g. only documenting or writing reports.

Explicit knowledge is easier to describe in text and can thereby be documented and distribute using ICT-platforms, an approach that VCC has used for handling this type of knowledge. Interviewees are generally positive towards using ICT-platforms, however some think that it is dangerous to put too much trust on the usage of them. The existence of the documentation does not only mean that everyone has read it, relying too heavily on an ICT-platform might result in a situation where all the required documentation exists but it is not distributed to the right people. For this the personal communication is only so good and there is an emphasis on needs for official forums to increase transparency**.** It is not seen as possible to only meet in the corridor and exchange knowledge, but this has to be distributed in some way. Workshops and forums are, according to interviewees, better to do knowledge combining and actually distributing information to all affected parties.

"[when distributing from teams to ART] it's very limited information sharing. Some things show on the [ICT-platform]" /…/ "*a lot of information disappears there. Team to team is good, but for the ART [communication] is limited. I think it's good if you then again have something that holds together and distributes, you have to broadcast the information and give people the possibility to hear what they are interested in or might have a need for."* – **I10**

"Even if he is good, there is a need for more transparency" /…/ *"you only here what [he] passes on."* – **I6**

"*[We] follow the principles from SAFe saying that communication that is short-term and only affects few, can be done directly between developers. Long-term effects and decisions that affect many are to be taken collectively*." **– I10**

All information used and distributed is not equally relevant for all parties, indicating a need for some sort of selection of what information to share. Here the interviewees once again highlight the importance of long-term relations with the suppliers. It is explained by the fact that a richer context knowledge about VCC and its products allows for a more accurate selection of what knowledge to distribute. Time is also an aspect affecting what information that is relevant and not, getting a fast reply can in some cases be as important as the message itself. Moreover, interviewees mention the information's impact level as another important parameter. Decisions with long-term consequences calls for more discussion and involvement of the parties effected by the decision.

5.5 Enabling collaboration through contracts

Contracts provide an outline for a collaboration dictating the rules and extent of how closely two collaborating firms can work. Further it impacts how flexible the work can be and how fast one can adapt to changes.

All suppliers in the study recognises the importance of a contract for the collaboration clarifying what should be delivered and how the ownership of the deliverables should be handled. Processes for procurement seem to vary a bit depending on which ART you look at and what services the suppliers deliver. However, a mutual problem is that the contracts do not truly support an Agile way of working, a perception shared by the ART management and suppliers. The purchasing department is not fully up to speed with the R&D department in terms of complying with the Agile mindset of working with suppliers. Procurement is still done with more traditional contracts which is not supportive of changes and requires a more rigid specification and scope.

Contracts role in the collaboration is by Supplier 1 not seen as that big off a disabler, even though not set up properly. This is especially a result of them having a long-term relation with VCC. The trust that has been built in such a relation enables both parties to be more flexible when interpreting the specifications. Thereby providing some room for changes along the way, which has resulted in that specifications today are less explicit in general. For Supplier 2 there was an emphasis also on the internal journey of the supplier, as the own organisation has to adapt to the more Agile way of working. For Supplier 3 issues regard finding tolerance to set some boundaries initially but change specifications and intentions as the collaboration developed, resulting in somewhat changed scope and allowing only vaguely working with specifications. Developing from specifications to this kind of informal collaboration has resulted in a higher degree of developer to developer communication and jointly working or problems. However, there are some issues with the process of procurement when outsourcing novel services, as software where you do not always know exactly what you need initially. Several of the interviews indicate that buying engineering hours instead

> *"it is really a journey because I think VCC is not really prepared. So the purchasing part is not at all complying within a Scrum thinking not at all, so we are over riding so many chapter in the contract"* – **I16** (Supplier Representative)

> *"but our current business model is not supporting this, so we need to figure out that I think. It needs more coordination from sales. I'm not really familiar with that part."* – **I12** (Supplier Representative)

> *"Even if they say they do it like that [agile contracts], the contracts are done /…/ with old papers"* – **I16** (Supplier Representative)

> *"The contract was procured in a quite traditional way" /.../ "We are agile in our waterfall setting in some way. There exists a fixed cost, a fixed time and you have a fixed scope. Everything that is waterfall!" /.../ "after that it was decided that we should work in an agile way, so we work agile within that box so to speak. But it is a very distinctive framework"* – **I14** (Supplier Representative)

of procuring using a vague specification is a better alternative of procuring this type of services. An approach which the legal and purchasing department not fully support currently.

Nevertheless, the purchasing department appears to see the advantages that Agile contracts bring to the organisation and have every intention to improve its support for it in the future. What is even more interesting to see is that they have started to embrace Agile methodologies themselves at the business office, with the ones developing their work processes. They are enthusiastic about the change towards Agile purchasing and believes it will bring speed and efficiency. Which is why they already have educated more than 350 purchasers in Agile procurement methods.

> *"However, our purchasers have probably begun to understand point with it [agile contracts]"* – **I10**

> *"People that have been included there [business office] have been really engaged, they almost think it is a bit dull to go back to their usual job"* – **I1**

6 Analysis

Based on the empirical material gathered within the two sub-units of this case study (ART 1 and 2 and their supplier collaborations, see Figure 5:1) certain phenomena have been identified, as shown in the empirical stories. Together with the developed analysis framework these findings are in order gone through and presented as shown in Figure 6:1, answering the research questions repeated hereafter. The analysis is structured following these three research questions and the gathered analysis leads to concluding thoughts (see section 6.4 for summary and conclusion in chapter 7). Doing this allows to *identify and create a greater understanding of what enables or limits knowledge combining in IOC* as is the purpose of this study.

RQ1: How is continuous knowledge combining supported?

RQ2: What parameters affect the extent and willingness for knowledge combining?

RQ3: What categories of improvement can knowledge combining generate?

