The make-or-buy decision

In the application on the Product X of firm X the Netherlands.

By

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Student number: 2099284

In partial fulfilment of the requirements for the degree of

Master of Science

in Business Administration

Specialization: Purchasing and Supply Management

At the University of Twente

Faculty: Behavioural Management and Social sciences

July, 2019

Keywords: Make-or-buy model, Product X water panel, cabinet, operation method, outsourcing

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Preface

Before you lies the master thesis "The make-or-buy decision: in the application on the Product X of Firm X the Netherlands". This thesis is the last step in the fulfilment of my study master of Business Administration – Purchasing & Supply Management at the University of Twente. Commissioned by Firm X, I have been working from November 2018 until July 2019 on this master thesis. I agreed on executing this research, since Firm X aspires to improve the world and therefore focusses extensively on sustainability, which I admire. The literature study performed in this research was time consuming and complex, but interesting. Hence it makes me even more proud to reveal the make-or-buy model created in this research.

Via this way, I would like to thank some specialist who participated in the realization of this research. At first, DR. P.C. Schuur was always there for me and we even had some late night Skype calls. Additionally, DR.IR. P. Hoffmann consistently answered all my questions and provided me with constructive improvements. Furthermore, I would like to thank the supervisors of Firm X, for spotless guiding me through the period of writing this master thesis and for the pleasuring and interesting discussions. The last acknowledgement is for the supply chain engineer, who taught me all the technical knowledge needed for this research.

I could not have completed this research without their cooperation.

I wish you a lot of reading pleasure!

Ruben Kester

Enschede, 2nd of July, 2019

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1. Introducing the problem

In the framework of completing the master study Business Administration at the University of Twente, this research is conducted at Firm X. The focus of this research is on detecting in what way Firm X should make or buy the water systems panels (from now named cabinets) from Product X. In order to advise Firm X in such a manner, a make-or-buy model is created and evaluated on practicability.

1.1 Aiming to advise to make or buy products by creating a model

The desired result of this research is to advise Firm X to make, buy or buy subassemblies for the cabinets of product X delivered from the Netherlands. In order to find an answer on the main question, a constructive tool is created for the make-or-buy decision for the cabinets of product X. So, this research aims to identify in what way Firm X should make or buy the cabinets of product X. In order to investigate in what way Firm X should make or buy the cabinets, a constructive make-or-buy model is created. This model aims to test two distinctive sets of modules of the cabinets (module level): (1) cabinet assembled with mounting plate, output canals and cable trays, and (2) cabinet which is fully equipped project specific. Testing those two sets of modules is needed to make an advise on module level, this is elucidated in section 6.2. This research is important to incite Firm X's position in the expeditious market. Therefore, this research should provide Firm X with a tailored strategic advice, based on a make-or-buy model arising from existing theory. Accordingly, this insight should gain competitive advantage in the market of product X. In order to provide Firm X such an advice, the following research question is composed:

"In what way should Firm X make or buy the water system panels of the Product X of Firm X B.V. delivered from the Netherlands?"

Importantly, this research focusses on cabinets from the Netherlands, since cabinets produced elsewhere by Firm X have different modules due to laws and regulations. To answer the research question in a structured manner, a set of sub-questions is formulated in section 1.2. For every single sub-question, the function and the methodology is described.

1.1.1 Firm X has four requirements for the make-or-buy model

Since the make-or-buy decision normally is executed by a multidisciplinary team whom 'go with their guts', Firm X yearns for standardized processes on which decisions can based. The supervisor of the case company set four important indicators which must be weighted in the

make-or-buy model created in this research: flexibility, scalability, reliability, and profitability. These indicators are separately discussed below:

- Flexibility: the ability to create customized products
- Scalability: the capabilities to be adaptive on increasing and decreasing demand from the market
- Reliability: ensuring products are delivered within 6 weeks' time
- Profitability: switching in operation method results in equal to lower production costs

The underlying motivation for these four requirements from Firm X arise, first in case of flexibility, from the participation in a niche market, which is expanding and evaluating rapidly over time. This contains that improvements of Firm X directly affect the whole market, but market improvements also have an effect on Firm X. Therefore, it is of importance for the production of Firm X to be able to customize products and therewith adopt to changing needs in the market. Additionally, the management wants to be able to build cabinets for special requests where customers are willing to pay a higher price. In case of scalability, Firm X does not only want to be able to adapt on differentiating needs (as explained for flexibility), but also to be able to adapt on increasing and decreasing market demands. On those fluctuating demands the requirement of reliability is also based. Inasmuch Firm X wants to ascertain products can be delivered within six weeks. These deadlines are implemented in production, because climate control systems are always installed in a late stage of the chain when building greenhouses or offices. Herewith long production time results in postponement of entire projects. Lastly, profitability is a prerequisite from Firm X for this research, because decreased profitability would have a negative effect on the financial well-being of the firm. Important to acknowledge is that Firm X most values the first three requirements and in order to increase their flexibility, scalability, and reliability, they are willing to pay some price.

1.2 Executing the IST-SOLL-bottleneck method for structure

This research is executed, because Firm X wants to review their strategy. In order to structurally resolve the problem statement and achieve the desired result, this research makes use of the IST-SOLL-bottleneck structure. This structure creates a gap-analysis between the current situation (IST) and the desired situation (SOLL) (Ben & Wil business-ict-alignment, 2014). The function of the bottleneck is to display problems from the IST and thereby clarifying the manner to achieve the SOLL, by improving the IST. From this moment, bottleneck is expressed as gap.

1.2.1 Identifying the current situation (IST)

The IST, elaborated in the next chapter, aims to identify the first sub-question:

1. What does the current situation regarding the production of the cabinets of the Product X look like?

Accordingly, the following question is set:

1a. What is the current operation method of the cabinets of the Product X?

Recalling the glossary, with operation method we mean the combination of all possible methods for dispersing production (internal production, outsourcing and buy semi-finished products). The purpose of identifying the current situation is to set Zero Measurement. This Zero Measurement is used in a later stage for comparison with the desired situation.

The methodology applied to identify the current situation is an informal conversation with the manager of the fulfilment department, who is in charge to make strategic production decisions. Furthermore, the author observed the production of the cabinets of the Product X for two weeks and questioned executives when unclarity took place for the author.

1.2.2 Identifying the desired situation (SOLL)

The desired situation of the firm is discussed in chapter 6 and is based on the reviewed literature. In more detail, the desired situation from the literature is rated based on indicators originating from five theories (the ground theories) and four indicators set by the management of Firm X (requirements of section 1.5.1). Accordingly, the second sub-question is composed:

2. How can Firm X achieve the desired situation?

In order to answer sub-question 2, the following questions are discussed:

2a. How should Firm X make or buy the cabinets according to the literature?
2b. In what way should the desired situation be implemented at Firm X?

The purpose of the SOLL is to picture the manner how Firm X is able to achieve the desired situation. Based on the SOLL, gaps can be identified which withheld Firm X from reaching the desired situation. So, this research aims to determine the desired situation via the creation of a make-or-buy model. Alongside this make-or-buy model is tested on practicability by interviewing the employees of Firm X. Herewith the following question is set:

2c. How do the employees of Firm X regard the findings of the literature?

Different to question 2a, and 2b, question 2c is answered in chapter 7. The methodology for the SOLL is interviews in combination with literature study. Employees of Firm X are interviewed about the their vision for the make-or-buy decision. These results are compared with the recommendations of the author based on the literature review. Eventually, this research aims to provide Firm X with an advice where the desired situation for making make-or-buy decisions is shown including a gap-analysis to reach this desired situation.

1.2.3 Bridging the gap

The gap analysis identifies the barriers for Firm X and is debated in chapter 8. When these gaps are displayed, they can be remedied to implement the desired situation. Therefore, the third sub-question is:

3. What are the gaps for implementing the most efficient operation method for the cabinets of the Product X?

In order to answer sub-question 3, the following questions are discussed:

3a. What gap is observed which withheld Firm X to reach the desired situation?
3b. How can the observed gap be bridged?

The methodology for the gap analysis is desk research. By using the IST and Soll as input gaps can be identified. Hereafter, desk research is executed to find solutions to bridge the observed gaps.

1.2.4 Aiming for three deliverables

Summarizing, this research aims to deliver 3 results, ranked on importance:

1. An Advice for the make-or-buy decision for the cabinets of the Product X
2. An analysis of the gaps which are observed in the current situation and which withheld Firm X to reach the desired situation
3. A make-or-buy model, which is applicable on all products of Firm X

An overview of the structure, input and methodology of this research is given in Figure 1.14.

