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Technology transfer as a part of the business – Inter-organizational transfer strategies based on experiences of aircraft production

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Abstract

Purpose

The purpose of this paper is through a literature study and a study of the Saab offset cases to identify strategies to increase inter-organizational transfer capability.

Design/Methodology/Approach

Based on a literature study and a study of three of Saab's offset cases and Saab's process for technology transfer.

Findings

This study has identified inter-organisational transfer strategies based on the importance of the hierarchy of decision-making and the change from capacity transfers to capability transfers in offset business. 1) The type of performance goals set in the business agreement decides how to realise the transfer. 2) The hierarchy of decision-making create a need to align the understanding of the performance goals between the different parts of the organisation, which affect the plans for how to transfer knowledge between the organizational as well as the individual levels. 3) To reach the performance goals of the technology transfer there need to be a balance between the disseminative capability of the sender and the absorptive capability of the receiver.

Limitations

This study is based on a single case within a relatively unique industry with an offset perspective and production transfers. Therefore, there is also a need for future studies to confirm the identified relationships within outsourcing/offset within other industries and other types of transfers.

Originality/value

A change from capacity transfers to capability transfers in both outsourcing/offshoring and offset business indicates that more research should be placed on the disseminative capacity of the sender. The literature review revealed that the disseminative capacity of the sender has been the subject of less research than the absorptive capacity of the receiver.

Keywords: inter-organizational transfer capability, technology transfer, outsourcing, related offset, knowledge management

Article Classification: Case study.

Introduction

Today multinational company groups commonly try to increase the efficiency of their manufacturing networks by relocating manufacturing activities through offshoring and outsourcing (Golini & Petkova, 2014, MacCarthy et al., 2016; Mugurusi & de Boer, 2013). With these decisions follows a technology transfer. *Technology transfer* is the transfer of technology from a sending context, where it is developed and/or in use, to a receiving context, where it is implemented and adapted for use (Robinson, 1988). However, technology transfers have proven difficult because of the existing interdependency between processes of the factories (Boulaksil & Fransoo, 2010; Wasner, 1999, Rehme et al., 2013), lack of knowledge about the foreign destination and lack of systematic location planning (Kinkel 2012). In outsourcing/offshoring today the technology transfer is mainly seen as a necessary evil, which may lead to backshoring (Kinkel, 2012). Recent research (Fratocchi et al. 2017; Nujen et al., 2018) shows a disconnection between the mainly cost driven outsourcing/offshoring and the mainly value driven backshoring (shorten lead times, increase flexibility and customer value). This disconnection can be related to the problem of in-efficient technology transfers. Though to reach the benefits of the outsourcing/offshoring decisions and make technology transfers an important strategic capability that lead to flexibility within production and supply networks (Galbraith, 1990; Fredriksson & Wänström, 2014), the ability to carry out efficient technology transfers among companies need to be strengthened.

In several countries, such as Sweden, the United States, China and Russia, the military aircraft industry is an important part of the economy (Hartley, 2014). In this industry, orders are most often accompanied by an offset contract. *Offset* can be defined as the agreement in which a large system is bought and the seller has obligations that benefit the buying nation and has long-term effects on the development of the buyer's national industry. 'Buyer' refers to the government purchasing the defense system (Ahlström, 2000). When the offset obligations are directly connected to the product or system sold, they are called *related offsets* (Batchelor & Dunne, 2000) and can take the form of co-production, subcontracting, licensed production, and technology transfer, among others (Brask & Jonsson, 2002; Eriksson, 2007). One main goal of related offsets is to develop the buyer's long-term technology competence (Ahlström, 2000; Axelson & Lundmark, 2009). Thus, an essential part of the business is to accomplish successful technology transfers.

Offset business and outsourcing/offshoring decisions have similarities. However, one difference is being able to realize a successful technology transfer as a selling argument in offset business (Fredriksson, Malm & Johanssen, 2016). In offset technology transfer is an important economic success factor for the sender and an important factor in terms of receiving new knowledge and in building new capability from the receiver side. **Thus, to decrease the risk of backshoring because**

of in-efficient technology transfers in outsourcing/offshoring decisions learnings from offset business companies' practices can be made. The Swedish military aircraft producer Saab has worked with offset business for many years and thus has considerable experience of technology transfer as part of the business. Therefore, the purpose of this paper is through a literature study and a study of the Saab offset cases to identify strategies to increase inter-organizational transfer capability.

In previous research of outsourcing/offshoring/backshoring/offset the main focus have been the motives of the decision, i.e. *the why* (e.g. Fratocchi et al. 2014; Stentoft et al., 2016; Fratocchi et al. 2017; Nujen et al., 2018). However, the question of *how to carry out the decision*, i.e. managing the inter-organizational technology transfer, have been less researched, especially from an organizational capability and readiness perspective, i.e. disseminative capacity (Nujen et al., 2018). The few earlier studies made have had a knowledge and process perspective (e.g. Grant & Gregory, 1997; Madsen, 2009; Knudsen & Madsen, 2014; Malm, Fredriksson & Johanssen., 2016; Fredriksson et al., 2016).

The paper is organized as follows. First a theoretical background introduces the concepts of offset business, capability gaps and technology transfer. Next the methodology is presented, followed by a presentation of the Saab cases. Case findings are developed and discussed and finally conclusions are drawn.

Theoretical background

The main differences between outsourcing/offshoring and related offset can be explained by the fundamental purpose of related offset, which often is to enhance long-term economic development in the buying country (Ahlström, 2000). One proven way to promote economic development is through technological development of the sub-supplier (Sharif, 1986; Roessner et al., 1992); therefore, it is important within related offsets to create job opportunities through, for example, transfer of production. Furthermore, new or advanced technology is often requested, since the buyer wants to assimilate new knowledge into the domestic economy, where it can diffuse and stimulate growth (Stephen, 2014). In an offset contract, the seller and buyer take the unique capabilities of participating industries into account i.e. special requirements, the extent of resources, and the level of economic development of the buyer, based on an assessment of the buying country's capabilities to absorb the requested technology (Mitra, 2009).