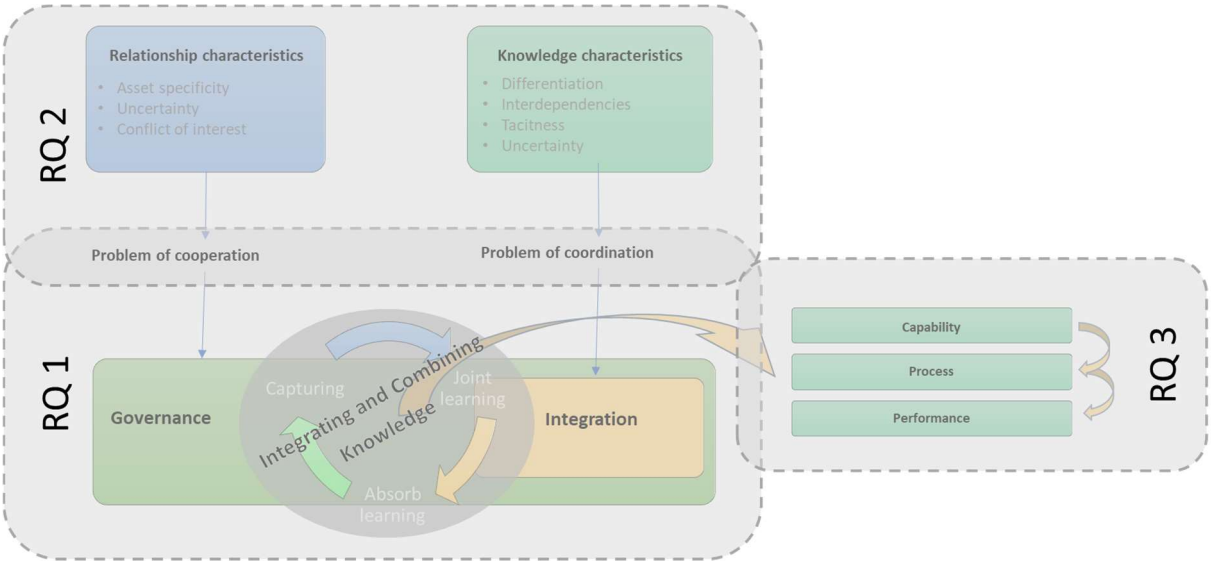

Figure 6:1 *Understanding which research questions (RQ) answers which of the mentioned parts from the analytical framework.*

6.1 RQ1: How is continuous knowledge combining supported?

There is a great need for the suppliers and VCC to be aligned towards each other both on operational levels, in processes and use of methodologies. A commitment towards that is to a large extent already in place and has enabled a smoother transition to collaborate with the suppliers turning them Agile. Though, still some issues remain, mainly tied to those of transforming the organisations to being Agile. We see that this regards missing links in the alignment of e.g. Solution Trains and different sync meetings for the roles within *SAFe* (e.g. for architects and *POs*). Mainly due to the novelty of the organisational transformation where employees have not fully found their roles and identified the new involved responsibilities. In line with the Agile principles (see section 2.1) the autonomy

of the teams should here be strengthened to compensate for the absence of support functions, which according to Agile methodologies is the best way to organise in. Organising and mobilising other dependent teams and functions in such a way so that the ART performs better overall. In our opinion will much of this probably be set when the SAFe is fully implemented and employees have found their roles, but for now the teams must take a larger responsibility. This also includes making sure to reduce sub-optimisation, by collectively talking responsibility for that improvements of the architecture and processes are prioritised. All of this to minimise the occurrence of technical dept. Distortion from this prioritise can be seen in the case where PIs are overcommitted due to pressure of delivering functionality faster and faster, leading to time allocated for improvements being used for development. We argue that this behaviour might create a downwards spiral where the technical dept only grows bigger and teams being able to deliver fewer and fewer functionalities each PI.

Working Agile together creates an even larger need for long-term alignment and planning. Not to create rigidness, but rather flexibility and a common understanding to build further upon and handle the complex matters through. Based on the empirical phenomena and analytical framework we have noticed that there must be closer collaboration in a setting using Agile methodologies, no matter the exchanged knowledge's characteristics. This because of the need to create a common understanding of the deliverables leading to all problems, regardless of its complexity/tacitness/explicitness, having to start with close interaction. After establishing a shared view of the overall problem, it is possible to divide the tasks and do more decoupled work. But our analysis is that the starting point for Agile organisations always requires coupled knowledge integration and working closely (see **Figure 6:2**). Achieving this involves a common interaction point which is best supported by the PI-planning in the studied context. We see that this forum facilitates a platform to

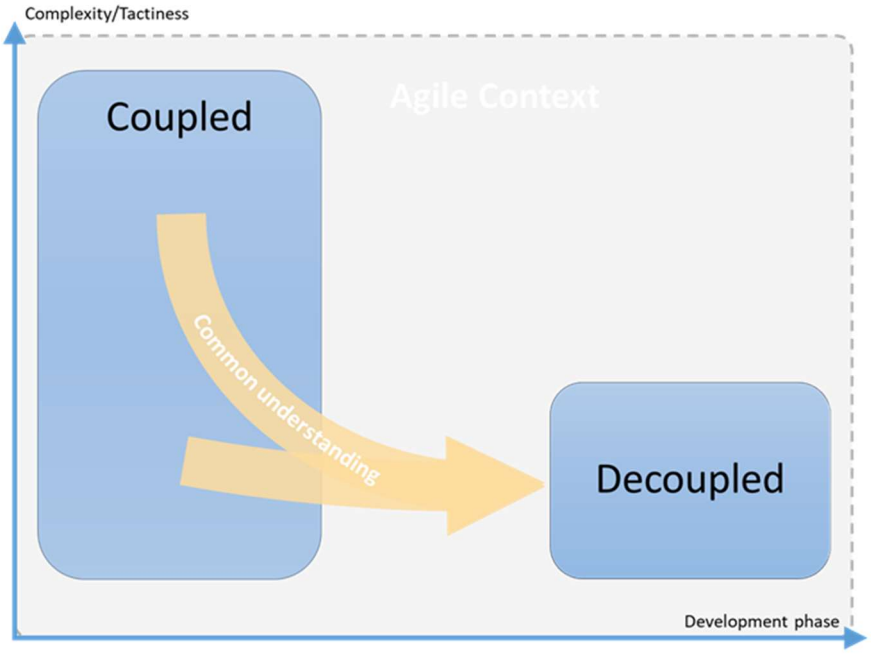

Figure 6:2 *Visualisation of how Agile contexts call for initial coupled interaction.*

discuss features and functions to create a common understanding, which enables to take the discussions further and more detailed in other forums.

Merging the findings from Rosell et al. (2017)'s study of knowledge combining with this Agile setting and our findings might indicate that there is a higher degree of coupled knowledge integration done in the Agile settings. This no matter the degree of complexity of the information shared. Working closely together in Sprints increases the degree of and requires coupled knowledge combining and thus puts a larger emphasis on keeping the shared information relevant, in order to be efficient.