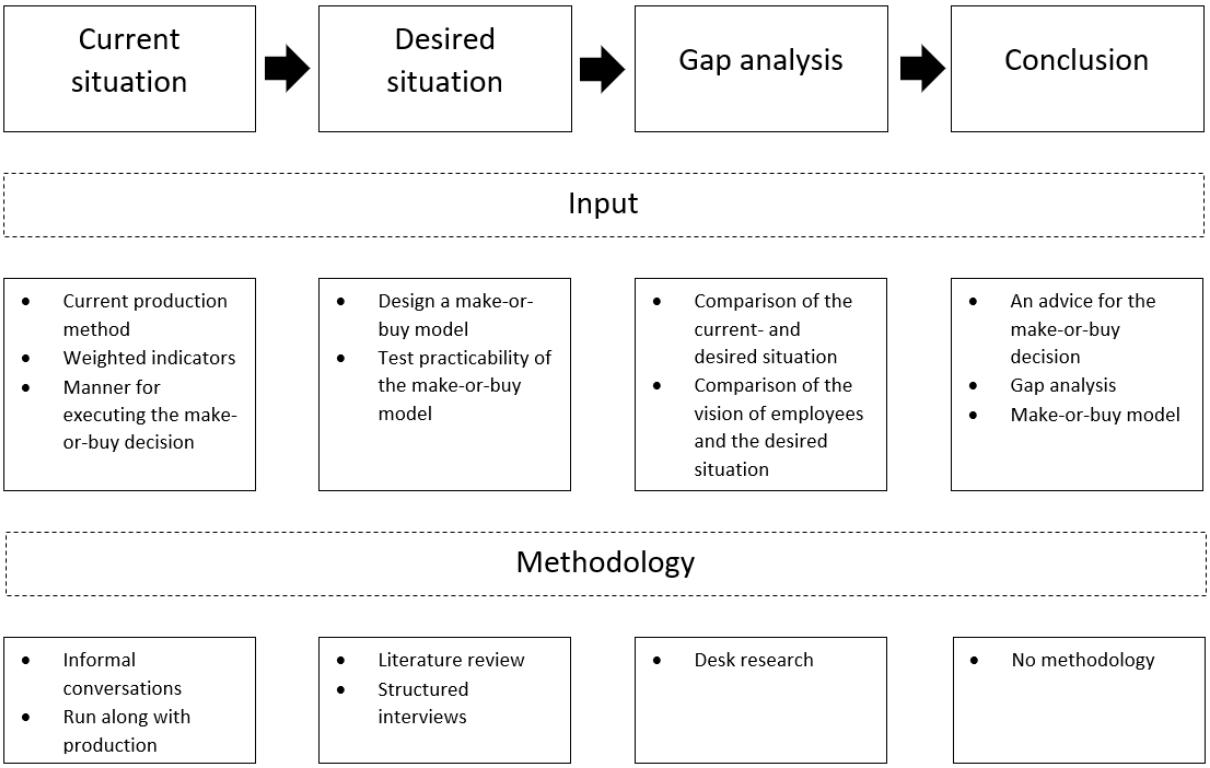


Figure 1.14: Overview of the structure, input, and methodology

1.3 The aimed model is new to the academic field and Firm X

This research aims to create a model on which make-or-buy decisions can be made. Notwithstanding, among the existing make-or-buy models, no model applies all the ground theories (recalling the glossary, the ground theories are: resource-based view, resource dependency theory, transaction cost theory, knowledge-based theory, and property rights theory) on a make-or-buy model. Since distinctive researchers do apply one or more of the ground theories on their make-or-buy models, the ground theories are of importance in the make-or-buy decision. But, none compiles all the five ground theories in a make-or-buy model. Therefore, it makes sense to introduce a make-or-buy model in the literature which regards the five ground theories. Hence, the introduction of this research results in a new vision regarding indicators which should be weighted when executing the make-or-buy decision. According to Beamon (1998), a new vision for indicators for the make-or-buy decision is needed to create rule-of-thumbs for performance objectives. This source might be interpreted as outdated, however researches which fulfil the recommendation of Beamon have not been found.

Furthermore, this research is of relevance for business sectors since it provides a clear framework whence Firm X is able to detect in what way they should make or buy a product by inserting their product specific variables.

2. Identifying the current situation (IST)

Within this chapter the methodology and result for the current situation are discussed. Let us first identify the current situation, before the make-or-buy model is designed in the next chapters (chapter, 3, 4, and 5). Within this chapter, first, the methodology is stated in section 2.1. Hereafter, in section 2.2, question 1a: *"What is the current operation method of the cabinets of the Product X?"* is discussed. Lastly, in section 2.3, a brief summary of the chapter is presented. Since the sub-question is subject to change, it is important to mention that the situation on the 1st of May is analysed. However, the current situation should be reviewed regularly.

2.1 Informal conversation as methodology

In order to retrieve information about the current situation, an informal conversation is held word-of-mouth with the manager fulfilment, who is also the supervisor of the case company for the author. No format is used during the conversation, and the conversation has an exploratory function to let the author get familiar with the firm. During the process of writing this research, additional information concerning the current situation is gained and processed in this chapter.

The manager fulfilment provided basic information about the current operation method, however during this conversation the author was addressed towards the department of supply chain engineers to gain in-dept information about the production process, production costs, and make-or-buy strategy. Furthermore, on advice of the manager fulfilment, the author run along with the production in the first two weeks to generate a detailed insight in the production of the Product X at Firm X.

2.2 Cabinet are currently bought semi-finished

Currently, the cabinets are internally produced by Firm X. However, Supplier X fabricates the cabinets with the rightful mounting plate. So, Firm X buys semi-finished cabinets in the least possible manner. More practical, Supplier X edits the bare cabinet by making holes in the iron cabinets. Hereafter, the production of Firm X arranges plastic frames in which wires can be directed, then Firm X connects the components related to the cabinet and wires the components. In the end, the cabinet is attached to the Product X and tested by Firm X. So, the operation method for the cabinets of the Product X is 'buy semi-finished'.

Firm X approaches the make-or-buy decision by executing a multidisciplinary debate where pros and cons are valued for multiple functions. During the debate, the multidisciplinary team discusses the regularity of the purchase in combination with delivery time, price differences,

minimum order quantity (MOQ), and production speciality. Elaborative, according to Firm X, the most attractive product to outsource would be a product which is ordered regularly, has a short delivery time, is cheap, can be single ordered and is not produced specially for Firm X. However, no standards are set by upper management about for example, the perspective of high or low pricing. This decision-making is delegated to the multidisciplinary team, consisting of: purchasers, supply chain engineers, manager supply chain engineers, and manager production, whom make decisions based on knowledge and experience, although a required element for Firm X to outsource is the existence of regulation of order.

2.3 Summary of the chapter

Now, we know Firm X currently buys semi-finished cabinets. Furthermore is mentioned that Firm X handles make-or-buy decisions by delegating the choice to a multidisciplinary team whom regard the regularity of the purchase in combination with delivery time, price differences, MOQ, and production speciality. Therewith we answered the question: “what does the current situation regarding the production of the Product X look like?”. This information of the current situation is needed to compare with the desired situation of the firm. Taking out of this chapter, Firm X buys semi-finished cabinets. Let us compare the strategy of buying semi-finished cabinets to the desired situation discussed later in chapter 6. Firstly, literature regarding the make-or-buy decision is discussed in the next chapter.

3. Literature regarding the make-or-buy decision

Within this chapter, literature regarding the make-or-buy decision is analysed. Firstly, the term make-or-buy decision is explained in section 3.1. The result of that section is useful for understanding the make-or-buy decision, which forms the fundament of this research. Second, in section 3.2, distinctive operation methods are identified. This section is of importance for this research, because this research advises Firm X what operation method is the most advisable operation method for the Product X and therefore the distinctive operation methods should be identified and clarified. Then, in section 3.3, the 'ground theories' regarding the make-or-buy decision are analysed, to determine indicators for the make-or-buy decision. Thereafter, in section 3.4 the practicability of the indicators is tested on speed, accuracy, flexibility and simplicity. Lastly, a brief summary of the chapter is displayed in section 3.5. The data of this literature study is retrieved by performing desk research. During this literature study the literature databases: Google Scholar, Web of science, and Scopus are consulted.

3.1 Clarifying make-or-buy decision

The make-or-buy decision involves the strategic decision-making for firms to either produce or buy a product. Ford and Farmer (1986) describe the distinction, where the 'make' decision refers to owning the labour, whereas the 'buy' decision refers to utilizing independent subcontractors.

The make-or-buy decision is closely related to the principle of horizontal-, vertical integration, and the firm's boundaries, hence these principles are explained below. Horizontal integration is the principle of acquiring a firm with the same product market combination, often competitors (Walker & Weber, 1984). Differently, vertical integration is the principle of acquiring a firm with connecting competencies, often firms to which is outsourced (Walker & Weber). So, the make-or-buy decision determines the firm's level of vertical integration, since it determines the operations the firm engages in. The size of vertical integration can also be described as the firm's boundaries, because the boundaries of a firm describe the activities which are executed by the firm (within the firm's boundaries) or outsourced to specialized companies (outside the firm's boundaries) (Holcomb & Hitt, 2007). When firms select the wrong business activities within the their boundaries, they have the risk of becoming too bureaucratic and losing strategic focus. Contrarily, firms outsourcing business activities which should be within a firm's boundary, have the risk of losing their competitive advantages (Holcomb & Hitt, 2007).

