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A Structured Outsourcing Procedure

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Abstract. Outsourcing of production entails a vast amount of activities and decisions. Although it has many acknowledged benefits, it is associated with substantial risk, and may lead to increased costs and loss of business if it is not carried out carefully and in a systematic manner. The identified outsourcing literature mainly focuses on specific parts of the outsourcing process and often provides limited practical guidance. Therefore, the purpose of this paper is to synthesize existing research on outsourcing processes into one structured outsourcing procedure. This can guide companies in carrying out outsourcing activities in a systematic manner. The suggested procedure is discussed in light of a case study of two production transfers between a Norwegian supplier of advanced maritime monitoring systems and one of its strategic suppliers.

Keywords: Outsourcing · Production transfer · Operations strategy

1 Introduction

Many Western companies choose to transfer parts of their production to other actors in their supply chains. Such transfers are often denoted outsourcing or offshoring processes, depending on the ownership structure (internal or external) and target location (domestic or foreign) of the transfer [1]. Outsourcing generally refers to the handover of responsibility for certain activities across organizational borders, whereas offshoring indicates that the responsibility is transferred to a subsidiary or supplier in a foreign location. Due to its many stated benefits, such as lower factors costs, access to new materials, distribution channels and technologies, as well as increased capacity to focus on core competences, outsourcing has been a very popular strategy in many industries [2]. Still, it is associated with substantial risk and may lead to increased costs and loss of business if it is not carried out carefully and in a systematic manner – reflecting the high complexity of such transfer processes [2].

Outsourcing of production entails a vast amount of decisions to be taken. Although several outsourcing frameworks and guidelines exist, only a few [e.g. [3,4]] describe all stages of the outsourcing process. These are typically rather general in their description of the activities that need to be carried out at the different stages. More detailed frameworks typically focus on the make-or-buy

phase of the process, by e.g. discussing possible benefits and risks when outsourcing [5], or they end before the physical transfer [6]. Frameworks that address the production transfer (PT), i.e. the actual relocation of manufacturing of products or components between two production facilities (Sender and Receiver), either focus on specific parts of the PT [6], or provide only a general overview of interdependent activities important for supply performance [3,7,8]. No comprehensive frameworks integrating all these aspects have been identified. Therefore, the purpose of this paper is to synthesize existing research on outsourcing processes into one structured outsourcing procedure. This can guide companies in carrying out outsourcing activities in a systematic manner. The procedure is discussed in light of an instrumental case study of two PTs between a Norwegian supplier of advanced maritime monitoring systems and one of its strategic suppliers within electronic manufacturing services (EMS).

2 Research Method

The structured outsourcing procedure is proposed on the basis of a thorough study of literature on production-, knowledge-, and technology-transfers, as well as more general literature on outsourcing, production start-up and ramp-up. When structuring the literature, the most comprehensive identified models and methods [3,4,5] were taken as a starting point. During the structuring of the literature a need to add, rearrange and adjust phases emerged – more or less resulting in the proposed procedure. However, an instrumental case study approach [9] has been selected to test and accomplish it. This was designed as a single case study as the access to adequate empirical data was limited to one supplier-buyer relation; however, two PTs were followed to increase the research quality. The empirical data was collected through workshops and semi-structured interviews with key representatives from both case companies, e.g. quality managers, product developers, key account managers and process engineers.

3 Structuring Outsourcing

In broad terms the production outsourcing process can be divided into three parts: (1) deciding what (if any) to outsource, (2) selecting and committing a supplier, and (3) transferring the production. Each of these contains a number of activities that a company needs to go through during an outsourcing process. These are briefly described and summarized below. IDs are assigned to the activities, in order to link them to the suggested outsourcing procedure at the end of the section.

3.1 The Outsourcing Decision

In describing the outsourcing decision, a framework by Kremic et al. [5] is adopted. This depicts typical elements of the outsourcing decision, and shows

where motivators, benefits, risks and other factors are typically encountered. The first step is to consider outsourcing in the first place. Here, the sender's motivation for outsourcing is weighed against general risks and benefits. According to [5] (a combination of) three major categories of motivation drives outsourcing: cost, strategy, and politics. The sender should have a conscious attitude towards these (A1). For instance, the outcome of outsourcing is often more successful if the decision is based on strategic considerations rather than solely on financial problems [10]. Further, the sender should analyze whether common benefits and risks of outsourcing either strengthen or weaken the decision (A2). Although it is not explicitly stated in the literature, we suggest documenting (A3) and communicating (A4) the resulting outsourcing policy internally. Next, the sender should identify (A5), evaluate (A6) and select (A7) what, if any, to outsource based on strategic-, financial-, functional- and environmental factors of each candidate and on the outsourcing policy [5]. When production is outsourced, Semini et al. [11] suggest careful attention to aspects such as logistics, equipment utilization, proximity to product development and intellectual property.