Interviews shows that the timeframe for the PI-planning is quite limited, thereby not facilitating enough time to treat any major decisions or changes that might arise. This fact reduces the ability to use the available competence in the room to improve the collaboration, making it obvious that there is a need for some way of handling this. We argue that the PI-planning should be kept short and relevant for all parties, by focusing on creating a common understanding for upcoming PI and handling dependencies between teams. One should not forget that VCC has just began their transformation and have not performed that many PI-plannings yet. They will thereby most likely be more time-efficient in the future, just by the participants being more used to the concept and understanding their roles. However, there is a need for a process that captures ideas for larger collective improvements from the PI-planning and transfers these discussions to a more suitable forum e.g. the I&A (*Inspect and Adapt*) or CoPs (*Communities of Practice*. One could assume that absence of this type of process would eventually lead to technical dept and inability to deliver functions at an adequate speed. We further argue that there is a need to clarify the purpose and structure of each interaction point, by managing the expectations of what information that is expected to be shared.

Competitors are according to Johansson et al. (2011) less likely to share knowledge if they are competing on the overall market, there are in these cases tendencies to grasp as much leverage over the other supplier as possible. An effect that according to Johansson et al. (2011)'s theories often increases when there is a high degree of novelty and uncertainty regarding deliverables. In addition to that Kanter (1994) states that having one party taking too much control over the collaboration effect the relationship negatively. However, this does not appear to be the case between the suppliers in ART 1, where the suppliers even seem open to adopt to one another. One example of this is the shared solution that the suppliers deliver to VCC, where they are willing to implement changes to their product to accommodate for shortcomings in the other supplier's product (see section 5.2). We argue that if Johansson et al. (2011)'s theory should apply in this case, suppliers would be less willing to adopt and perhaps even fight over who is responsible for the error. This does obviously evoke the question of why this is not the case in the studied environment. Our analysis of this situation is that VCC is a vital customer for both suppliers, but more importantly VCC is a good strategic partner when promoting products towards other OEMs. Moreover, the suppliers' state that VCC is in the forefront of technology in the field in which they deliver products. Making the

collaboration and their input on how they can improve and develop their products valuable for their individual competitiveness on the overall market. VCC market position and reputation does thereby seem to have been a supportive parameter for the collaboration.

6.1.1 Abstraction levels

When learnings are done successfully within the collaborations it is much due to the use of forums for interaction and exchange. Meetings with a suitable abstraction level of technicality and function allows for seeing common interests and possibilities in situations where which otherwise could be hidden by not understanding each other or losing interest. This also goes for the possibility to combine knowledge between suppliers, as they state that it is possible to meet and discuss the majority of things together (see section 5.3). In doing so it seems possible to access the competence available within each other's organisations and make a contribution to build upon each other's progress. This supplier engagement, builds upon the long-term relations to VCC and the common interest and commitment, aligns well with Ale Ebrahim et al. (2009); Ford et al. (2011); Katzenbach and Smith (2015).

Getting the interaction points to function well also seems to be a matter of keeping the agenda and topics relevant. This means that everyone must be represented when their expertise could be interesting or required to combine knowledge, but also that they only should be present during sequences which regards their interests and competence. Balancing having people available and not is of course difficult, jeopardising to spend unnecessary time or missing out on important learnings. Yet, we argue that it could managed by using separate meetings with certain abstraction levels, adopting larger meeting to match the technical knowledge of weakest participant. More technical discussions should if needed only take place between parties involved in that level of technicality. This type of interaction is thereby more effective in smaller groups with a less diverged technical expertise. Having a well-defined abstraction level, structures, and only using on-demand meetings when necessary will provide a good base for Continuous Knowledge Combining. Sync-meetings on a higher abstraction level focusing on processes and planning e.g. the PI-planning does on the other hand need to be reoccurring at a defined interval to provide some structure.

6.1.2 Right info in right channels

Interviewees are feeling that interaction forums are great, but they might sometimes get stuck in the wrong kind of discussions, which wastes a lot of expensive time. Nevertheless, the meetings have the potential to generate major benefits and real improvements. The PO-sync as an example allows for learning more on a feature level and as it is well defined at a certain abstraction level allows for better selection of what knowledge to share. Doing this kind of selective knowledge distribution also allows a more accurate combining of knowledge, as all parties have an understanding linked to what is shared, in some way. This seems to agree with Ahlskog et al. (2017) and Kanter

(1994) in that successful *IOC* involved higher knowledge overlap and more competent people. The same phenomenon can be seen in the study, as interviewees highlight the importance of technical experts and "guru expertise" about technical standards. Knowing the VCC context is also important, as it allows for greater learnings because of the ability to selectively choose what knowledge that is relevant for that specific context.

The need for higher competence when doing IOC gives the impression to be true both in theory and the study. But, using suitable abstraction levels for discussions (as previously argued), could still make it possible to have close to all team members involved in the conversation. Tighter collaborations and developer to developer communication has shown to emerge from such interaction generating benefits like e.g. flexibility, speed, and accuracy in development. Letting developers collaborate and meet regarding higher degrees of technicalities, over organisational borders allows for this to continue. However, we argue that developer to developer interaction should be kept on a technical level and feature related discussions and alignment in more strategic terms should be kept between the POs, PMs and technical experts.

When first having met face to face in a meeting, we think it is possible to discuss more complex and tacit sets of knowledge and problems over phone or *ICT-platforms*. This due to that a common understanding has been established. A perception that aligns well with the Agile principles which states that face to face interaction is the most efficient way to distribute knowledge to the team (see intro for chapter 2). Learnings and possibilities must then not stay in these interactions or meeting minutes but be distributed to everyone who could benefit from them, in a suitable way. Only relying on face to face communication and individual team members to access the information on ICT-platforms is not enough. We argue that there is a high likeliness of information getting lost and knowledge not being available, hiding away learnings and possible innovations. There by indicating a need for pre-scheduled sync meeting where members are expected to participate and distribute their learnings to participants outside of their teams. This can be done at the system demos, in on-demand workshops, CoPs, or other sync meetings. A scepticism towards relying too heavily on ICT-platforms for distributing and combining knowledge is something we consider to be healthy. Particularly since negative effects of this is highlighted by interviewees as well as the theory (see section 3.1.1).