Outsourcing and subcontracting have similarities since in both cases production is externalized, however there is a huge difference between both terminologies and should therefore not be confused. In the case of subcontracting, a firm's employees are not able to produce the product, whereas in the case of outsourcing, the firm's employees are able to produce the product, however due to strategic considerations (e.g. costs) the production is conferred towards another firm (Christopher, 2016).

Within the literature on outsourcing, two distinctive streams can be identified: descriptive, and prescriptive. Descriptive literature focusses on the strategic meaning of outsourcing for the organisation, and creating theories (e.g. transaction cost theory) (Van de Water & Van Peet, 2007). Prescriptive literature focusses on designing solutions, by creating models to solve problems (Van de Water & Van Peet). This research creates a make-or-buy model and therefore is prescriptive of nature. Yet, descriptive literature is used as input to create the prescriptive literature.

Ford and Farmer (1986) stated that the make-or-buy decision is generally not taken with a strategic perspective, nor with an overall policy, but mostly by default or subjective opinion. Cánez, Platts and Probert (2000) mention that the make-or-buy decision is important, because companies have finite resources and manufacturing costs could be higher than firms can afford. By analysing the distinctive production options, firms could be able to extend their potential.

Differences in strategies arise when reviewing the literature. Ford and Farmer (1986) stated that companies dominating their market acquire former subcontractors in order to make all products needed. Contradicting, Christopher (2016) and Kakabadse and Kakabadse (2005) state the trend is not anymore to acquire subcontractors, but to outsource production. This distinction in statements could be subject to time differences. So, upfront no single strategy can be designated as preferred. Hence, the next section goes into more detail.

3.2 Three distinctive operation methods

First of all, operation methods can be split in internal and external production, also known as the make-or-buy decision (Masten, 1984). Additionally, Veugelers and Cassiman (1999), mention that combining the 'make' and 'buy' possibility could also be a strategic option for production. In practice, this indicates buying semi-finished products which are finished by end producers.

In order to fathom these concepts, the advantages and disadvantages of internal production, external production and purchasing semi-finished goods are discussed briefly. Firstly, internal

production is a superior form of governance when technological production requires great coordinated adjustments during production (Chesbrough & Teece, 1996; Langlois, 1992; Teece, 1996). This indicates that internal production ensures higher flexibility, and secrecy of technological added value. However, it ignores market developments.

Other, external production gives the opportunity for companies to specialize and therefore to shorten product development cycles (Leiblein, Reuer & Dalsace, 2002). Aydin, Cattani, and Druehl (2014) claim the increased responsibility of firms on behalf of manufacturing, product design, and process innovation increased the attractiveness of specialization and therefore outsourcing products. However, Aydin, Cattani and Druehl mention that outsourcing intercontinental is financially becoming less attractive, because offshoring to countries with low labour rates ultimately leads to national increase of labour rates over years. So, outsourcing ensures shorter product development cycles, and reduces responsibility for production and innovation which better capacitates firms to specialize, however outsourcing intercontinental is becoming less attractive due to increasing labour costs in other continents. Furthermore, when producing external, it is hard to maintain secrecy of production.

Lastly, for technical firms, the preference of Leiblein, Reuer and Dalsace (2002) is to produce using semi-finished devices, since it improves the end-product performance and reduce costs due to specialization while keeping technological production secret. Buying semi-finished goods as production strategy can thus be seen as having the benefits and disadvantages of both: internal and external production. This indicates that buying pre-assembled products is a good method for improving quality while reducing costs and controlling for product secrecy. However, this operation method still partially contains the disadvantage of ignoring market developments, thus solely relying on internal innovations.

3.3 Ground theories of the make-or-buy decision

Lots of theories have been established to clarify the decision to make or buy a product. However, contradictions are visible in those theories (Mouzas & Blois, 2008). Therefore, theories which are discussed by multiple researchers are discussed in this chapter. When typing ‘supply chain theories’ in the scientific search engine Google Scholar, the first article showing up is of Carter and Rogers (2008). Those authors plead for using the resource-based view, resource dependency theory, and the transaction cost theory when discussing supply chain performance. Since the make-or-buy decision is part of supply chain decision, these theories are considered in this research. Besides Carter and Rogers, researches of Peteraf (1993) and

Barney (2001) accordingly mention the importance of the resource-based view. Regarding the resource dependency theory, among others Hillmann and Withers (2009) and Casciaro and Piskorski (2005) acknowledge the usefulness of the theory in organizational performance. The last theory plead for by Caster and Rogers is the transaction cost theory, researches of Walker and Weber (1984) and Geyskens and Steenkamp (2006) recognize the importance of the transaction cost theory in make-or-buy decision.

Second, when typing 'theories make or buy' in Google Scholar the article of Poppo and Zenger (1998) shows up where is argued that, besides the transaction cost theory, the knowledge-based theory should be regarded in supply chain performance in order to create boundaries for production. Along with Poppo and Zenger, Grant (1996) and Nonaka, Toyama and Nagata (2000) argue the importance of knowledge-based theory in production.

Third, when typing 'theories for strategic management' in Google Scholar, the article of Kim and Mahoney (2005) shows up where is stated that although the four theories mentioned above are commonly used, property right theory explains and predicts various business phenomena. Where they point towards the knowledge-based theory as driver for producing products, they argue property right theory should be considered in order to understand strategic decision making in the make-or-buy decision. Furthermore, Kim and Mahoney plead for agency theory in strategic management, however since the agency theory regards the difference in organizational goals between managers and owners, this theory is considered as not useful for make-or-buy decisions. Other researches mentioning property right theory as valuable input for the make-or-buy decision are e.g. Demsets (1974) and Besley (1995).

Summarizing, five theories are selected for this research: resource-based view, resource dependency theory, transaction cost theory, knowledge-based theory, and property rights theory. In the next section these five theories are shortly discussed and tested on usability and applicability for this research.

Resource-based view

The resource-based view is based on the idea that competitive advantage can be created by using strategic resources (Barney, 1991). Strategic resources can be identified by the VRIS-framework. The VRIS-framework indicates that resources which are Valuable, Rare, Inimitable, and Sustainable, generate sustained competitive advantage. The resource-based view is therefore focussed on exploiting internal strengths by responding on external opportunities (Wernerfelt, 1984).

The VRIS-framework is useful to create competitive advantage. Furthermore the theory is applicable to this research, since it reveals that strategic components should be valued in order to identify competitive advantage. Eventually, the choice to make or buy a product is executed for efficiency and thus to create competitive advantage. So, considering strategic resources is advisable in the make-or-buy decision.

Resource dependency theory

The resource dependency theory points firms to minimize uncertainty and dependency while maximizing the autonomy on suppliers (Hillman, Withers & Collins, 2009). Where the resource-based view focusses on gaining competitive advantage by having VRIS resources, resource dependency theory tries to gain competitive advantage by increasing bargaining power.

Resource dependency theory is used heavily by companies for many years, however the theory is regarded as outdated (Hillman, Withers & Collins). Therefore, the usability of the theory should be questioned these days. Hence the resource dependency theory is valued as not applicable to this study.

Transaction cost theory

Transaction cost theory is based on the principle that economic transactions have tailored costs associated. One can think of negotiation costs for example. Those specific costs can become of significance under the condition of transaction-specific investments and uncertainty and therefore should be considered before switching suppliers (Heide & Stump, 1995). Williamson (1975), argued that internal production would be superior in the case of high asset-specificity and uncertainty, however later research identified that the asset specificity and uncertainty can also be mitigated by creating relationships with suppliers (Borys & Jemison, 1989). An asset is specific when it is usable for only one specific purpose (e.g. a machine has to be bought to produce one specific product) (Holcomb and Hitt, 2007).

This theory clarifies actions which should be undertaken when asset specificity and uncertainty are highly applicable to a firm’s product. As mentioned before, firms can remedy their risk by either internalize production or build close relations with suppliers. This theory is applicable for this study, since it directly influences the decision making for in- or externalizing production.

Knowledge-based theory

Knowledge-based theory suggests that knowledge is the most important resource. Grant (1996) mentions that knowledge-based theory distinguishes itself from other theories and regards: the nature, organizational structure, role of the management, and boundaries of a firm. Regarding the boundaries the theory states the moment the output of stage A is solely needed to accomplish stage B, external production is an efficient method. However, if the knowledge to accomplish stage A is necessary to accomplish stage B, firms cannot efficiently outsource production (Maskell, 2001).

This theory is useful for firms to detect whether outsourcing production could be useful. This theory is applicable to this study, because it shows the effects of specialized knowledge in the production on the firms boundaries. As mentioned in the previous section, determining the firm's boundaries is of importance for the make-or-buy decision.