Research into offset relationships demonstrates that offset business creates unique setups with long-term industrial commitments that typically last for more than ten years (Axelson & Lundmark, 2009). As an effect of these long-term commitments, the seller will often establish partnerships within the buying country and close cooperation with the local suppliers (Kirchwehm, 2014). Another effect

of the fundamental purpose of the related offset is that the seller in most cases is not allowed to select the receiver of the technology transfer (Fredriksson et al., 2016; Ahlström, 2000), because the receiver most often is chosen by the buyer based on aspects other than its capability (Ahlström, 2000). Thus, the capability gap between sender and receiver of the technology transfer can be large and should be assessed and bridged to accomplish a successful technology transfer (Malm et al., 2016).

Vincent (2008) defines a capability as the ability to perform or achieve certain activities that also can be developed and improved. Oppat (2008) and Winter (2000) highlight in their definitions that capability should give competitive advantage, i.e., it is reflected in an activity that produces outputs that clearly matter to the organization's survival and prosperity. In this research, we follow the definition of Malm et al. (2016, pp. 641) where "*capability is the ability to perform certain activities so that when the activities are transferred they can be developed and improved by the sender and give competitive advantage*". A capability gap therefore includes the difference in the ability between the sender and the receiver in relation to performing an activity in such a way that it gives competitive advantage and can be improved and developed (Malm et al., 2016). Thus, in the case of small capability gaps, the individuals on each side of the transfer possess highly overlapping knowledge (Reagans & McEvily, 2003).

In theory, the definition of technology transfer can coincide with the definition of production transfer. However, the two concepts are not always easy to distinguish from each other (Bozeman, 2000). International production transfer can involve everything from the production of standardized parts to the production capability of a complete factory (Minshall, 1999). A technology transfer can essentially be divided into three major phases: 1) preparations before the transfer, 2) physical transfer of equipment (if applicable), and 3) start-up at the new location (Madsen, 2009). A steady state occurs when the new location has reached full-scale production at the targeted levels of cost, quality, volume, and yield (Terwiesch & Bohn, 2001; Fjällström, 2007). During start-up, the production rate and yield is stepwise or gradually increased. The transfer can be organized differently: it can be either characterized as fast with a steep start-up or slower with a stepwise start-up (Madsen, 2009, Terwiesch & Bohn, 2001). For example a large and rapid transfer calls for extensive preparation, while a slow transfer makes it easier to focus on key equipment and learning (Steenhuis & de Bruijn, 2005, Madsen, 2009).

In earlier research on technology transfers, authors have focused on measuring the progress of the startup. Firstly, by the time to reach a steady state (e.g. Salomon & Martin, 2008; Steenhuis & de Bruijn, 2005; Galbraith, 1990; Stock & Tatikonda, 2000; Stock & Tatikonda, 2008), because variance in

this translates into economic consequences for firms (Salomon & Martin, 2008) and the central goal of most transfers is to progress as quickly as possible. The second measure is the difficulty of the transfer, because transfers that involve the most non-routine problems will be perceived as the most eventful and thus difficult, *ceteris paribus* (Szulanski, 1996, Terwiesch & Bohn, 2001, Jensen & Szulanski, 2004), possibly leading to either capacity or quality losses (Almgren, 1999). The capacity and quality losses that arise during a transfer affect firm performance because they require reactive actions. Consequently, the budget and some of the participants' expectations of the transfer will not be met (Szulanski, 1996, Terwiesch & Bohn, 2001, Jensen & Szulanski, 2004). However it has not only been the progress of the start-up that have been in focus, the receiver's ability to use the transferred knowledge to create and augment its competitive capabilities (Lyles & Salk, 1996) in terms of economic and business criteria (e.g. Lyles & Salk, 1996, Bustinza et al., 2010) have also been of interest.

Achieving an efficient technology transfer is difficult because it involves a physical transfer of technology and equipment, as well as a knowledge transfer within a certain context (Argote et al., 2003). For example, earlier studies (e.g. Teece 1977) have illustrated that well defined processes like an oil refinery's are easier to transfer than manufacturing processes. The conditions of the context may moderate the outcomes of a technology transfer (van Wijk et al., 2008). The context of the technology transfer also includes the sending and the receiving organization, the relation between the organizations and what knowledge is transferred (Argote et al., 2003). An essential part of an effective technology transfer is therefore to bridge capability gaps between the sender and the receiver (e.g., Lyles & Salk, 1996; Salomon & Martin, 2008; Galbraith, 1990).

Capability gaps can be decreased through efficient knowledge transfers (Minshall, 1999). Ferdows, (2006), Grant and Gregory, (1997) and Minshall, (1999) have developed models to decrease the capability gap between sender and receiver. These models have a strong focus on the adaptation of production processes to the receiver's capability, and identification of suitable processes for transfer after a supplier is selected based on performance and what to outsource. However, most often the knowledge required to apply the technology to be transferred is tacit and goes beyond written instructions (Madsen et al., 2008). This kind of tacit knowledge is often not evident in its original context, as it is embedded in the surroundings (including people and machines) (Grønhaug & Kaufman, 1988). Therefore, when technology is transferred to a new context, new problems will often arise; information not needed earlier is suddenly requested. The transfer of tacit knowledge is therefore of high importance for the success of the technology transfer.

Planning a technology transfer is especially complicated when the receiver has limited experience of the particular technology (Steenhuis & de Bruijn, 2005; Malm et al., 2016), i.e. a large capability gap. The focus of earlier research into how to improve the outcome of technology transfers has been on conceptual models showing how knowledge can be assessed and how knowledge can be included in the transfer process (Ferdows, 2006; Grant & Gregory, 1997). Minshall (1999), and Grant and Gregory (1997) present a model that has a strong focus on the adaption of production processes and these processes' transferability. There are other researchers who have a less hands-on approach and focus more on the knowledge transformations that transfer of complex knowledge requires reconstruction and adaptation (Lillrank, 1995; Kogut & Zander, 1992). However, these models are of little help in offset business, where deciding which technology to transfer is not fully up to the sender. Instead other studies that have focused on how to improve knowledge transfer are of more relevance.

Intra-organizational transfer capability is defined by Easterby-Smith et al. (2008) as the capability to diffuse knowledge within organizational boundaries. Based on the same analogy, inter-organizational transfer capability is the capability to diffuse knowledge between organizations. If the sender's intra-organizational transfer capability is good, it will support the inter-organizational transfer capability (Minbaeva, 2007) because, in most cases, this is a sign of the sender having a good disseminative capacity. But it is not only the disseminative capacity of knowledge senders that affects inter-organizational transfer capability, the absorptive capacity of knowledge recipients is also important (Tang et al., 2010).