6.1.3 Contracts

The structures that are emphasised as important for successful collaborations (see Figure 6:3) and becoming a team are integration, coordination, governance, and cooperation. Within these topics has the supplier contracts been highlighted as an issue of importance. The current contracts between VCC and its suppliers have though found to have limited impact on the flexibility and performance of their collaborations. Which we claim to derive from long-term relations, an opinion as also highlighted by Ford et al. (2011); Kanter (1994). Parties act more rational in long-term relations and only rely on contracts as a starting point, they then often turn to collaborate without explicitly or formalised

terms. Seeing that all three suppliers have a history of good collaboration with VCC has also acted as a stable environment, when changing operations and processes, linked to the transformation towards SAFe. but otherwise the transformation seems to have gone just as smooth. In this way it seems as if governing is tightly connected to trust, commitment and common responsibility by sharing efforts. Whilst the observations by Scaled Agile Inc (2018) that frontloading of specifications is needed when collaboration with more traditional suppliers, also was found to be true in this case. This also results in the development of vague contracts, or contracts that see a drift of their scope as time goes, due to continuous development of the collaboration and deliverables.

Even though the collaborations are working well, one could see indications that this might not be entirely true when looking at the circumstances for the collaborations. VCC is possibly, due to being the initiator and customer, the one benefiting the most out of the collaborations. Interviewees have expressed concerns that information and learnings mainly flow one way. Which has negative effects (see section 3.1.1) on the creation of long-term commitment since only one party sees the benefits of collaborating closer, this will thereby reduce the overall performance. It is important for the parties to see joint learnings, developments and knowledge combining in order to see further improvements, as emphasised both in the empirical stories (see section 5.1) and analysis framework (section 3.2). The lack of dual flow for knowledge may also be affected by the expectation on the collaboration, as well as the internal structures for handling learnings. Both a low degree of adaptability and ability to reuse developments is seen at one of the suppliers, probably caused by a need to update the internal processes and business models. This follows what is stated by various authors (see section 3.2.1) of that the internal organisation for cross-functionality and knowledge combining is a prerequisite for successful IOC. If not, the learnings will most often stay within the specific collaboration rather than enable further developments and allow for knowledge combining between the entire organisations. This aspect highly relates to integrating, capturing and absorbing learning, that allow for knowledge to successfully be combined in new ways (see Figure 6:3).

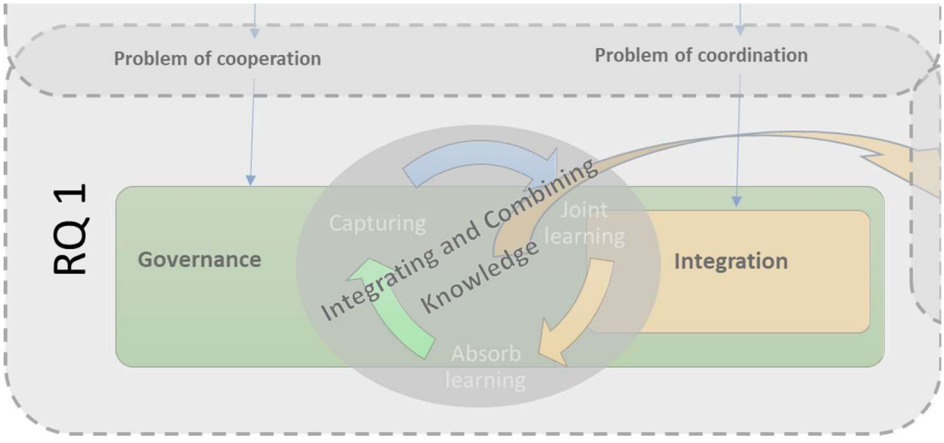

Figure 6:3 *Mechanisms and structures that according to the analytical framework are found important for successfully allowing continuous knowledge combining (see section 3.3.3).*

One could perhaps argue that this ability to absorb knowledge will become more vital in the future. The interviewees indicate a trend towards responsibility of the overall solution shifting from the suppliers towards a more collective responsibility between the OEMs and suppliers, a perception which aligns with Binder et al. (2008) theories.

6.2 RQ2: What parameters affect the extent and willingness for knowledge combining?

The study has much like the theory shown physical and operational distance to be limiting parameters for collaboration, due to its negative effects on the creation of a team spirit. The identified "they and us" feeling in ART 1 is most likely a result of this, teams are not colocated and thereby unable to create a collective identity. An even more interesting finding from the cases is the verifying Ferrazzi (2014)'s theory that physical distance can emerge even between teams located in the same build but at different floors. One could from that findings draw the conclusion that colocation is a parameter that has a positive impact on reducing distance and thereby supporting collaboration and knowledge combining. From the interviews it becomes evident that physical distance is not the only type of distance that have been present between VCC and its suppliers. Interviewees indicate that distance due to affinity also might be the case, particularly caused by cultural differences. Indication were made that direct access to developers previously was hampered because of supplier organisations being more hierarchical. They thereby preferred contact to be done through managers. Theory purpose that to have successful international collaborations, with cultural differences, you first need to acknowledge your differences and evaluate the impacts it might have on the business. We argue that this is exactly what VCC has done in this case, they started out with recognising their differences and saw the benefits of having more direct communication. VCC then influenced suppliers to change by constantly communicating that they wanted open communication and the benefits it entails.

Mover, there are other benefits of being colocated than reducing distance. Daily face to face interaction that colocated teams would entail will allow for a less formal type of interaction e.g. at a coffee break, confirmed by the interviewees. Which according to Kanter (1994) creates more effective IOC, indicating that a larger degree of common workshops and face to face interaction would affect the collaboration positively. Further a less strict scope and obligations will result in a more transparent collaboration between organisations, enabling creation of a common understanding of what to be developed. It is hard to say if the increased transparency seen between VCC and its suppliers is a consequence of more flexible specification, or if other parameters have been more significant. We would say that it is more likely that VCC's continuous communication promoting transparency, in combination with the incorporation of Agile methodologies is more likely to be the cause.

Transparency is one of the key parameters identified for supporting knowledge combining in the studied environment, but transparency per se needs to be enabled by

trust and low prestige. Suppliers are not likely to share sensitive information or admit that they have problems if the interaction with VCC is judgemental and they get disciplined for delivering bad news. In that way low prestige and trust are probably significant parameters to create transparency, which the interviews also indicated. Incorporation of SAFe and thereby a more continuous flow of deliverables is another parameter having allowed and affected transparency positively. The suppliers are now delivering smaller sub-functions more frequently, even going into daily deliveries of their changes. This approach is something which undoubtedly has forced the developers towards allowing lower prestige since it requires them to share unfinished work.