Property right theory

The main idea of the property right theory is to clarify how to strategically deal with resource allocation. Property rights are formed by entities and provide the owner with bargaining power. Hence property rights affect economic behaviour and outcomes (Kim and Mahoney, 2005). The three important criteria for efficiency of property right are: universality, exclusivity, and transferability (Libecap, 1989). Important to acknowledge, a product with property rights is not necessarily protected against copying, since some countries do not protect firms with product property rights. Differently, when outsourcing a product with property rights, stakeholders are able to identify information about the product (as cost price, and substitutes), which could reduce the bargaining power of the firm disposing of the property rights (Demsetz, 1974).

This theory is useful in case of determining a firm's bargaining power and competitive position. This theory is applicable to this study, because outsourcing products with exclusive property rights could weaken the power of the property right since, in that case, more companies dispose of the specialistic information.

Summarizing, the indicators for the constructive make-or-buy model found in the researched theories are: (1) strategic resource, (2) asset specificity, (3) uncertainty, (4) needed knowledge for production, (5) available knowledge in the firm, and (6) product property rights. Where strategic resource has its origin in the resource based view, asset specificity and uncertainty have their origin in the transaction cost theory, needed knowledge and available knowledge for

production are derived from the knowledge-based theory and the last indicator product property right has its origin in the property right theory. However, asset specificity and uncertainty can be left unnoticed when firms build relationships, because they function as an analogue. So, to value a model, either asset specificity and uncertainty or building relationship should be considered in the model. Let us test this six indicators on practicability in the following section.

3.4 Practicability of the indicators

The practicability of the six selected indicators (section 3.3) are tested by the 'four attributes of good vehicle routing problem heuristics' (Cordeau et al., 2002). Thus, the selected indicators are criticized in terms of speed, accuracy, flexibility, and simplicity (in the essence of amount of data needed), in order to identify if the indicators are feasible for research. However, since flexibility is explained as the sum of routing cost, capacity and routing duration where capacity and routing duration initially have to be set on 1 and need periodical review, solely routing cost can be discussed for now.

In the case of speed, firms can identify themselves if a product is a strategic resource of the firm in order to be profitable. Furthermore, asset specificity is an indicator which is fast identifiable when considering what costs come into play when switching supplier. The indicator uncertainty may be hard to identify quickly, since uncertainty is a broad definition and needs time consuming research in order to clearly map uncertainty. The indicator building relationships is, contrary to uncertainty, quickly identifiable for firms. The indicators needed knowledge and available knowledge for production are quickly detectable, since firms produce badly when the needed knowledge exceeds the available knowledge. The last indicator property rights is quick identifiable as well, since little research need to be done to see if patents already exist and if they are in possession of the firm.

In case of accuracy, the indicator strategic resource does not seem to cause any problems, because managers have a clear view about dependency on certain products for the financial wellbeing of firms. Second, asset specificity cannot be prey to inaccuracy when firms have a clear overview of the components per product. However, uncertainty seems to be a problem again in case of accuracy, since firms are dependent on external information to scan for uncertainties. External information may not be accurate in some cases. The indicator building relationships may be complicated to measure accurate, since it is subjective of nature. For the indicators needed and available knowledge accuracy does not seem an issue, because, again, firms produce badly when needed knowledge exceeds the available knowledge. Product

property rights do not cause any problems is case if accuracy as long as the right institutions are checked for registered patents.

In case of flexibility (recalling we solely discuss routing cost), the indicator strategic resource is not costly to identify. Next, to check if assets are product specific is not costly. Contradicting measuring uncertainty of the product could be expensive due to e.g. the need of an extensive market analysis. The needed and available knowledge to produce are product are not costly to analyse. Lastly, no costs are needed to identify if products have property rights.

In case of simplicity, the indicator strategic resource is simple to measure, because solely financial statement need to be checked in order to identify whether a resource is strategic for the firm. This simplicity to measure also applies to asset specificity, because ERP-systems can be checked to identify if components are asset specific. Uncertainty is not simple is case of the amount of data needed. Expectations based on market research can be done, however needs lots of data. The indicator building relationships can be measured by having interviews with employees and even better suppliers and ex-suppliers. However, many distinctive interviews must be executed to retrieve reliable data, so simplicity is low for this indicator. The indicators needed knowledge and available knowledge are simplistic to retrieve, since requirements for specific functions can be checked and compared to the employees of the firm. Product property rights are simplistic to investigate since these data are openly available at institutions.

So, mainly uncertainty scores low on speed, accuracy, flexibility and simplicity, contrary the other indicators score good and seem useful as input for creating a constructive make-or-buy model. Since uncertainty scores low, it could be the case that measuring uncertainty becomes problematic. Nevertheless, it is an indicators which should be considered. Hence, we do continue with uncertainty as an indicator, but readers should acknowledge that measuring uncertainty is time consuming, inaccurate, costly and hard. Therefore, when measuring uncertainty becomes problematic in a later stage, the consideration of uncertainty can be skipped. It is not needed to directly leave the indicator uncertainty, since the importance of considering uncertainty in the make-or-buy decision is acknowledged and thus should be considered if possible.

3.5 Summary of the chapter

This chapter starts (section 3.1) with an introduction of the make-or-buy decision, where is explained that the make-or-buy decision involves the strategic decision-making for firms to either produce or buy a product. Consequential, is section 3.2, is mentioned that firms have the

opportunity to make and buy a product. However, an additional opportunity for firms is to buy pre-assembled products. Then, in section 3.3, the ‘ground theories’ concerning the make-or-buy decision are debated, namely the: resource-based view, resource dependency theory, transaction cost economics, knowledge based theory, and property rights theory. The resource-based view is based on the idea to create competitive advantage by using strategic resources which are: valuable, rare, inimitable and sustainable. Different, the resource dependency theory is based on the idea that competitive advantage can be generated by minimizing uncertainty and dependency while maximizing the autonomy on suppliers. Furthermore, the transaction cost theory is based on the principle that economic transactions have tailored costs associated. These costs should be carefully considered before selecting or switching suppliers, especially in case of high asset specificity and uncertainty. Fourthly, the knowledge based theory suggests that knowledge is the most important resource. Therefore, when deciding to outsource production or buying pre-assembled products, firms should consider that the knowledge needed to create the bought product is not of importance to produce the firm’s end product. Lastly, the property rights theory clarifies how to strategically deal with resource allocation. Regarding the property rights theory, firms should consider: universality, exclusivity, and transferability of the property right of the product in order to deal with resource allocation. Based on these theories six indicators are identified which should be considered when compiling a constructive model for the make-or-buy decision: (1) strategic resource, (2) asset specificity, (3) uncertainty, (4) needed knowledge for production, (5) available knowledge for production, and (6) property rights. Furthermore is identified that asset specificity and uncertainty are an analogue to building relationships. Readers should acknowledge that the indicator uncertainty is hard to measure, but because uncertainty is identified as indicator, not considering uncertainty could lead to false conclusions. Hence we do bring uncertainty as indicator to the next chapter. In the next chapter existing models are discussed and rated on behalf of the ten selected indicators, six deriving from the literature (section 3.3) and the four required indicators from Firm X (section 1.1.1).

4. Selecting existing models

Within this chapter primarily, in section 4.1, four existing make-or-buy models are discussed. In Google Scholar is searched for ‘make or buy decision model’ where useful articles found on the first page with a clear decision model were selected for discussion in this research. Section 4.1 is of importance for this research to see in what manner other researchers created a make-or-buy model. If there exist models which correspond to all the investigated indicators from literature and the required indicators from the case company, it would be a waste of time to create a model. Therefore, in section 4.2, the discussed models found in the literature are rated on the six investigated and four required indicators. Lastly, a summary of the chapter is given in section 4.3.

4.1 Four selected models highlighted

Many models regarding the make-or-buy decision have been established over the year (Tayles & Drury, 2001). The four selected models in this research are: (1) Tayles and Drury, (2) Humphreys, McIvor, and Huang (2002) (3) Gerbl, McIvor, Loane and Humphreys (2015), and lastly, (4) Holcomb and Hitt (2007). Aforementioned, those four models are selected since they show up on the first page of Google Scholar when is searched for ‘make or buy decision model’. This method is used because regarding all make-or-buy models is very time consuming and adjusting one of these models, if needed, has the preference of the author. So, in the end all indicators are valued in the make-or-buy model. The four selected models are discussed below.

Tayles and Drury created a model in which indicators must be answered with ‘yes’ or ‘no’ to end in a specific terminal which advises to: make, invest and make, inload potential, divest and buy, acquire resources and make, or buy. In order to make a deliberate choice, the model makes use of feedback loops.