The receiver's absorptive capacity constitutes the ability to recognize, assimilate and use that knowledge (Malm, 2017). The absorptive capacity is often described as the recipient's knowledge prior to transfer, i.e. its experience (Szulanski, 1996, Galbraith, 1990, Ferdows, 2006). The disseminative capacity of the sender refers to the ability of the sender to disseminate knowledge in a way that the receiver can convert this new knowledge to the new context (Oppart, 2008). Earlier studies have highlighted the importance of the disseminative capacity of the sender and that the absorptive capacity of the receiver should be well known to accomplish efficient technology transfers (Tang et al., 2010; Minbaeva, 2007; Ferdows, 2006).

Summary presenting the conceptual framework

Figure 1 below shows the conceptual model of this paper, presenting the relationship between inter-organizational transfer capability and performance of the technology transfer. As described in the theoretical background, the success of technology transfers has in earlier research been measured

from two perspectives: 1) the start-up in the form of the time and resources that the start-up consumes and 2) the economic and business criteria that show the receiver's ability to turn the transferred knowledge into competitive advantage. From the perspective of offset business, both types of measures are of interest. When capability growth is requested by the buyer (Ahlström, 2000), the activities to be transferred are often new activities for the receiver. Thus, start-up speed is not always the main objective of offset business technology transfers. Instead the receiver's learning and development of capabilities is in many cases in focus, and therefore measures of quality, economic and business criteria of the receiver can be of greater interest. To improve inter-organizational transfer capability, the sending organization needs to prepare carefully before entering a project management mode of transferring knowledge (Knudsen & Madsen, 2014). One part of the preparation is to evaluate the transferability and appropriateness of processes in question (Minshall, 1999; Grant & Gregory, 1997). However, as seen above the transferability and appropriateness of the processes depend on the disseminative capacity of the sender and absorptive capacity of the receiver. To improve inter-organizational transfer capability and increase performance of technology transfers, there is a need to increase the understanding of the relationship between disseminative capacity, absorptive capacity, transferability and appropriateness of the processes. This understanding has come further within offset business, which can be utilized in outsourcing/offshoring to improve the outcome of transfers.

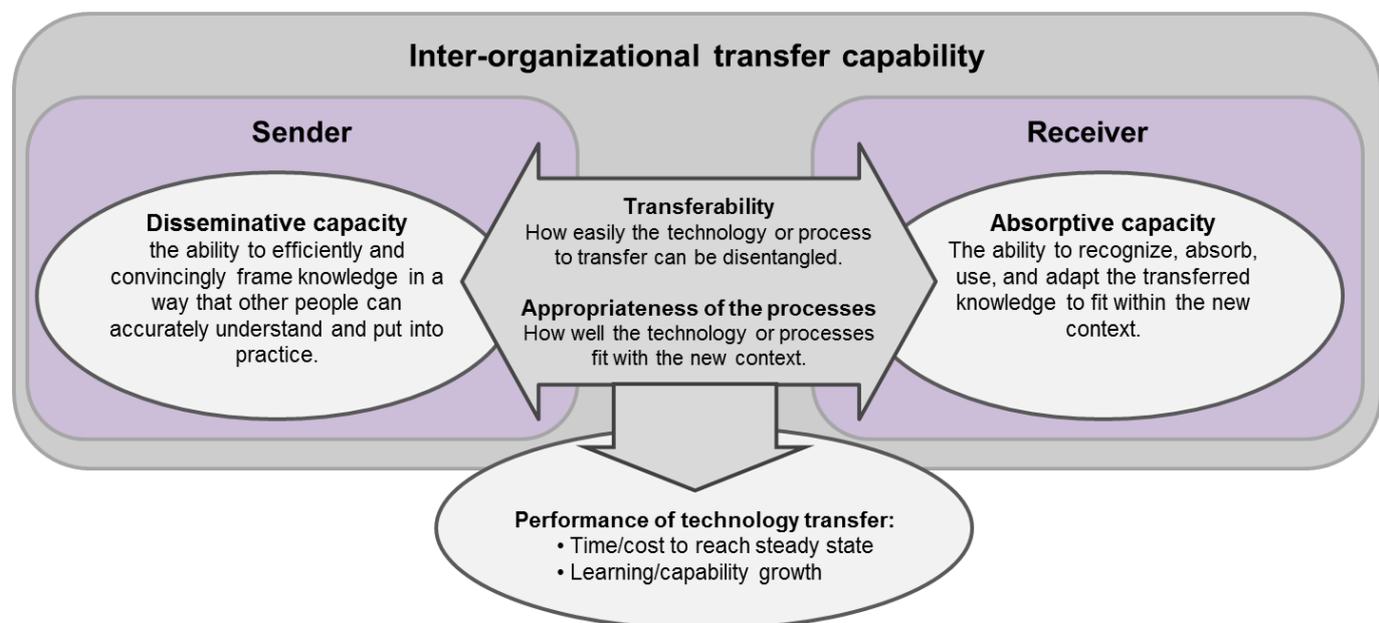


Figure 1: The conceptual model of this paper - relationship between inter-organizational transfer capability and technology transfer performance.

Methodology and case description

A single in-depth case study was conducted at Saab Aeronautics in Sweden. Saab serves the global market with world-leading products, services, and solutions from military defense to civil security. Offset business is an essential part of Saab's way of working. Saab is divided into six business units. The case study was performed at the business unit at Saab that is responsible for developing, industrializing, producing, marketing, selling, and supporting the Gripen aircraft (SAAB, 2017). Within business practice, offset business can have various names: industrial participation, industrial collaboration, business value development, governmental procurement, security of supply, etc. (Ahlström, 2000; Stephen, 2014). Saab complies with the Defense and Security Procurement Directive 2009/81/EC. The directive does not change the situation for defense trade with non-EU countries and does not affect this study; technology transfers outside Europe or any initiated before the directive came into force.