3.2 Supplier Selection

When the company has selected which functions, products or processes it should outsource, the next stage is to select a target supplier and location for the transfer. Here, a fourstage supplier selection process by Cousins et al. [12] is adopted. First, suppliers are prequalified (A8). Prequalification criteria will vary between companies and industries; however, suppliers' manufacturing capabilities and financial viability will usually be assessed. Often, companies keep a record of prequalified suppliers, enabling them to skip this phase. Otherwise, information about suppliers needs to be collected and evaluated. Next, the company should agree on measurement criteria (A9) that are specific to the product under consideration (e.g. unit price, lead time, supplier flexibility). Third, relevant information about suppliers should be gathered (A10), for example through requests for proposal or quotation. This information is used to make a selection in the fourth phase (A11). Danilovic and Winroth [13] argue that no matter how hard management strives to have a high level of integration in collaborative networks, the integration must be supported by legal agreements (A12). Draft agreements would often need to be designed for each case. Examples of issues that need to be included are forms of decision making, risk allocation, security issues and renegotiation/termination rules [13]. As will be evident in the next section, the contract may need to specify responsibilities before, during and after the transfer.

3.3 Production Transfer

Finally, when the receiving supplier has been selected the PT can commence. Based on [7], a PT process consists of four phases: the preparation for transfer, the physical transfer of equipment and inventories, the production start-up at Receiver, and the steady state. The Steady State starts after there has been

reached a full-scale and stable production, at targeted levels of cost and quality [14]. Each of the PT related activities identified in the literature has been assigned to one of these four phases (Table 1).

Table 1. Overview of the studied production transfers and their main activities

Outsourcing policy: A1. Identify the amount of cost-driven, strategy-driven and politically-driven outsourcing [5,10]. A2. Analyze whether benefits and risks will strengthen or weaken the decision to outsource [5]. A3. Establish policy document. A4. Communicate the company's outsourcing policy to employees. Outsourcing candidate selection: A5. Identify possible candidates for outsourcing (functions, products or processes) [5]. A6. Evaluate identified candidates [5,11]. A7. Select candidate(s) [5]. Supplier selection: A8. Prequalify suppliers [12]. A9. Agree on measurement criteria [12]. A10. Obtain relevant information [12]. A11. Make selection [12]. A12. Contract negotiation [13]. Transfer preparation: A13. Establish Project team [4,7]. A14. Kick-off meeting [15]. A15. Establish other teams [4,14]. A16. Sign formal agreement [13,16]. A17. Plan as Stepwise Transfer during low demand season (if possible) [17]. A18. Ensure interaction with Receiver. Higher uncertainty, higher requirements [18]. A19. Develop training plan [19]. A20. Create transfer register. Include Transfer plans and checklist, Change Control procedure, etc. [4]. A21. Evaluate Receiver's preparedness (premises, equipment., support services) [4]. A22. Perform Transfer Risk Assessment. Implement measures [17]. A23. Problem solving upgrading recalibration test of production system [7,14].	A24. Define Engineering Change process[14] A25. Train Receiver's personnel [14,19]. A26. Update/ create documentation with Receiver [14,17,19]. A27. Improve Receiver's performance [20] A28. Update Planning & Control system [17]. A29. Develop Communication plan [4]. A30. Transfer information [4]. A31. Receiver reviews info. and finds gaps [4]. A32. Ensure joint info. sharing platform [14]. A33. Establish relations to sub-suppliers [21] A34. Verify preparations [17]. Physical Transfer: A35. Transfer production equipment [7]. A36. Send personnel to Receiver [14]. A37. Install and test production equipment [7]. Production Start-up: A38. Sender temporary transfers personnel [14]. A39. Set up experimental line [14]. A40. Involve all affected personnel [7]. A41. Qualify component vendors [14]. A42. Decide when to transfer responsibility to order raw material to Receiver [17]. A43. Adapt processes to a new environment [22]. A44. Problem solving on parts/materials[7]. A45. Verify production [23]. A46. Continuously monitor performance. Consider shut-down when lower than targets to solve problems [14]. Implement measures [17,24]. A47. Adapt docs and Plan. & Control syst. [17]. A48. Conduct post-transfer audit. Evaluate transfer [16,23]. A49. Gen. sum. report (lessons learned, etc.) [4]. Production Steady State: A50. Continuously monitor and improve production [7]. Consider maintaining experimental line [14]
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Apart from the Physical Transfer, a PT consists of three additional types of transfers: knowledge transfer (KT) (of tacit knowledge), administrative transfer (AT) (of explicit/codified knowledge), and supply chain transfer (SCT) (by establishing relations to vendors of materials)[25]. It is important to ensure all these types of transfers during a PT. In addition, transfer parties will have to perform certain project administrative activities, such as establishing a PT organization and manage the PT project [4].