Humphreys, McIvor, and Huang (2002) pursue on the research of Probert (1996). The model of Probert is tested at six engineering businesses, where the case companies declared an improvement of the business results of 20-40% on the return on capital. The model evaluates five categories: identifications and weighting of performance, an analysis of the technical capability, comparison of retrieved internal and external technical capabilities, an analysis of suppliers’ organisation, and lastly an analysis of the total cost of acquisition. Furthermore to gain reliability, the model is reviewed by senior procurement managers of ten multi-national organizations acting in different industries. Some indicators of the model are open-ended and therefore contain interpretation and therewith researcher bias.

Gerbl, McIvor, Loane and Humphreys (2015), distinct six cells for outsourcing possibilities, where: ‘local’, ‘nearshore’, and ‘offshore’ are regarded for both ‘captive-’ and ‘independent vendor’ partners. Each cell has some indicators which should be corresponding to the analysed firm. If so, the firm should execute the specific outsourcing option. The moment no cell relates to the case of a firm, internal production should be applied.

Holcomb and Hitt (2007) state that seven indicators explain strategic outsourcing: asset specificity, small numbers bargaining, technological uncertainty, capability complementarity, strategic relatedness, relational capability-building mechanisms, and cooperative experience. No specific numbers are connected to these indicators and therefore the authors interpretation is needed to apply this model.

4.2 The model of Tayles and Drury corresponds most to the set indicators

Selection of a model is based on the ten selected indicators from the discussed theories, in section 3.3, in combination with the requirements of Firm X (flexibility, scalability, reliability, and profitability), which are mentioned in section 1.1.1. Regarding the literature section, the resource based view identified (1) strategic resources as an indicator which should be included in the model. Furthermore, the transaction cost theory stated (2) asset specificity and (3) uncertainty are indicators for the make-or-buy decision, however relationships could be a replacing indicator, so either relationships or asset specificity and uncertainty should be represented in the model. Additionally, the knowledge-based theory mentions the importance of the (4) needed knowledge for production and the (5) available knowledge in the firm as indicators. Lastly, the property right theory claims the presence of (6) product property rights as an indicator for the model. Furthermore, Firm X required (7) flexibility, (8) scalability, (9) reliability, and (10) profitability to be considered when regarding the make-or-buy decision.

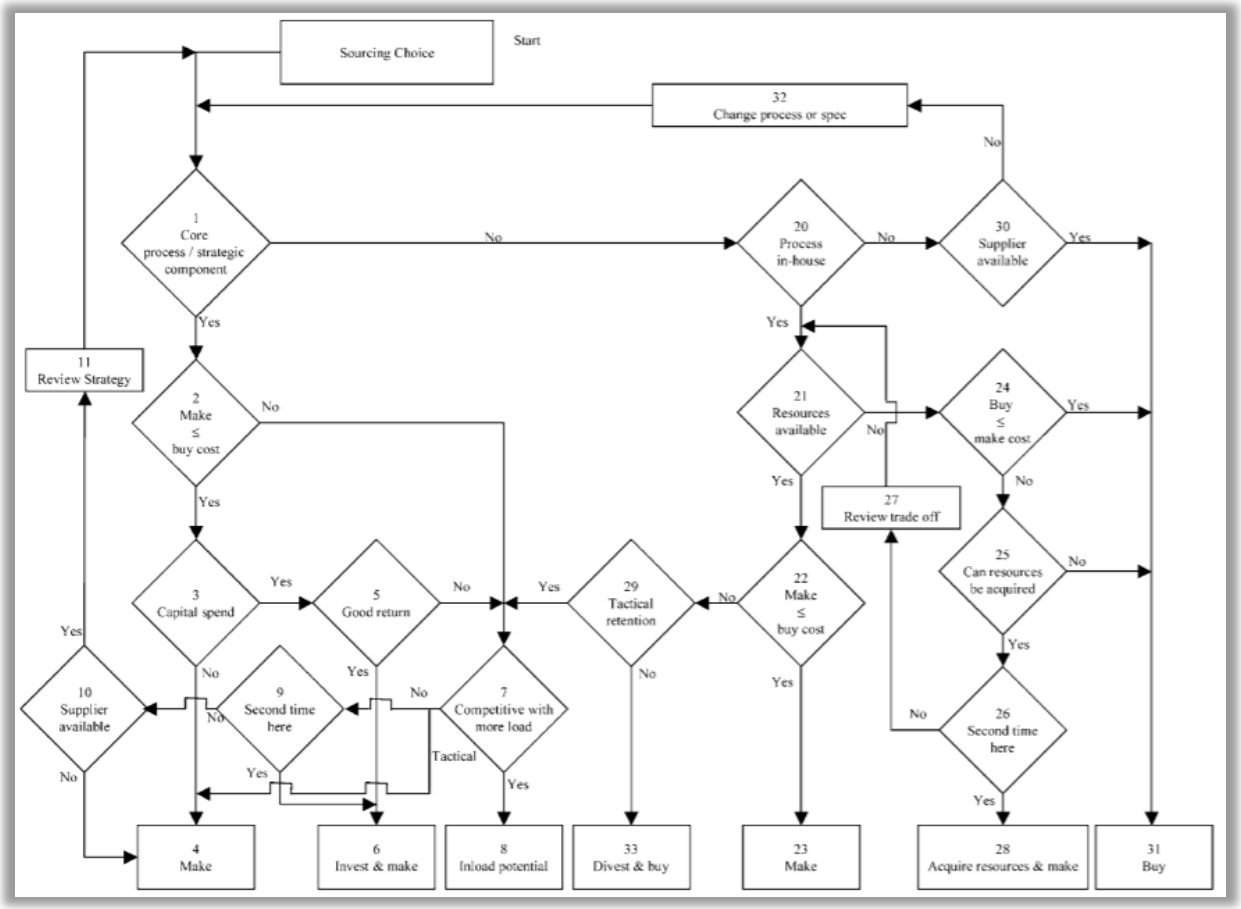
The models are judged on those ten indicators based on the availability in the model and retrieve ‘++’ when the indicator is thoroughly considered, a ‘+’ when the indicator is considered well, ‘-‘ when the indicator is temperate considered, and ‘--' when the indicator is not considered at all. The ‘–‘ are subtracted from the ‘+’ to generate an overall score. Because this manner is partially subject to subjectivity scores of the model are dependent on the authors interpretation. However, when judging, some extent of subjectivity exists, and the amount of influence is reduced by judging based on those ten indicators. The results of this rating is visible in Table 4.1.

Clearly, models for the make-or-buy decision do exist, but when comparing the models to the indicators of the ground theories, it reveals the existence of a gap in the literature. However, in Table 4.1 is visible that the model of Tayles and Drury scores the highest. Hence the model of Tayles and Drury is used to be improved in the next chapter. The model of Tayles and Drury is displayed in Model 4.1. Since the text in Model 4.1 is small, an A3 version of the model is visible in Appendix II.

The model of Tayles and Drury has some self-explaining decision-moments, however the following decision-moments need further explanation: (5) good return, (20) process in-house, and (29) tactical retention. (5) Good return, refers to the monetary income of the product and therefore the word 'good' should not be confused with its homonym meaning 'product'. (20) Process in-house regards the capabilities of a firm to produce in-house, e.g. employee capability and storage possibilities. (29) Tactical retention initiates whether it is tactical for a firm to retain their 'make' approach.

Table 4.1: Rating of the models

	Strategic resources	Asset specificity	Uncertainty	Needed knowledge	Available knowledge	Product property rights	Flexibility	Scalability	Reliability	Profitability	Score
Tayles and Drury	++	-	+	+	+	-	-	+	--	++	+++
Humphreys, McIvor, and Huang	--	--	+	++	++	--	-	--	++	+	_
Gerbl, McIvor, Loane, and Humphreys	++	--	++	--	++	--	--	--	--	+	-----
Holcomb and Hitt	+	++	++	-	-	--	-	--	--	--	------



Model 4.1: Make-or-buy decision-making model of Tayles and Drury. Source: Tayles & Drury, (2001).

4.3 Summary of the chapter

In section 3.1, four models are discussed: (1) Tayles and Drury, (2) Humphreys, McIvor, and Huang, (3) Gerbl, McIvor, Loane and Humphreys, and (4) Holcomb and Hitt. Consequential, in section 3.2 these models are judged on ten indicators: strategic resources, asset specificity, uncertainty, needed knowledge for production, available knowledge in the firm, availability of property rights, flexibility, scalability, reliability, and profitability, which have their origin in section 1.1.1 and 3.3. The indicators are valued with '++', '+', '-', and '- -' for the four selected models. Based on that valuation, the model of Tayles and Drury scores the highest and is therefore selected and used throughout this research.