The research design, case study, is justifiable when the case represents a critical test of existing theories, a rare or unique circumstance and represents a typical case (Yin, 2014). The longitudinal approach allowed the capturing of the dynamics of transfers conducted by Saab, using the process analysis approach as suggested by Pettigrew (1977). The case includes both a retro perspective and longitudinal parts. The retrospective perspective provides a possibility to analyze an outcome (Voss et al., 2002). Longitudinal studies are also most often characterized by active participation in collecting data and information. However, longitudinal research offers the possibility of observing relations between cause and effect over a longer time span (Voss et al., 2002). Data were collected through interviews, internal documents and focus group interviews conducted mainly by one of the authors, who was employed as an industrial PhD student at Saab, and had access to internal meetings and documents. The interviews, with Saab employees at various levels, were performed from the spring of 2011 to the spring of 2017, where some of the interviews (2011-2015) were part of the data collection for a PhD thesis (Malm, 2016) and two earlier papers (Fredriksson et al. 2016; Malm et al. 2016). These two earlier papers had a focus on the process steps from negotiation to ending of relationship within related offset and capability gaps and how such gaps can be bridged through the specific tools used at Saab on individual and organizational levels. The present paper is based on Saab learnings made from their historic transfers to South Africa and Czech Republic and their ongoing transfer to Brazil. The data from the transfer to Brazil (column 3 Table 1) as well as the Technology Transfer process (the text below Table 1), is data collected.

The interviews made during the PhD studies (2011-2015) have been reanalyzed for this study based on the conceptual model in Figure 1. Furthermore, during 2016 and 2017 follow-up interviews have been made based on an interview guide including thematic questions developed

based on the conceptual model in Figure 1 (Halvorsen, 1992). This interview guide was used as a follow-up to confirm that all areas of interest had been covered in the interviews (Eisenhardt, 1989; Voss et al., 2002). The individual interviewees were technology transfer managers, business project managers, manufacturing managers, sourcing and supply managers, and development managers. In addition, some project members and blue-collar workers who were involved in the selected technology transfer projects were interviewed. In total, more than 40 individual interviews lasting from 30 minutes to 3 hours were performed. To confirm gathered data from interviews and documents, and to gain alternate views of the analytical results, focus groups were conducted at Saab. The purpose of employing focus groups was to gain deeper insight into the studied subject through guided discussions between selected participants. The focus group participants were strategically selected in accordance with Wibeck (2010), based on their experience of technology transfer. Two focus groups of six members each were conducted in September 2013, and the participants inspired each other, leading to productive in-depth discussions. The focus group discussions were recorded and transcribed by the authors (Wilkinson, 1998).

The analysis was exploratory, focusing on identifying how Saab has worked with improving the inter-organizational transfer capability in their technology transfers and what performance measures have been in focus. This was done to gain understanding of the relationship between the different parts of the inter-organizational transfer capability in Figure 1. Based on this, more general strategies and guidelines for how to improve inter-organizational capabilities within technology transfers of outsourcing/offshoring have been identified.

Case description

In this paper, related offset is emphasized in the industrial context of aircraft manufacturing, connected to the defense industry. Saab's offset contracts are often extensive, and have a long time horizon. The duration from campaign to fulfilment can often be from 10 to 15 years. The offset agreement is most often negotiated between the selling company and the buying government, and the content and the extent of the technology transfer is negotiated already during the campaign. On Saab's part, a prioritized business strategy in offset negotiations has been to emphasize the importance of capability growth to the buying part. The buyer often requests capability growth within specific areas, and the extensive technology transfer included in such offset deals definitely contributes to a signed offset contract.

A fighter plane is a complex product that demands a high level of manual skills. In one sense, the product is almost entirely handmade and therefore production leadtimes are long and production rates low (Balaji et al., 2014). The complexity of the production can be described through

the large number of components involved. For example, the Gripen fighter is constructed from 11,000 parts and 125,000 fasteners. There are 300 metres of pipes and the electrical parts are fitted in 145 harnesses with a total of 1800 connectors and include about 35 kilometres of wiring. Saab's production of Gripen has two main production processes: parts manufacturing and assembly. Parts manufacturing consists of bonded parts, sheet metal parts and machined parts. Assembly consists of sub-assembly, structure assembly and final assembly.

The case findings presented in the next section are based on three of Saab's offset businesses, including technology transfer, summarized in Table 1.

Table 1: The studied offset businesses and their technology transfers.

	Case A	Case B	Case C
Description	<p>From BAE (England) to Denel (South Africa). Saab controlled the transfer.</p> <p>The South African government contracted Saab for 28 Gripen aircraft. Related to the contract was an offset agreement worth USD 8.7 billion, of which USD 808 million constituted related defence offsets.</p>	<p>From Saab (Sweden) to Czech Republic</p> <p>The existing supplier could not achieve the required production volume. Four suppliers were assessed in countries that were preferred from an offset perspective. The chosen supplier offered the most competitive performance at the most reasonable price of the four.</p>	<p>From Saab (Sweden) to Brazil.</p> <p>A large order worth approximately EUR 4 billion from Brazil was placed in 2015, which was accompanied by an offset agreement. In order to fulfil the offset contract, production of Gripen must take place in Brazil.</p>
Time for project	Retro 1997 to 2013	Retro & Longitudinal, 2007 to 2013	Longitudinal, 2014 and ongoing
Case study	2010 to 2015	2011 to 2015	2014 to 2017
Type of Agreement	Related Offset	Related Offset	Related Offset
Technology to transfer	<p>Extensive offset contract. Saab needed to ensure support, maintenance and spare parts for a long time period. The South African government wanted to offer employment opportunities to historically disadvantaged citizens in selected geographical areas.</p> <p>Investigated technology transfer included structural parts for the Gripen aircraft.</p>	<p>The purpose the transfer was to manufacture three different NATO pylons for Gripen aircraft at a new supplier. Gripen NATO pylons are installed on the aircraft fuselage and wings to carry different kinds of payloads. The transfer project was responsible for industrializing the production at the receiver, i.e. the work needed to establish serial production that met the agreed requirements.</p>	<p>The transfer project contributes to realize offset contract fulfilment as well as deliveries of aircrafts to the customer by securing a well-functioning production in Brazil. The production offset transfer includes structural assembly work as well as final assembly, flight preparation and testing.</p>
Major issues	<p>The supplier assessment was performed by BAE; at the time, Saab did not see the benefit of performing its own evaluation.</p> <p>Cultural differences, management and leadership caused mis-communications and project delays. Saab has a non-hierarchical leadership approach and often delegates responsibility to individuals or teams, while in South</p>	<p>The local project organization setup at Saab had to be set when negotiations started, in order to be proactive and ready to start the project as soon as the contract was signed.</p> <p>Assessments to establish the current status of products, manufacturing processes and supplier capability are crucial for the planning and structure of a project. All such</p>	<p>Ongoing, it was a challenge to frame and disseminate knowledge.</p>