Face to face interaction and PI-planning in particular, was the parameter most frequently highlighted by interviewees as vital to support collaboration with suppliers, aligning well with Scaled Agile Inc (2018) stating it to be the most vital event. Interviewees further indicated that it was the ability to collectively create an understanding of the deliverables, enabled by having all people in the same room, that made the PI-planning so useful. A common understanding of what to be delivered and when, is something we argue helps to create a shared vision and commitment. Katzenbach and Smith (2015) emphasise that a group will not truly collaborate in an effective manner before they have created a shared commitment, which is why we think the PI-planning is so important for the collaborations.

Moreover, the study shows a need for close collaboration something that might be explained by the tasks and characteristics of the distributed knowledge. Complex tasks relying on more tacit knowledge calls for a higher degree of knowledge overlap and collective decision making, an element we think is part of the reason joint meetings has been addressed as important for VCC's collaborations. We further argue that the complexity and novelty of the products developed calls for coupled knowledge integration a perception supported by the theories in 3.3.2. However, the task complexity is not the only indication from the case pointing in the favour of coupled knowledge integration, closer integration, and collaboration. The incorporation of SAFe and thereby less strict specifications is another parameter highlighting an increased need of interaction and face to face meeting (see chapter 2.1). We argue this since loose specifications may result in a lack of a long-term plan and shared commitment, leading to ineffective collaborations. A common forum like the PI-planning can, if correctly implemented (see section 6.1), facilitate the necessary platform for solving these issues and mitigate the negative effects of having a vague scope.

VCC have a long-lasting collaboration with its suppliers where they have built trust and confidence in one another's capacity to deliver accurate functionality. This trust is highlighted as essential for the collaboration improving the willingness to share and combine knowledge. We would further argue that VCC has managed to transition towards SAFe with less friction due to these good relations. All the suppliers' states that the current contracts do not support the way they work today, it appears like the contracts still favours the old traditional way of working with rigid specifications. Nevertheless,

neither VCC or the suppliers indicates that it has prevented them from becoming Agile in a significant way, since they override and collectively interpret the formulised agreement in favour for an Agile work process. We argue that this ability to adopt and being more flexible towards the contracts is a result of the long-lasting relations and thereby trust. An observation supported by Ford et al. (2011) which estimates that two thirds of all collaborations lack non-formulised contracts and are instead based on trust. However, this observation would most likely be not true in less static collaborations where suppliers are replaced more frequently. Resulting in a situation where they do not have the time to build either confidence or a stable relation based on trust.

Below, is an updated version of the analytical framework with the parameters that were identified to affect the willingness to collaborate in the studied context: physical distance; long-term commitment; Transparency and low prestige.

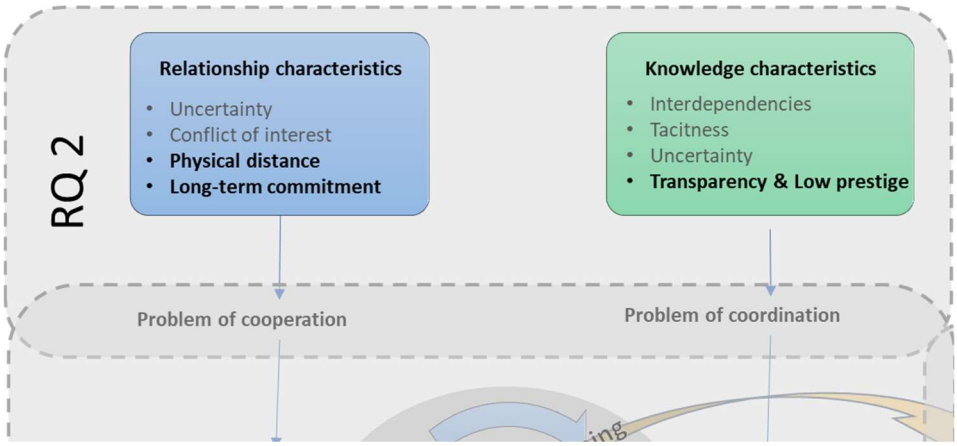

Figure 6:4 *Visualisation of the analytical framework with additional parameters important for Continuous Knowledge Combining in the studied context.*

6.3 RQ3: What categories of improvement can knowledge combining generate?

Thanks to structures enabling collaboration and sufficiently working with the parameters to support continuing to build it, several collaborative improvements have been observed (as shown in section 5.2). In this section they are analysed further and it is noted that they can be categorised as Middel et al. (2005) proposes (see section 3.4). Building capabilities within the higher levels seems to enable further improvements as capabilities are built. As an example of this operational performance leads to need for improving processes, in turn increasing the possibility for enhanced operational performance, putting an emphasis on the dependency between the levels (see visualisation in Figure 6:5).

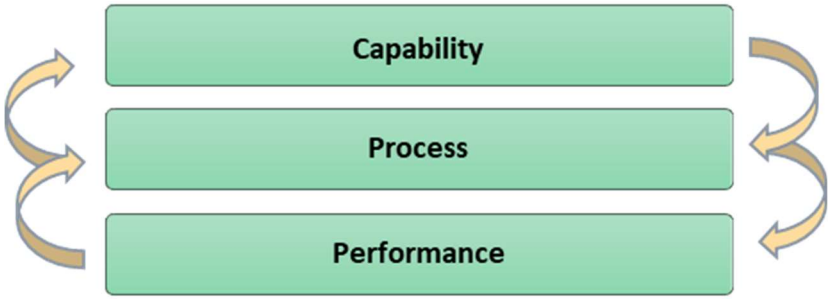

Figure 6:5 *Seeing that certain improvements create a need for improving in a higher level, that builds the capability for further improvements in the levels below.*

Improvements that have been shown are in diverse areas, supporting theory (see section 3.2.1) in what successfully managing knowledge combining between several parties can result in. They according to the empirical findings relate to:

- Identifying issues in the development
- Defining which issues to handle and work on
- Adapting the processes between organisations (i.e. becoming Agile etc.)
- Use of common ICT-platform
- Setting a common understanding and definitions
- Defining acceptable level of issues
- Adapting organisational culture

How these relate to the different levels might in some cases seem either obvious or vague. To clarify this the following sections will give an analysis of the impact from some of the improvements and how they possibly relate to one another.