5. Adapting the selected model

In this chapter, the selected model of Tayles and Drury is adjusted on the negative scoring indicators: asset specificity, product property rights, flexibility, and reliability to create a more comprehensive model, which aligns with the identified indicators. Therefore this chapter delineates the negative scoring indicators individually. Firstly, asset specificity is discussed in section 5.1. Thereafter, in section 5.2 product property rights is discussed. In section 5.3, flexibility is discussed. Then, in section 5.4 the last negative scoring indicator, reliability is discussed. Additionally, in section 5.5 some extra adjustments on the selected model are explained. Furthermore, in each section the location of the indicator in the model is debated. When all detected indicators (of the firm in section 1.1.1 and of the literature in section 3.3) are considered in the adjusted model, the outcome of this research becomes more reliable. Hereafter, in section 5.6, the adjusted model is presented and explained. Lastly, in section 5.7, a brief summary of the chapter is displayed.

5.1 Adding asset specificity

During the following sections, it is advisable to use Model 5.1, presented in section 5.6, for guidance. Within the upcoming text, numbers are used which refer to decision-moments in the make-or-buy model.

Asset specificity is explained as an investment which has a higher value towards production of a specific product. For example, to produce a product a firm might have to invest in a machine or employee which can only be used for that specific new product. In the model asset specificity is placed twice, since it is an indicator which should be considered when the decision-moment core process is either answered ‘yes’ or ‘no’. When core process (1) is answered with yes, the next decision-moment is product secrecy (2). Since secret production should directly be filtered out in order to ensure they do not end at the buy terminal. Therefore, make ≤ buy cost (3) is considered when: production should be kept secret, specialization does not improve the firm, or production exceeds six weeks. If making is more expensive than buying, asset specificity (4) should not be considered, because if asset specificity is considered and answered with no, there should be the option to make, which is in that case more expensive and thus not preferential. Furthermore, the transaction cost theory (where the indicator asset specificity has its origin) aims to save costs and reduce risk, so asset specificity should not be considered when making is more expansive than buying the product. Contrary, when making is cheaper than buying (3), asset specificity (4) is the next logical decision-moment. According to the transaction cost

theory, asset specificity is a key characteristic to make a product, hence in model 5.1, when asset specificity is answered with yes, it is directly bounded to make (6). When asset specificity is answered with no, the next decision-moment is capital spent (5). It could be the case that asset specificity is answered with 'no', but capital has to be spent, for example, an employee with a specific expertise has to be employed to make the product. Therefore, when asset specificity is answered no, the next question should be if capital must be spent. For that reason is clarified that the decision-moment of asset specificity (when core process is answered yes) is at the right place in this figure, namely between make ≤ buy cost (3) and capital spend (5).

Secondly, the decision-moment of asset specificity is discussed at the right side of the figure (when core process is answered with no). Asset specificity at the right side (29), is nearly on the same place as asset specificity (4) on the left side of the figure. However other than the sequence of make ≤ buy cost (3) and asset specificity (4). Asset specificity (29) is consciously placed above make ≤ buy (29) cost at this place. The reason for this reverse sequence, is because decision-moment make ≤ buy cost (3) is placed under 'core process' and therefore does not point out to outsourcing, but solely to the possibility to maximize production via 'competitive with more load' (18). When mass producing, asset specificity is not of importance since the asset might be product specific, but the product is produced with high quantities and therefore the asset specific investments have less magnitude. However when the product is a non-core process, there is less necessity to make the best profits (as in the case of core process), and it could be tactical to shift towards outsourcing production, even when making is cheaper than buying. In cases like those firms may decide to specialize for example. No we clarified that asset specificity (29) is located rightly in the scheme. Namely, it is placed after resources available (28) and points towards either make ≤ buy cost (30) or tactical retention (44).

5.2 Adding product property rights

Product property rights is clarified as having universal, exclusive, and transferable products which mostly are created by having a patent on a specific product, and thereby excluding other firms to produce that product. Therefore, the property rights theory mentions, when property rights come into play, outsourcing should not be considered. Hence, the figure should exclude the option to end at a buy option, when property rights is answered with 'yes'. Since the option to end at buy is solely possible when the product is not your core product, the decision-moment of property right only has to be included at the right side of the figure. Regarding the figure, property rights (13) is inserted just before the buy option, as explained above, but ability to customize products (14) is still inserted as a subsequent. There is a reason for property rights

(13) not being the last decision-moment before concluding that firms should buy is explained later in section 5.3.

Additionally, some may mention that ending at buy is still possible when property rights is answered with yes. However, if resources cannot be acquired by a firm having property rights, beggars cannot be choosers. So the firm should either phase out or buy the product.

5.3 Adding flexibility

With the term flexibility, Firm X implies the flexibility to produce customized products (section 1.5.1). Therefore, when outsourcing production, Firm X does not desire suppliers to standardize production. Accordingly, the decision-moment 'ability to customize products' should be included in the model, which refers to the question: "Does the supplier to whom is outsourced has the capability to customize production if needed?". So, the decision-moment flexibility should be included just before ending at the buy terminal (so also buy semi-finished) as a final check. When suppliers do not have the capability to react on customized production, Firm X should make the product. Regarding the adjusted model, 'ability to customize production should be included before terminals buy semi-finished (12), buy semi-finished (40) and buy (15), but not before divest & buy (45). Divest & buy (45) can only be reached when tactical retention is answered with 'no', however it is always tactical to retain producing for Firm X when the supplier is not able to customize production. When suppliers are not able to provide Firm X with customized products, Firm X should insource production and therefore (in case of no core process, 38 and 14) detect if the resources are available to produce or (in case of a core process, 11) check whether the firms becomes competitive with more load (18), since we know buying currently is cheaper for the firm (9). This difference has to be made, since in case of a core process the availability of resources does not have to be regarded, because firms should be able to produce the product themselves and therefore have the availability to acquire the resources.

5.4 Adding reliability

In case of Firm X, doubts about reliability only comes into play when (partially) outsourcing production, since Firm X is able to produce the Product X and the cabinets within six weeks. However, if production is outsourced it is critical for Firm X that the production time does not exceed the six weeks. Thus the make-or-buy model should include a decision-moment 'production time longer than 6 weeks', but only when the model tends to end at a terminal which contains 'buy' (so also buy semi-finished etc.). The first buy option of the model is buy semi-finished (12). If buying is cheaper than making the product (9), the product relies on

internal innovation (10) and external partners can customize the product (11), however the external party cannot manage to produce within six weeks when outsourcing production (8), Firm X should make the product instead of buying even if specialization improves the quality of the product (7). So, when external parties are not able to produce within 6 week, it is advisable for Firm X to start asking whether they should make, invest & make, or inload potential, and therefore go back to (3) make ≤ buy cost.

The next terminal which ends at a buy option is divest & buy (45). Since divest & buy (45) only can be reached when tactical retention is answered with 'no', and it is tactical to retain producing when suppliers cannot produce within six weeks, no decision-moment 'production time longer than 6 weeks' needs to be included.

The next buy option is buy semi-finished (40), which is reached nearly the same as buy semi-finished (12). The route which is the same is via a 'no' at make ≤ buy cost (38), 'yes' at internal innovation (35) and 'yes' at ability to customize product (39). However, it is slightly different than buy-semi-finished (12), because for Firm X it is advisable to buy semi-finished goods if specialization improves quality (36), production time is shorter than six weeks (37), and making is cheaper than buying (38). Because reducing profit when specialization improves the quality is acceptable in case of a non-core process. So, production time ≥ 6 weeks (37) is linked towards make ≤ buy cost (38) if production time is shorter than six weeks. When suppliers are not able to ensure production time is shorter than six weeks, it is advisable for Firm X to identify if internal production is possible. Hence, if production time ≥ 6 weeks is answered with 'yes', the decision-moment points towards resources available (28).

Lastly, the terminal buy (15) should regard the 'production time longer than six weeks'. Buy (15) is reached via ability to customize products (14) or can resources be acquired (16). Via can resources be acquired (16) the model can end at buying even when production is secret, property rights exist or production time exceeds six weeks. However if a firm is not able to acquire the resources needed, firms have to either buy the product or cease production. But all other options to end at ability to customize products (14) have filtered out (via 8, 33, 37, or 43) the option that production is bought when production time exceeds the agreed term of six weeks.

5.5 Executing other adjustments

We make three other adjustments on the model of Tayles and Drury. Firstly, the literature in section 3.2 identified make, buy, and buying semi-finished products as production options, while model 4.1 solely contains make and buy options. Therefore, the option to buy semi-

finished products is added to model 4.1 (see model 5.1). In section 3.3 is explained that buying semi-finished products has a disadvantage of no product secrecy and relying on internal innovation. Therefore, these decision-moments should be considered before concluding that buying semi-finished products is the most suitable operation method. Furthermore, buying semi-finished products should not be considered when quality decreases. For either core products as secondary products the option to buy semi-finished products should be considered. The moment production is secret, a firm should solely have the option to make a product. When production is not secret firms should consider whether specialization improves quality. When specializing does not improve quality, the firm should not specialize and thus not have the option to end at a buy or buy semi-finished terminal. Therefore can be stated that the two terminals with buy semi-finished goods are placed at the right location. Furthermore, when firms rely on internal innovations, buying semi-finished products could be optional, whereas for firms not relying on internal innovations, thus reacting on market innovations, it should be optional to end at the buy terminal. Hence, the decision-moment internal innovation is connected to the operation method buy.