	<p>Africa, the managers act with more authority.</p> <p>The agreement between Saab and South Africa established a number of technology and work packages to be included in the offset contract. Saab designed a Skills and Technology Transfer Program (STTP) to meet the requirements. The basis of STTP was that selected personnel from Denel in South Africa were seconded to Saab to learn from Swedish employees, at all levels in the organization. This was successful.</p>	<p>assessments must be planned to include pre-audits conducted by experienced personnel.</p> <p>Saab's operators had a better understanding of the manufacturing documentation than the receiver's operators, probably due to the tacit knowledge embedded in the documentation.</p> <p>The extent of training and education was negotiated at a high hierarchical level. This made the content of the training unclear, there were frequent discussions of responsibility issues between the sending and receiving site.</p>	
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Saab has identified that the related offset business, and in particular the offset agreement between the sending and receiving company, affects the realization of the technology transfer. Based on experience from earlier transfers (Case A and B), Saab has initiated a process with related offsets for future and ongoing transfers (Case C). That process is simplified and illustrated in Figure 2. The airworthiness of Gripen is crucial for Saab, and within the offset agreement Saab usually takes responsibility for the receiver's competence development and capability growth. Hence, at Saab the focus in the transfer process is on capability growth. In Figure 2, the phases in white illustrate where Saab is responsible and taking the lead. The phases in grey illustrate the partner's responsibility.

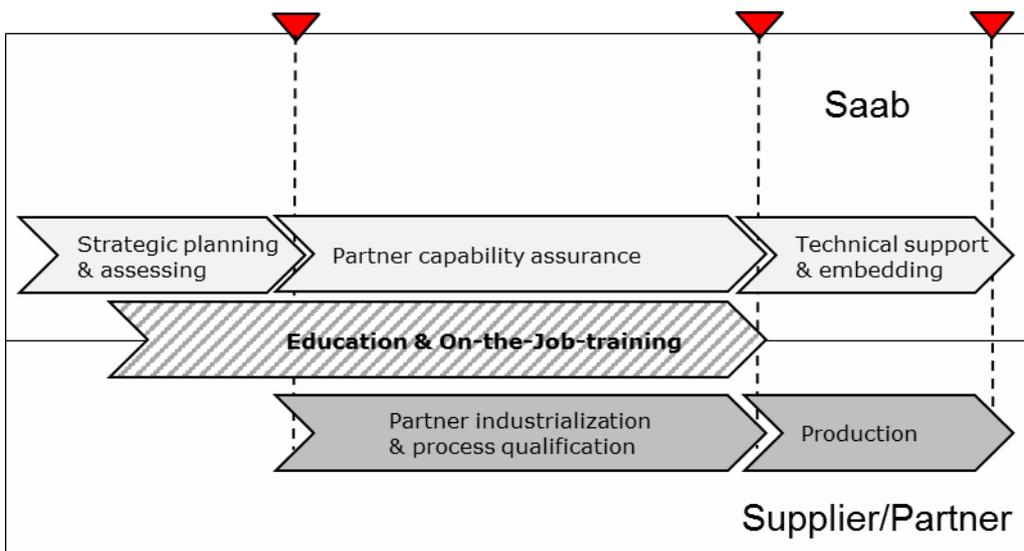


Figure 2: Illustration of Saab's technology transfer process.

Within the process in Figure 2 the purpose for Saab is to improve the inter-organizational transfer capability through an increase of the sender's disseminative capacity and the receiver's absorptive capacity.

The first phase in Figure 2, "Strategic Planning & Assessing" focuses on why and what to transfer. Often, both the why and the what are partly predetermined through a prerequisite from the offset agreement. Therefore, in this phase, focus is on fitness for transfer (Grant and Gregory, 1997). The fit between the capabilities of the transferring and the potential receiving sites is then evaluated. The evaluation criteria are based on the identified work packages to transfer, which are based on the level of development that the buyer wants to reach that is defined in the offset agreement.

In the second phase, "Partner capability assurance", the extent of technical support provided to the receiver (absorptive capacity) and the need for industrialization at the sender is identified. The technical support is divided in back-office and on-site support. The main purpose of such industrialization activities is to match the product and the manufacturing system.

"Technical support & embedding", is a phase to ensure that Saab provides technical support at the supplier's site. Saab finds it important to evaluate and adapt processes for concessions (MRB, Material Review Board) and change requests.

The phase "Education & OJT (on-the-job-training)" is crucial when large capability gaps are identified between the sender and the receiver of the technology transfer. This phase includes learning programmes at both the organizational and the individual level, which are developed based on the offset agreement and earlier assessed capability gaps.

In the phase "Partner industrialization & process qualification" the focus is on the receiver (partner) to perform the industrialization according to set requirements. Saab sets the requirements based on the previously performed assessments (absorptive capacity and current capability), then the partner performs the industrialization to fulfil the requirement. The focus from the receiver side is on how to adapt or set up their manufacturing system.

The phase "Production" has little focus on capability growth. At this stage, all major gaps should have been closed to allow for ramp-up of production.

Findings – Technology transfer within related offset business at Saab

The findings from this study are analyzed based on Figure 1, Inter-organizational transfer capability. In this study a structured way of working with transfers within related offset and other forms of business agreements has been identified at Saab. Saabs way of working have been structured in relation to Figure 1 resulting in Figure 3. The development of Figure 3 is based on the findings from the case study and this figure provides a presentation of how the inter-organisational transfer capability is related to the business agreement, the capability gap between sender and receiver and the tools to bridge this capability gap. Based on the findings from Saab we can observe that the inter-organizational transfer capability is a question of alignment of technology transfer activities of different hierarchical levels, from national to individual level.

In Figure 3 the business agreement is a complex process and is illustrated to flow down through the agreed requirements as input to assessments to identify capability gaps. Thereafter, Saab works with different tools (Organizational learning plans, Individual learning plans and On-the-job training) to bridge the identified capability gap. Figure 3 also illustrates that these tools are on different hierarchical levels, from organizational level all the way down to each individual at the individual level. It is important that the tools at the different levels are aligned, where the business agreement sets the prerequisites for the transfer in total. This study has identified, from the interviewed managers at Saab, that to perform a thorough capability assessment the business agreement must be well understood. In addition, the chosen technology and the work package of knowledge to transfer should be thoroughly investigated and evaluated. Without the combination of these two parts, it is not clear what gaps are in focus in the specific deal, i.e. we cannot identify the absorptive and disseminative capacity needed.