6.3.1 Increasing capabilities – Level 3

Two examples of building capabilities within the collaborating organisations distinguishes from the other by being intertwined and together enable further improvements. They seem to derive from VCC having set the standard for Agile processes in the collaborations and thus stated the need for this with the suppliers as well. Through it the delivery amount has increased from quarterly or monthly deliveries to

much faster implementation, listening more to VCCs requirements and wishes. To be able to do this, they have had to build internal capabilities to become agile and flexible. Learning this kind of processes, methodologies and following the Agile methodologies has been gained directly from VCC and being able to transparently discuss it. Making use of the learnings has been seen as positive within the entire organisation and something also seen of interest amongst other OEMs, wanting to collaborate like that as well. We see that this interest both increases commitment, available learnings and possible knowledge combining.

Through the collaboration between the suppliers and the close collaboration that the Agile work requires, language barriers have become obvious to interact better. To reduce these barriers the supplier is building up capability internally so that developers can speak better directly with developers. This also creates an ability to take out technicalities from the PI-planning forum and create separate syncs, where technicalities are better discussed. Doing so allows fast communication and adaptation occur, leading to building better products together and become able to continuously improve the processes and functions. The outcome from doing so can be increasing alignment and spending time on the right functions and products, instead of constantly updating and patching the development to fix issues.

These improvements build capabilities that allow further improving, becoming more flexible and better collaboration. Having this long-term commitment and willingness to adapt in order to better work together seems to be a main contributor, something that Ford et al. (2011) states as crucial. This requires trust, according to the authors, something that is seen in disregarding the collaboration leading to excluding other collaborations. Seeing these improvements shows that willingness is large between the organisations and they are mobilised (as argued necessary in section 3.3). As a result, capability building can continue to occur in the collaborations. Continuing in doing this will further build strong relationships, as included in the definition for this level of improvements (see section 3.4). Language capability especially allows this and is to be seen as a vital development in building a strong collaboration. From this also comes the possibility to more accurately share knowledge and combine it in new ways, as knowledge and understanding between the parties is built also on an interpersonal level.

In order to continue seeing these improvements we see a continued need for emphasis on direct communication. This is further enabled by a low prestige, meaning that interaction actually can occur, questions be stated and a need to see improvements can become obvious (e.g. by having to speak a foreign language, showing the need for developing capabilities further), also shown by Rosell et al. (2017). Neeley (2018) further emphasises continuing building trust, interpersonal connections and understanding, allowed to be incomplete, enabling these improvements. The continued adaptation of the organisations and operations also builds a further ability to increase the capa0bilities of each other and the own organisation. Needed transparency seems enabled by the Agile transformation,

which also is rooted with Agile (see intro to chapter 2), in turn increasing how each other's expertise can be utilised.

6.3.2 Improving the processes – Level 2

Working closer and more agile (and the role of contracts) has led to a higher frequency of product releases. Going towards release every second week and aligning the processes has lowered the amount of bug fixes and patches, and lead time from need to working function has been drastically reduced. This enables continuing to work on improvements of both the product and processes. Technical improvements such as daily deliveries between the organisations and joint ICT-platforms has led to more communication between the organisations and these kinds of results. Improvements in the processes have therefore been a part of the tight working together, but also resulted in a need for developing capabilities internally to enable further interaction (a level 2 improvement leading to a level 3 improvement in language). This then further allows more accurate products and high frequency of delivery.

Seeing these improvements is a result of having sufficient channels for communicating and thus shows that the current processes are allowing for knowledge combining and adaptation. As the enablers for collaboration show (see section 3.1.1), having met face-to-face reduces distance between both the people and organisations, leading to it being possible to interact sufficiently over the ICT-platform and in technical discussions. Through this all kinds of knowledge can more effectively be communicated, even at a daily developer to developer level of interaction. The alignment of processes and partaking in interactions seem to allow for understanding each other's situation and better selecting information and communicating, as Newell et al. (2009) emphasise (and is urged in section 3.3.2).

Continuing to interact, meet, create understanding, dare to have low prestige and communicate issues frequently, as argued in section 6.1, will enable further improvements of this kind. We therefore believe that teams must continue building the capability to see when such interactions are necessary and how to best build knowledge and understanding between the teams. Having them in place could also further reduce the occurrence of faults, necessary rework and allow reusing elsewhere developed products, as they are better understood.

6.3.3 Operational improvements – Level 1

Understanding requirements and needs for each other to develop and deliver the right things has also enabled better functioning products. This is a result from the adapted processes, continuous communication and increased delivery frequency. Status and products being shown and delivered at a high frequency requires reduced prestige in showing the issues and current progress, which has further enabled improvements. Building a more tolerant tone between the organisations and seeing that all parties take equal responsibility has also helped this. By moving from contracts that punish suppliers

for faults, into collaboration where errors and issues are wanted to be shown and fixed, this seems to be on the right track for continued improvements. Having worked tightly together has shown that some definitions of problems have to be done and therefor leading to common understanding. Doing this allows for dividing the tasks better between the organisations and seeing reduced dependencies, whilst still delivering accurate developments, as also mentioned by Rosell et al. (2017). Breaking down the task more and having all developers being able to see and update them in the ICT-platform, seems also to be beneficial in this way. Learnings such as these have also gone from supplier to supplier, as all the organisations in common have understood how to handle problems and where they are possible to solve most efficiently. Enabling to combine knowledge and absorb it (see section 3.3.3) is an important part of building further (high level) improvements, which probably begins in this level.

6.3.4 Future challenges for seeing more improvements

As well as succeeding well with many improvements, we have noticed certain challenges, that if managed could further lead to better performance. Managing to utilise the interactions from Agile even more (especially *Retrospectives*, *Inspect and Adapt* and different sync meetings - i.e. PO, architect and *Scrum Master* syncs) could lead to seeing needed improvements and building certain capabilities. This is a vital part of the Agile principles (see intro for chapter 2) and particularly important when working with traditional suppliers (as stated in section 2.3). Learnings also have to be further distributed, in a structured way that allows for new knowledge combining and distribution. These would probably benefit from being done both within and across the organisations (as argued in section 3.2.1). Some of the improvements seen by us as an outside observer seem to derive from not asking straight out what e.g. hinders supplier communication and showing commitment. Increasing this transparency and openness could probably have solved this, as other improvements show that there will be no harm in further openness.

6.4 Summarising answers to the RQs

Here a list of important bullets to considerate when regarding the different research questions are summarised. For the purpose, this section fulfils it to some extent, but is further elaborated on in the concluding chapter.

RQ1: How is continuous knowledge combining supported?