The transfer preparation phase includes the most identified activities. Here, KT activities are mainly related to the training (A25) and involvement of Receiver personnel in the preparation of documentation, the systems, and of the production equipment and processes (A26). In addition, it might be necessary to implement KT activities for performance improvement at Receiver, such as six sigma or lean [20] (A27). AT activities are related to e.g. updating of planning and control systems with data based on the estimated lead times and other performance indicators for the PT [17] (A28), and the transfer of the updated information to Receiver (drawings, materials planning method, packaging procedures, etc.) (A30). SCT primarily concerns a possible transfer of suppliers to the Receiver (A33). Examples of project management (PM) activities are kick-off meeting (A14), signing of formal agreements (A16), and generating a transfer

register with plans, flow diagrams, instructions and control procedures (accessible to both parties and up-to-date) (A20). The physical transfer mainly involves transfer of production equipment (A35), installation and testing of equipment (A36), but also certain KT by temporary transferring personnel from Sender to Receiver (A36) to provide support and report back to Sender [14]. Such a transfer can also take place during start-up (A38). Other KT activities during start-up imply setting up an experimental line for learning and for testing of performance improvement solutions at the Receiver (A39), and involving all the affected personnel along the process (A40). An AT task for the Receiver is to adapt documentation and systems to their own planning environment (A47). SCT activities during start-up are mainly related to qualification of component vendors (A41) and the decision about when to transfer the responsibility to order raw material to the Receiver (A42). As a PM activity, a summary report (A50) should be generated and stored in the transfer register.

4 Discussion and Conclusions

The empirical data collected during the case research is summarized in Table 2.

As seen in Table 2, Sender and Receiver had a series of challenges with the two PTs that might have been reduced by some of the actions from Table 1. For instance, communicating the company's outsourcing policy internally (A4) and organizing a kick-off meeting where the reason for the PT is clarified (A14), could have increased the Product Team's motivation to share essential information with the Receiver in Case A [15]. The PT parties should have constituted a project team (A14), with PT managers and other members from all the affected disciplines and with clear roles [14]. Moreover, as stated by [4], PTs should be managed by help of a PM plan based on risk management principles (A20). Hence, all the activities with potentially negative consequences (e.g. transferring the test equipment to Receiver) should have been identified together with experienced personnel and measures should have been implemented (i.e. risk management) (A22). Further, some authors state that PTs, to the extent possible, should be planned as 'stepwise' transfers (A17) instead of 'clear-cut', as in Case A. Production at Sender should be gradually decreased as volumes increase at Receiver. Thus, in case of unexpected demand or major production disruptions during Start-up, one would have a secondary source of supply at the Sender [17]. Further, parties had several communication issues in both Case A and B. Thus, by preparing a communication plan (with e.g. points of contact and their roles) (A29), they could have minimized these challenges. This plan should be included in the PT register along with the PT plan and other tools, such as activities checklists, a change control system, and a flow diagram [4,14]. Moreover, the register should be continuously updated and be easily accessible to both parties (A20). Finally, at the end of the Start-up in Case A, Sender could have conducted a post-transfer audit, comparing the pre- and post-outsourcing costs [16] and evaluating whether the Steady-state had been achieved and whether the production should be relocated to other manufacturer or not (A48). In ad-