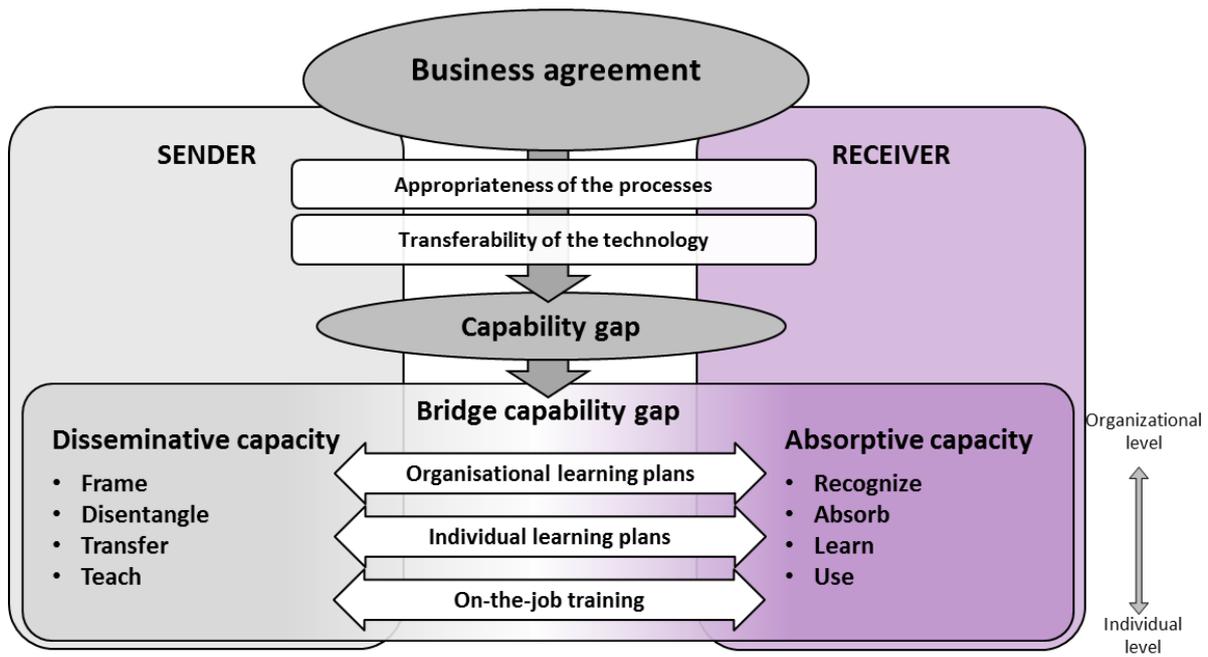


Figure 3: Inter-organizational transfer capability based on the findings from Saab.

Furthermore, in Figure 3 the disseminative and absorptive capacity are operationalised, making them tangible in comparison to the definitions presented in Figure 1. This is an interesting finding as especially the disseminative capacity has been hard to capture from a company perspective. Therefore, the sections below further develop the findings regarding the relation between the disseminative and absorptive capacity in Figure 3, i.e. Capability gap and Bridge capability gap. The findings are presented from a sender and receiver perspective, with focus on how the disseminative and the absorptive capacity can be affected through the actions of the sender, and thereby how the transfer performance can be improved.

Capability Gap

To achieve successful transfers with large anticipated capability gaps our study at Saab identified the importance of dealing with the capability growth of the receiver. To do so, a capability gap assessment needs to be performed between the appropriateness of the processes at the receiver and the transferability of the process at the sender (see Figure 3). This evaluation includes production processes, machines, production documentation, logistics, tooling, capital assets/machines, manufacturing plans, drawings, resources etc. The capability gap assessment provides input for the sender to structure and plan the realization of the technology transfer and the anticipated capability growth at the receiver.

Evaluations of the status of specific articles at the sender were also identified as important. Such evaluations include an assessment of the status of the article, i.e. is the production documentation in

place? Or are there any recent or reoccurring deviations? The purpose of such evaluation on the article level is to *frame* and later *disentangle* the chosen technology to transfer. Furthermore, such detailed evaluation helps to increase the transferability of the technology throughout the transfer.

When gaps have been identified, both the sender and the receiver need to take action to reduce the gaps. The receiver was in some cases experienced enough to be able to increase their absorptive capacity through adapting their manufacturing system, hence affecting the process appropriateness. Important for Saab was that the output of the adapting manufacturing system provided the receiving manufacturing unit with the ability to deliver ordered products on time, at the requested quality, and at the agreed cost. Therefore, the receiver's ability to understand the scope and the effect of the set requirement for the transfer was identified as important by Saab.

Bridging Capability Gaps

To bridge the identified capability gaps, the disseminative capacity was identified as important. Saab's disseminative capacity was found to include their ability to transfer the technology and the work packages in a way that the receiver could apply these in their environment. When assessing the capability gaps at the sender's and the receiver's, it was also important to develop a structure plan of how to bridge these gaps. Saab identified that the company had to work on different hierarchical levels to bridge the gaps, all the way from the organizational learning plans down to On-the-job-training (OJT) (Figure 3). Our study identified the importance of keeping the alignment from the prerequisites given by the business agreement, through the organizational learning plans down to the individual training.

In this study, the purpose of *organizational learning plans* was seen as the identification of authorizations, competence and skills needed to fulfil the work packages of the transfer. The *individual learning plans* are based on the organizational learning plans. The individual plans include detailed plans and schedules at an individual level, which makes it possible to fit the individual needs of the receiver's employees. At Saab, OJT was part of both the blue-collar workers' training and the engineers' training. A more experienced worker mentored new employees, with the goal of transferring tacit knowledge. The individual learning plans were more focused on explicit-to-explicit knowledge conversion. Our study revealed that the different work packages were identified and agreed on already during the negotiation and thereby the ability to steer how to plan, conduct, follow up and approve individual plans. Therefore, when working with technology transfer within related offset, this study stresses the importance of keeping alignment between the agreements made on a national level early in the process and the actual execution during the technology transfer much later. Maintaining the alignment is difficult because of the different parts of the organizations involved and

the long-time spans. Well-structured and well-executed organizational and individual plans and OJT were identified as increasing the *disseminative capacity* at Saab and increasing the possibilities for improved *absorptive capacity* at the receiver. Thus, it is important to consider the content and extent of the learning plans already during the negotiation phases of the offset agreement. By connecting the OJT to an individual learning plan a more structured knowledge transfer was achieved, including both tacit and explicit knowledge. OJT was identified as constituting an important part of the technology transfer, since much of the knowledge to be transferred was tacit.