Our analysis has identified these following parameters to support continuous knowledge combining in the studied case:

- Well-defined abstraction levels and structures for meetings, communicating using the right forums.
- VCC's leading market position and reputation, enables supportive collaborations with suppliers.
- All parties equally contributing to the collaboration, creating win-win situations.

RQ2: What parameters affect the extent and willingness for knowledge combining?

These are according to us the most important parameters to enable continuous knowledge combining in this context:

- Physical, organisational and cultural distance between parties in the collaboration
- Extent of communication and proportion of face to face interaction
- Transparency, open environment for discussions and low prestige
- Creating collective vision, alignment and shared commitment
- Long-term supplier collaborations and trust

RQ3: What categories of improvement can knowledge combining generate?

Some of the most crucial improvements currently observed from the case is the following:

- Building different capabilities between and within the organisations, thanks to the long-term commitment.
- Improving and adapting internal processes towards each other and implementing Agile methodologies, seeing further benefits in other collaborations and by technology leading the way.
- Increasing operational performance as a consequence of appropriately dividing tasks, understanding dependencies and each other better.

7 Conclusion

Here the study is concluded in accordance with the purpose: identify and create a greater understanding of what enables or limits knowledge combining in inter-organisational collaborations.

The world around us and especially the automotive industry is increasingly complex and working with Agile allows the desired flexibility to handle this. Therefore, Agile always starts out in the complex realm, with many things being undefined or unknown. Collaboration is also ever more important and to treat all these complexities the organisations have to start by creating a common understanding through interaction points and tight collaboration. This coupled approach to development allows common goals and increased commitment for every party. From this it is later possible to understand each other better even when not working tightly together (being only a phone call away). According to our findings Agile always calls for coupled collaboration in order to build common goals and then allows dividing tasks more sufficiently.

This type of collaboration is necessary as the link between teams increases the need for transparency and acknowledging dependencies. Complexity, dynamic aspects of the business context and dependencies are balanced by making use of the static elements such as collaborating with supplier that you have a long-term relationship with, when possible. Doing so allows to go beyond that of traditionally contracted collaborations, into using more vague specifications (a necessary result of the complexity) and collaborate even when not all supporting processes are present.

To continuously combine knowledge you have to understanding requirements and possibilities that exist within the collaboration. It is thus important to have a high degree of openness and allow for direct interaction between the teams. Establishing open communication between all parties in the teams and ARTs is realised by working in suitable interaction points with certain abstraction levels. For this to occur the combination of Agile meetings is considered highly purposeful, especially the PI-planning. Dealing with the right information in these forums is what enables teams to better communicate and thereby achieve continuous knowledge combining.

7.1 Managerial implications

Our conclusions bring implications that will benefit organisations if implemented, looking at the importance of:

- refining interaction points with suitable abstraction levels and involving relevant parties
- enabling further openness and transparency
- supporting autonomy of teams, taking responsibility and establishing purposeful interactions
- reviewing contracts and using vague specifications to manage complexity and transformation to Agile

Flexibility and the implementation of *SAFe* requires enabling autonomy within the ARTs. All members should contribute to the collaboration through creating platforms for jointly working even better and taking responsibility for filling in the missing parts. Utilising direct contact between developers becomes increasingly important along with continuing to invite suppliers and all relevant parties to the interactions. Only when they are developing in their own best way and establishing suitable interactions can continuous knowledge combining occur.

Forums and interactions have to be refined so that knowledge combining and learning is done in an efficient way. Some forums will have to change their form, to not contain technicalities but regard more common alignment and understanding. Other additional interactions have to be developed and direct contact between team members should allow for openly speaking regarding different abstraction levels. Meetings have to be adjusted and scheduled in a way that keeps them highly relevant for all parties and supports low prestige participance. In all occasions, start of by identifying your audience and then adjust the information accordingly. Aligning the collaboration by creating a common overview first enables technicalities to be efficiently discussed in ICT, separate meetings or directly between developers.

As the tasks turn to become more abstract and vague, the contracts will have to be reviewed to allow for flexibility. Coupled Agile collaboration in this context leads to uncertainty regarding deliverables which the contracts need to reflect and allow. For now, traditional contracts with vague specifications work due to the long-term supplier collaborations, but when bringing in new suppliers Agile contracts have to be in place. The long-term relations with suppliers add stability to the dynamic and changing environment, which reduces the impact of having many additional unknowns present (i.e. roles, developments, processes, architecture, contracts or specifications). ARTs and managers have to commonly look into how these contracts should work and how procurement should be involved to review and evaluate supplier performance. For all this it is important to get the suppliers perception of the collaboration, asking straight out what could be improved.

7.2 Research implications

The empirical findings seem to confirm that complex tasks are becoming more prevalent and that Snowden and Boone (2007) suggestion is accurate: that this calls for solving tasks in teams (as emphasised by Rosell et al. (2017)), gathering competence and using a "probe-sense-respond" method. The Agile context emphasises a need to shift to new ways of knowledge combining, due to embedded complexity and high flexibility that comes with vague long-term plans. Due to this our study also follows what Ford et al. (2011) and Kanter (1994) have noted, that formal agreements such as contracts are outweighed by long-term collaboration with built in trust. Our findings also show that what Middel et al. (2005) proposes is confirmed also in this study and that absence of the mentioned parameters (i.e. shared goals, long-term orientation, openness, transparency, common

learning and transferring knowledge etc.) has vital implications on the possibility to see collaborative improvements and conduct continuous knowledge combining.

Handling the complexity of the present business context, it is crucial to create a common understanding where complex tasks can be specified in such a way that the collaborating parties can start working with them. When having reached this, by using high involvement interaction points, suitable abstraction levels and tight collaboration (*coupled collaboration*), tasks can turn more explicit, be easily communicated, and broken down to smaller components (*decoupled collaboration*). Also applying to incremental development, as the complexity of this type of collaboration requires interaction. This confirms the framework of Rosell et al. (2017), investigating if it is also true in settings with multiple collaborating parties. Moreover, it adds an understanding of how Agile builds in complexity, requiring initial coupled collaboration for all kinds of knowledge exchange (be them explicit, complex or tacit) (see Figure 7:1).