Table 2. Overview of the studied production transfers and their main activities

Completed transfer: Case A	Ongoing transfer: Case B
<p>Transfer object: Acoustic sensor. Mature product. High volumes. Not too complex. Little IP.</p> <p>Original location: Sender's production facility in Norway. Before, Sender had been producing the sensors and assembled them with housings and electronics from two different suppliers.</p> <p>New location: After transfer, Receiver assembles tests and delivers final products to Sender. Receiver is expected to reduce unit cost over time.</p> <p>Outsourcing policy: Combination of cost and strategy. Need to reduce cost; aim to be a 'technology company' rather than manufacturing company.</p> <p>Outsourcing candidate selection: High volume product that requires higher efficiency and less competence than the Sender has.</p> <p>Supplier selection: The Receiver was prequalified and used to deliver electronics for the product.</p> <p>Preparations: Parties had no kick-off meeting. Key personnel in the Product Team, Sales, and Test were little involved in the preparations. Product Team was little informed about the reason for the transfer and their motivation to support Receiver was low. It had been unclear who was responsible for what at Sender and a transfer plan and risk assessment had not been prepared and conducted before transfer. Initially, it was decided that all test equipment would be moved from Sender to Receiver. When Product Team found this out, they realized that the Sender would not be able to run spot-checks, losing the control over the quality of their deliveries. Moreover, initially, Sender was to manufacture the product until Easter and Receiver everything after that (clean-cut). This turned out to be unrealistic. [KT:] Receiver participated in VSM at Sender and sent 3 operators to learn the process at Sender. [SCT:] Sender's original suppliers of housings and electronics were transferred to Receiver.</p> <p>Physical Transfer: Sender copied their test equipment and transferred the copy to Receiver.</p> <p>Start-up: Receiver experienced that several of their process improvement suggestions were rejected without a clear justification and the latest ones even turned out to be futile. During a workshop (April '15), the Product Team revealed, to the Receiver's surprise, their plans to update the product to a new version. Finally, Sender was unaware if the transfer had been profitable or not, but they said that the start-up was long with high scrap rates and stock levels.</p>	<p>Transfer object: Signal converter. New version of existing product. More complex than Product A.</p> <p>Original location: The same as in Case A. For previous version, Sender installed PCBs from Receiver in cabinets from one supplier, and power supply and wiring from another supplier. Sender tested the final products.</p> <p>New location: Same Receiver as in Case A. After transfer, Receiver installs electronics including own PCBs in cabinets. Sender still tests final products.</p> <p>Outsourcing policy: Same as in Case A.</p> <p>Outsourcing candidate selection: Product was selected due to the upcoming new version, 'now was the time'. Key components were already outsourced.</p> <p>Supplier selection: Same as in Case A. Their experience with product A was partly decisive.</p> <p>Preparations: The transfer started in Sept. '14, with a kick-off. Sender asked Receiver to secure material from sub-suppliers without any formal agreement. A significant amount of this material became obsolete because of BOM changes, and the financial consequences were unsettled for a long time. The transfer was planned with partially overlapped product development at Sender and process development at Receiver. Often, BOM and other product design changes came too late (e.g. during continuous production instead of the Pilot phase). 4 BOM changes were sent after Receiver had ordered material. Moreover, Sender had problems with own change control system that did not allow purchasing materials for prototypes before design-freeze. Thus, many changes were unrecorded until Product Developer started to collect them in a common excel-file. [KT:] No personnel from Receiver were transferred for training at Sender.</p> <p>Receiver appreciated having one contact person at Sender (Product Developer) whereas Sender's Prod. Developer felt that it had been challenging to know whom to contact at Receiver. She had also experienced that two contacts at the Receiver had different BOM revisions. [SCT:] Sender's original supplier of cabinets was transferred to Receiver. Later on, Sender may replace them by its own subsidiary in a low-cost country.</p> <p>Physical Transfer: None.</p> <p>Start-up: At the time of the workshop in April '15, the production had been transferred from Receiver's Development department to Manuf.</p>

dition, Receiver's performance should be monitored along the entire PT and measures should be implemented (A50) [4]. With respect to Case B, several authors stress the importance of a formal agreement (A12, A16) between parties, signed as early as possible during Preparations. The agreement should include each party's responsibilities along the process (e.g. who bears the cost of obsolete material), and desired performance targets (e.g. yield) [14]. Further, to effectively

manage engineering changes, parties could also define the change control process (A24) during Preparations, and they could create a flow diagram of the PT with necessary decisions gates [4]. For instance, before starting with the continuous manufacturing, the production should have passed a verification gate (A45). Finally, with higher uncertainty of the PT (i.e. novelty, complexity, and tacit knowledge) there are higher requirements of interaction between parties (A18). For Case B, the assembly of product B was novel for the Receiver; the product version was an innovation, and it had a high amount of uncodified knowledge. Thus, parties could have invested more in information management systems (e.g. a common IT platform) and could have drawn advantage from the domestic proximity by having regular and more frequent meetings with the Receiver [23].

In this study, existing research on outsourcing processes is synthesized into one structured outsourcing procedure, comprising the outsourcing decision, the supplier selection, and the PT stage. We argue that one of the strengths of this procedure is providing a detailed overview of the PT specific activities, which are often overseen in earlier outsourcing procedures despite their impact on final performance results. The proposed procedure can guide practitioners in conducting production outsourcing processes in a systematic manner. Nevertheless, it should be validated in different manufacturing contexts and adapted to different types of production outsourcing. The authors objective for the future is to configure and validate a phase model comprising activities from the current procedure, decision gates, suggested disciplines for each activity, as well as appropriate methods and tools.

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