Discussion

Three different areas were identified as important to emphasize developing inter-organizational transfer strategies within outsourcing/offshoring.

From capacity to capability

The main purpose of earlier outsourcing/offshoring has been cost reductions through the utilization of low-cost labour (Mugurusi and de Boer, 2013). Because of this focus on cost reduction, previous studies of technology transfers relating to outsourcing and offshoring have focused on capacity achievements, such as performance in the form of time for start-up. This is evident in classical studies such as Ferdows, 2006 and Grant & Gregory, 1997 where focus has been on how knowledge within manufacturing can be accessed and transferred as easily as possible to reach expected capacity levels. Hence, focus has been on cost reduction in outsourcing/offshoring decisions, and thereby the focus of the technology transfers has been on the receiver side and their absorptive capacity (Cohen & Levinthal, 1990). Though, a company like Saab sells its disseminative capacity as part of the offset contract. The study of Saab illustrates a move towards a focus on capability transfers instead of capacity transfers where a main purpose is to develop the receiver's ability to learn and to build their capacity. In this case the disseminative capacity (e.g. Oppat, 2008) is in focus, to transfer capability and to build new knowledge at the receiver side. However, our literature study revealed that within transfer of knowledge and transfer of capabilities, the term "absorptive capacity" has been researched to a larger extent than its counterpart i.e. "disseminative capacity".

The move from capacity transfer to capability transfer was particularly true for the offset agreement between the Brazilian government and Saab. In this case the buyer requested capability growth within specific areas. The move from capacity to capability also affects the performance goals of the technology transfer, from time/cost to reach steady state to learning/capability growth (see Figure 1). This move is a reality also in outsourcing/offshoring oriented companies as their focus shift to the more value oriented backshoring decisions (Nujen et al., 2018) and the focus on transfers to subsidiaries (Fredriksson & Jonsson (forthcoming) shows that 64% of the

transfers from Sweden have been to subsidiaries in foreign countries). This highlights the importance of companies within outsourcing/offshoring starting to develop strategies of how to improve their inter-organizational transfer capability and especially how to increase their disseminative capacity (left side Figure 3).

Strategies of business agreement

In this study of technology transfer from Saab to foreign countries and companies it has been observed that the negotiation and the realization of the offset agreement takes place at different hierarchical levels, see Figure 4. This hierarchy can be divided into three levels: national level, company level ‘commercial’, and company level ‘operations’. The governments in the selling and buying countries represent the national level. The commercial level involves sales and marketing at a company. The operational level involves the development and production.

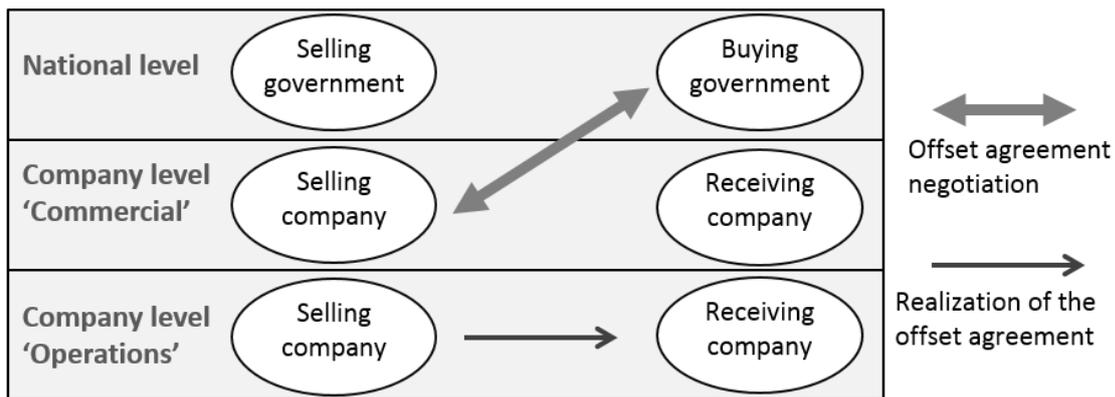


Figure 4: Different levels for offset negotiations of the offset agreement and realization of the offset agreement (Malm, 2016).

The decisions taken in the negotiation phase set the prerequisites for the actual transfer at the operational level within the sending and receiving companies (Fredriksson et al., 2017). Furthermore, it). However, long time periods (it often takes ten years or more) to go from negotiation of the offset agreement to its realization (Ahlström, 2000; Axelson and Lundmark, 2009) and different hierarchical levels of the involved people between negotiation and realization (see Figure 4) make people see different purposes of the transfer, i.e. capacity or capability. This affects the performance goals based on which the transfer is planned (Malm et al., 2016). Employees at Saab working with the realization phase of the transfer seek to keep time and cost to reach steady state at a minimum as main purposes. On the other hand, people involved in the negotiation phase consider learning/capability growth as the main purposes. Thus, if understanding of the business agreement is lacking within the operational levels that are to carry out the technology transfer there will be a mismatch between the

intention in the business agreement and the focus at the operational level. This create a risk within offset business identified at Saab: underestimating the effort required to accomplish the transfer.

To increase understanding, there must be alignment from the agreement set within the offset negotiation down to the people involved in the realization of the transfer. In the Saab case we could observe that to reach this alignment much focus is on how the negotiated agreement on governmental level (see Figure 4) can be translated into appropriateness of the process and the transferability of the technology fit with the companies in the buying countries and the wish for capability growth (see Figure 3). The time lag and the differences in between the employees involved in the decision making and the realisation of the transfer have been observed in outsourcing/offshoring as well (e.g. Fredriksson and Johansson, 2009). Nujen et al. (2018) have also shown that backshoring strategies are affected by how the capability gap have been dealt with during the outsourcing/offshoring period. Thus, going back to the discussion of the increasing transfers to subsidiaries and the backshoring trend, also for outsourcing/offshoring companies, there is a need to develop strategies for keeping an alignment between the motives of the decision and how to organise the realization.