Secondly, review trade-off is left out of the adjusted model. Tayles and Drury state: *"to ensure that resources are deployed as optimally as possible. The acquisition of resources will only take place after a second time round the loop"*. However is believed that resources should always be deployed as optimally as possible and acquisition of resources should be regarded carefully before acting. Therefore an extra loop is not needed.

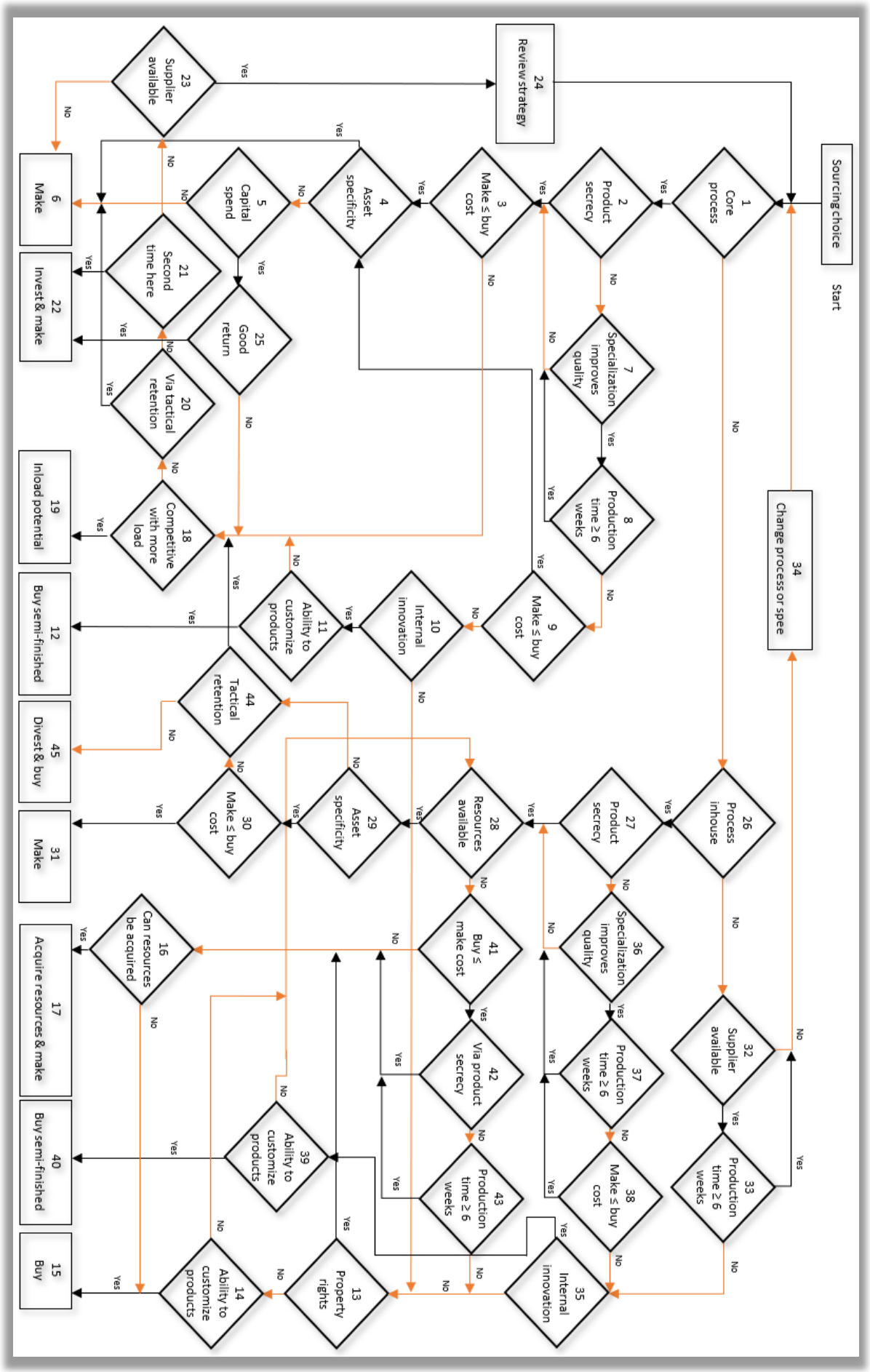
Lastly, in order to optimize readability of the scheme, arrows representing a no are turned orange.

5.6 Introduction of the adjusted make-or-buy model of Tayles and Drury

Within this section, let us present the model. In order to create a clear structure in the main body of this paper, a brief explanation of the function of the model is given here. For a detailed explanation of the model see appendix IV. The model generated in this chapter is an adjusted version of the model of Tayles and Drury. The reason for modifying their model lies in the basis of the ground theories for the make-or-buy decision in combination with tailored prerequisites of the case firm. Different to the original model, in the adjusted model, 'yes' and 'no' are placed above the arrow if possible, and otherwise left from the arrow. Recalling, for visibility an A3 version of model 5.1 is displayed in appendix III.

Within the adjusted model asset specificity, product property rights, flexibility, reliability, and some other adjustments are executed. Overall, these adjustments are done by aiming to create a reliable make-or-buy model with which Firm X is able to determine in what way they should make or buy a product.

Since the created model is based on the ground theories, this research is not tested on applicability. Therefore, in section (7.2) proposition are composed to test whether the suggestions, which are based on the literature, are acknowledged by the employees of Firm X.



Model 5.1: Adjusted make-or-buy decision-making model of Tayles and Drury

5.7 Summary of the chapter

Since the model of Tayles and Drury did not consider asset specificity, product property rights, flexibility, and the option to buy semi-finished products, these indicators are inserted in the adjusted model. We clarified the location of the indicators in the model. Additionally, readability of the model is improved by marking arrows representing ‘no’ orange. In section 5.6 the designed model is given and explained. A detailed explanation for the make-or-buy model is displayed in appendix IV. In the next chapter the make-or-buy model is used to identify in what way Firm X should make or buy the cabinet of the Product X. Furthermore, we use the changes made in this chapter to compose and test propositions in chapter 7.

6. Identifying the desired situation (SOLL)

In order to determine how Firm X can reach their desired situation, this chapter identifies the desired situation based on the adjusted make-or-buy model displayed in section 5.6. Within this chapter firstly the methodology is discussed in section 6.1. Hereafter, in section 6.2, the results of the question 2a: *"How should Firm X make or buy the cabinets according to the literature?"* is discussed. Additionally, question 2b is discussed in section 6.3 and embraces: *"In what way should the desired situation be implemented at Firm X?"*. Lastly, a summary of the chapter is given in section 6.4.

6.1 Informal conversations and desk research as methodology

The methodology is different for question 2a and 2b. For question 2a, an informal conversation is held with the manager fulfilment, where the generated model in section 5.6 is used as a manual. So, decision-moments are regarded step-by-step, however when research was needed to identify the answer, specialists within the company were asked for clarification. Additional research was needed for decision-moments: specialization improves quality (section 6.2.1), and make ≤ buy (section 6.2.2)

In order to answer question 2b, results of question 2a are used. In order to answer decision-moments in the make-or-buy model, practical data is needed (e.g. outsourcing costs). This practical data can be used to advise how the desired situation can be implemented at Firm X.

6.2 Recommended is to buy semi-finished cabinets

In order to determine the desired situation, we use Model 5.1. So, in this section we find the result for the desired situation (advise Firm X in the manner to substantially decide to make, buy or buy subassemblies of the cabinets for the Product X in the Netherlands).

In this section the theoretical path which the cabinets of the Product X follow in the model is carefully described. To advise Firm X on module level, we make a distinction between two sets of modules of the cabinets: (1) cabinet with mounting plate, output canals and cable trays (Figure 6.1 and 6.2), and (2) cabinet which is fully equipped project specific (removed due to confidentiality). Solely these two sets of modules have to be tested, since it covers all production possibilities.

If (1) cabinets with mounting plate, output canals and cable trays should be bought semi-finished, solely the cabinets with mounting plate should be bought, since that is the least possible manner to buy semi-finished cabinets. When cabinets with mounting plate, output

canals and cable trays should be made, the entire first set of modules of the cabinets should be made. If the first option ends at ‘buy’, we should test to what extent they should buy. So, then the (2) cabinet which is fully equipped project specific should be tested. If the first set of modules should not be bought, it makes no sense to test a more comprehensive combination since we already know in what way it is advisable to produce.