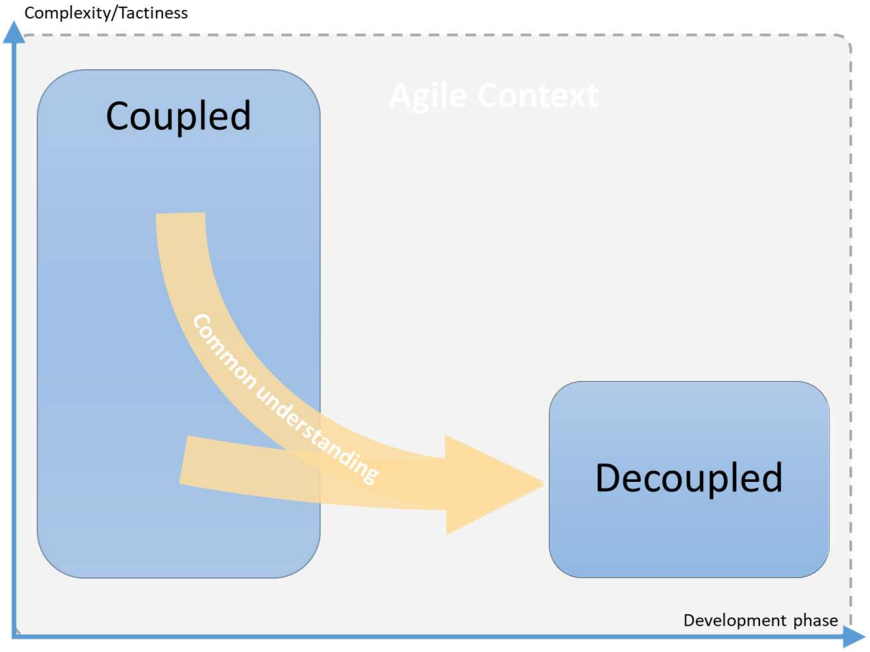

Figure 7:1 *Impact of Agile on how collaborations should perform to allow for decoupled collaboration, affecting the definitions by Rosell et al. (2017).*

According to our findings we see that use of different abstraction levels can lead to reduced requirements for team members having large competence and knowledge overlap in order to collaborate, as is argued by Ahlskog et al. (2017) and Kanter (1994). *IOC* still requires large knowledge of each other, but now divided between members. Suitable knowledge selection and distribution comes out of knowing what is important for you, how you think and communicating relevant information transparently.

7.3 Call for future research

We propose that additional case studies could build done to create a more generalisable base of knowledge around the concept of continuous knowledge combining in IOC with multiple parties. It would also be beneficial to look at success stories of knowledge combining in scaled Agile contexts.

With changing and complex business contexts, where organisations are dependent on each other, there is a need to further understand how also dynamic collaborations can be managed. Future studies could look at organisations that have recently transformed to more Agile ways of working and having changed their supplier base. A proposed research questions in this case could be:

- *How is Continuous Knowledge Combining supported in these dynamic business contexts?*

With the Agile transformation and continuously collaborating with suppliers, there is still a gap in understanding how Agile contracts should be formalised. Especially when wanting to enable the desired continuous knowledge combining. Some different questions here arise:

- *How should the contracts be setup in order to follow the coupled process of knowledge combining?*
- *How should procurement continuously evaluate supplier performance?*
- *What is the legal departments role in these contracts and how should Intellectual Property Rights be managed sufficiently?*

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Appendix A – Interview Questions

English interview version

Organisation and setup

Please describe what you work with and with whom?

How is your team organised?

- Please tell us about in what work role **you** typically interact with people from other organisations
- Describe how your **team** interacts with other teams/organisations
- How has this changed when the ART was introduced?
- Please describe the places where supplier interaction happens

Processes for collaboration

What processes/"events" do you have in place for collaboration with external parties?

  - Is this team specific?
- How are "lessons learned" handled in them?
  - How are the possibilies to share and combine knowledge?
  - What is the primary goal for doing "lessons learned"?
- Which "events" do you feel have worked extra well?
  - Why?
- Which ones do you feel have been insufficient/have not been working well?
  - Why?
  - How was this problem handled?

In what way **can you** share knowledge to those you collaborate with?

- How are suppliers' expertise integrated?
  - What type of knowledge do suppliers contribute with?
- How do you decide on what knowledge to share?
- How do you make use of shared knowledge in your team?
- How has this changed when the ART was introduced?
- Have there been any improvements enabled by combining collective knowledge?

Ending the interview:

How familiar would you say that you are with agile and the work processes [novice, familiar, expert] / [sceptic, interested, lover]

Do you know of someone else (e.g. in your team, supplier, other team) that would be suitable for an interview in this subject?

Could we contact you for further questions or perhaps meet again for an interview, when we have come further with our interviews and analysis?

Swedish interview version

Organisation och struktur

Kan du beskriva hur du arbetar och med vem?

Hur är ditt team organiserat?

- Berätta mer om i vilken arbetsroll som **du** typiskt möter och arbetar med människor från andra organisationer
- Beskriv hur ditt **team** interagerar med andra team/organisationer
- Hur har detta ändrats sedan arbetet i ART började?
- Berätta om de tillfällen som interaktion med leverantörer sker

Processer för samarbete

Vilka tillfällen/processer finns för att kunna samarbeta med externa parter?

  - Är detta team specifikt?
- Hur ser möjligheter ut för att dela och integrera kunskap?
  - Vad är det huvudsakliga målet för att genomföra ”lessons learned”?
- Vilka tillfällen känner du fungerar extra bra för samarbete med externa parter?
  - Varför?
- Vilka tillfällen upplever du har fungerat mindre bra /varit otillräckliga?
  - Varför?
  - Hur har detta hanterats?

På vilket sätt **kan du** dela kunskap med de du samarbetar med?

- Hur integreras leverantörernas expertis?
  - Vilken typ av kunskap kan leverantörer bidra med?
- Hur väljs den information som delas?
- Hur tar ni tillvara på kunskapen som delats mellan team?
- Hur har detta ändrats sedan arbetet i ART började?

Har det skett några förbättringar genom att ni har kunnat integrera gemensam kunskap?

Avslut på intervju:

Hur bekant skulle du beskriva att du är med agilt och arbetsprocesserna ni har? [ny, bekant, expert] / [skeptisk, intresserad, älskare]

Ny = precis stött på begreppen och börjat/aldrig jobbat i det
Bekant = litar på andras erfarenhet och har funnits med i processerna ett tag
Expert = drivit och jobbat agilt, certifierad enligt ”SAFe”, agile coach eller liknande

Kan du rekommendera oss att möta någon annan (t.ex. i ditt team, leverantör, annat team) som skulle vara lämplig för intervju detta ämne?

Kan vi återkomma med fler frågor eller kanske mötas igen för en intervju, när vi har kommit längre med våra intervjuer och analys?