Also within outsourcing and offshoring, a discrepancy has been observed between the part of the organization that selects the supplier and sets up the contract and the part that carries out the transfer (e.g. Fredriksson and Johansson, 2009). Attempts have been made to deal with this by way of different types of cross-functional decision-making (Moses and Åhlström, 2009; Platts et al., 2000). Even though the use of cross-functional decision-making has been useful in increasing understanding, previous research shows that it is difficult to successfully relocate manufacturing (Knudsen and Madsen, 2014), which is also shown in the growing research area of backshoring (Kinkel, 2012, Stentoft et al., 2016). Thus, this study contributes by showing the importance of companies focusing not only on how to include different functions in the decision-making but also on developing tools to align the organizational goal of the outsourcing/offshoring decision with the operational goals of the technology transfer. Saab has created an alignment with tools to bridge the assessed capability gaps (see Figure 3), from the business agreement down to OJT at an individual level.

The balance between disseminative and absorptive capacity

Based on Figure 1 and Figure 3 one can believe that there is a balance between the disseminative of the sender and absorptive capacity of the receiver. At Saab it was observed that the disseminative capacity at the sender and the absorptive capacity of the receiver did not always match as development of capabilities on the receiver side was wanted. A challenge from the studied case was that at an early stage, Saab was aware of the business agreement negotiation and therefore could

prepare for the realization phase earlier than the receiver, i.e. the capability growth was planned before all prerequisites were known. Thus the study at Saab revealed how Saab often had a larger disseminative capacity (see Figure 5) compared to the absorptive capacity of the receiver. This was because the receiver was often “rushed” in to the transfer, because they were chosen by their government. Furthermore, because of this they have not always chosen their own capability growth, which also can explain that they are not ready as they have not analyzed what they want to learn from Saab. Therefore, our study has revealed the need to balance the disseminative capacity and the absorptive capacity to bridge the capability gap, at a pace that suits both sender and receiver. The tools applied by Saab, see Figure 5, are therefore a key to balancing the capability gap and decreasing the unbalance between the disseminative and absorptive capacity. The imbalance between the disseminative and absorptive capacity is a new discovery of this paper. Earlier studies have mainly focused on the capability gap and the absorptive capacity of the receiver. To increase the inter-organizational technology transfer capability further research in relation to outsourcing/offshoring and backshoring also need to incorporate the disseminative capacity in the studies.

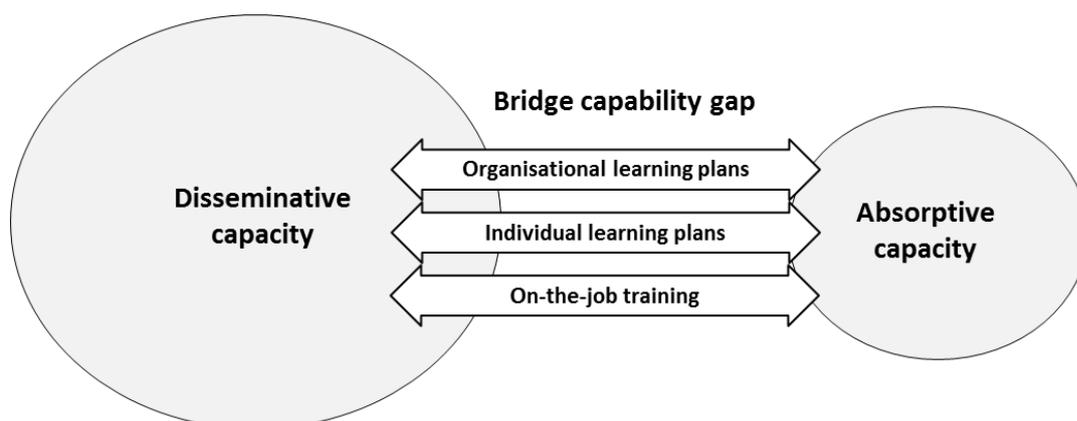


Figure 5: The imbalance between disseminative and absorptive capacity creating a capability gap, as observed in the Saab case, and the tools used to bridge the capability gap.

Conclusions

The purpose of this paper was through a literature study and a study of the Saab offset cases to identify strategies to increase inter-organizational transfer capability. Through the literature review it was revealed that an ordinary production transfer is mainly focusing on transfer of capacity. However, from this study at Saab it was identified that within the offset business, the focus is more on the development of capabilities, because within an offset business the receiving government and the receiving company buy capabilities. This makes the technology transfer an important part of the business case in offset and therefore much more attention should be put on the disseminative

capacity of the sender, which from the literature review was identified to be less researched than the absorptive capacity of the receiver. Based on the findings and the discussion this study has identified the trend of moving from capacity to capability transfers increase the importance of inter-organizational transfer capability also within outsourcing/offshoring. Therefore, when develop companies inter-organisational transfer strategies the following issues need to be considered:

- 1) Outsourcing/offshoring companies need to be aware of the different parts in Figure 1 already during decision making to set the right type of performance goals for the transfer in the business agreement. Because the type of performance goals set in the business agreement decides how to realise the transfer.
- 2) There is a hierarchy of decision-making between negotiation and actual transfer within the organisation. This create a need to align the understanding of the performance goals between these different parts of the organisation. Particularly the importance of the development of aligned plans for how to transfer knowledge between organizational and individual levels was stressed, because technology transfer also takes place at all levels.
- 3) To reach the performance goals of the technology transfer there need to be a balance between the disseminative capability of the sender and the absorptive capability of the receiver. It is also important to bridge the capability gap between the sender and receiver at the three levels: organizational, individual and on the job training. Otherwise there is a risk that the cost and the time of the transfer will be higher and longer than necessary as well as the capability/learning growth smaller than anticipated.

This study is based on a single case from the offset perspective within a relatively unique industry and this is a limitation. The single case study is motivated with the ability to go into detail and identify specific actions, which is needed identifying possible strategies. However, because of the single case there is also a need for further studies in other companies. These companies need to represent other types of industries as well as outsourcing/offshoring decisions. The inter-organisational transfer strategies presented are based on literature from the production transfer area as well as studies of technology transfers related to production, which is a limitation and further studies within other type of transfers are needed to generalise the strategies to other areas such as IT-outsourcing/offshoring.

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