Regarding the second stated set of modules, if the set of modules ends at the make terminal, we know solely the modules of the first set of modules should be bought. If the second combination (cabinet which is fully equipped project specific) ends at the buy terminal, the entire cabinet should be bought. However, when the second combination ends at the buy semi-finished terminal, the product relies on internal innovation. In that case, the modules which are dependent on internal innovations should be made, whereas the remaining modules should be bought. So, by testing these two sets of modules we can clarify all five levels of outsourcing:

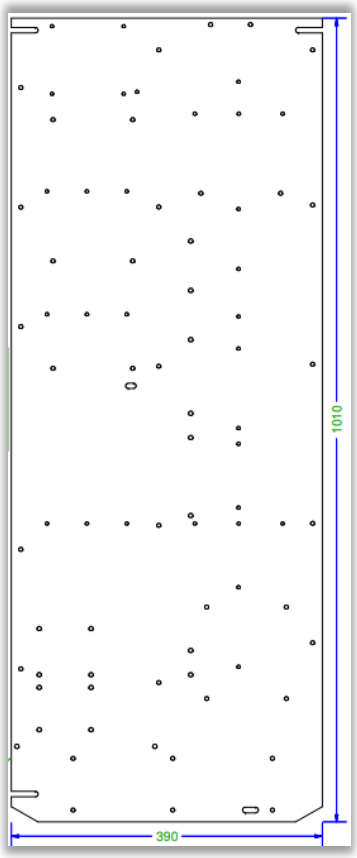


Figure 6.1: Mounting plate. Source: internal source

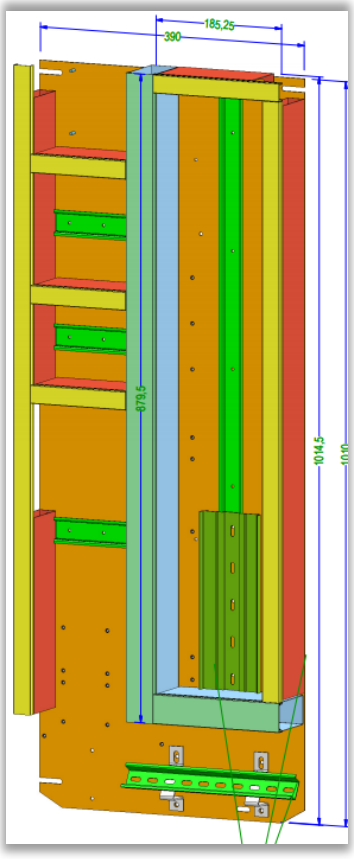


Figure 6.2 Mounting plate with output canals and cable trays. Source: internal source

1. Internal production (make)
2. Buy cabinet with mounting plate (buy semi-finished)
3. Buy cabinet with mounting plate, output canals and cable trays (buy semi-finished)
4. Buy cabinet with modules not relying on internal innovations (buy semi-finished)
5. Buy cabinet which is fully equipped project specific (buy)

Now we continue with the desired result according to the make-or-buy model. By applying the model on the Product X, some decision-moments cannot be answered directly. Therefore, additional desk research and conversations with colleagues are needed. Let us go through the model in detail now.

6.4 Summary of the chapter

Within this chapter we found an answer on the main question of this research: “In what way should Firm X make or buy the water system panels of the Product X of Firm X delivered from the Netherlands?”. Namely, it is advisable for Firm X to buy the Cabinet A with modules not relying on internal innovations, whereas for the Cabinet B and Cabinet C it is advisable to buy the cabinets including mounting plate, output canals, and cable trays. This desired situation can be achieved by contracting Supplier X as partner. Within the next chapter we identify if the employees of Firm X acknowledge this desired result and if they value the make-or-buy model as practically applicable on the cabinets.

7. Practicability of the model

In the previous chapter we identified the desired result based on the make-or-buy model. During this chapter we find an answer on question 2c: *"How do the employees of Firm X regard the findings of the literature?"* in order to check practicability of the make-or-buy model. Hence, this section detects if there exists any gap between the make-or-buy model and the vision of the employees about the make-or-buy decision. In section 7.1 the methodology of the chapter is discussed. Based on the executed adjustments on the make-or-buy model, propositions are listed in section 7.2. These propositions are listed to identify if the adjustments are acknowledged by the employees of Firm X. The results of these propositions are discussed in section 7.3. Lastly, a summary of the chapter is presented in section 7.4.

Recalling, this research aims to identify in what way Firm X should make or buy the cabinets of the Product X. In order to support the reasoning, a theoretical model is created. However, when completely focussing on a theoretical model, practicability of the model is not tested, which decreases the reliability of the model. Therefore, employees of Firm X are interviewed with the aim to increase the reliability of the adjusted make-or-buy model.

7.1 Interviews as methodology

To detect how the employees of Firm X regard the findings of the literature, five interviews are held with employees which represent four of the different layers of the fulfilment department: operational fulfilment, supply chain engineers, production, and water systems. Two representatives of the supply chain engineers were interviewed, since they were both interested in being a interviewee in this research.

The interviews not only aim to identify the opinion of the employees regarding the make-or-buy decision for the cabinets of the Product X, but also aims to identify if the added decision-moments (section 5.1 – 5.5) are acknowledged by the employees of Firm X. So, at first the interviewees are asked about their preferred operation method for the cabinets of the Product X and secondly their motivation for this preference is questioned. Thereafter, nine propositions are questioned to identify if they agree on the make-or-buy model. In total, this comes down to eleven interview questions. By questioning if the employees agree on the propositions and therewith the adjustments on the model (section 5.1 – 5.5), this research is able to identify if there exists a gap between the interviewee's preferred operation method and the justified operation method by the adjusted model. These results are interesting, first for identifying if they agree on the decision-moments which should be considered, according to the theory, for

determining the make-or-buy decision. Secondly, these results are interesting to detect if employees agree on the created model, but still regard an operation method other than the outcome of the model as their preferred operation method. By having that information distinctive links can be made e.g. the model is still incomplete or employees have some kind of misunderstanding or lack of knowledge about performing the make-or-buy decision.

In order to test the propositions of section 7.2, a combination of closed an open ended questions is used. Specifically, the propositions I, IV, and VII were asked via closed questions. The goal is to identify whether they believe the indicators should be included. In order to get a clear answer, yes or no responses are desirable. Hereafter the interviewee is questioned for their motivation. The interviews were executed following a structured manner, which leaves fewer space for extra information. This method is used, since the motivation for inserting the decision-moments can be explained by the presented literature and it is interesting to detect whether the employees acknowledge this literature in practice. In order to reduce the chance of sputter, and therewith to solely retrieve useful information, structured interviews with frequently closed questions are executed. All interviews are held in Dutch, because that is the main language on the Firm X office. Thereafter the Dutch manuscript of the interviews are coded in English via the method: transcribe, open coding, axial coding and selective coding (Dingemanse, 2017).

7.2 Composing nine propositions

First of all, the suggestions made and tested by Tayles and Drury are not considered in this research and assumed to be true. Since Tayles and Drury state:" *the model has significantly enhanced the way they look at the sourcing decision*". Hereafter is mentioned that some indicators might be missing. Consequently, solely the adjustments on the model are necessary to test. Thus, the propositions suggested in this section should correspond with the adjustments made in section 5.6. However, the firm specific requirements (flexibility, scalability, reliability, and profitability) are not based on theory, hence there is no literature to support those adjustments. Therefore, the requirements of the case firm are not be tested in this research. So, for the indicators flexibility and reliability no propositions are composed. This leaves us with four adjustments (5.1) asset specificity, (5.2) product property rights, (5.5) buy semi-finished, and lastly, (5.5) review trade-off. The adjustment to optimize readability by having distinctive colours for arrows representing a 'no' is not tested either. The goal of the propositions is to detect if the indicators are acknowledged by the employees of Firm X and if the indicators direct the tested product in the right way. When we know the employees acknowledge the indicators, we can assume the theory to be applicable in practice as well. More practical, two questions

should be identified by testing the propositions: (1) if the indicator should be in the model, and (2) if the indicator is located at the right place in the model. The results of this chapter are used for conclusion and discussion in this research.

Let us begin with asset specificity. In order to test whether the indicator should be included in the model the following proposition is composed:

I: Asset specificity is meaningful to discuss in the make-or-buy decision

Assuming asset specificity should be included in the model, subsequent the location in the model is questionable. Therefore, both outcomes of the model should be discussed. The moment asset specificity is answered 'yes' in the model asset specificity (4) directly points towards the terminal make (6), whereas with asset specificity (29) solely make ≤ buy cost (30) is questioned before making is advised as operation method. Thus, we see that it is advisable to produce asset specific products internally. Therefore the following proposition is composed:

II: The more asset specific the product, the more practical is internal production

Now we discussed 'yes' as answer on asset specificity in the model, next we discuss 'no' as answer for asset specificity. Regarding the model we see that asset specificity (4) points out to capital spend (5), whereas asset specificity (29) points out to tactical retention (44). So, when products are non-asset specific, extra barriers show up in the model to end at the buy terminal. Thus, when assets are not product specific, the decision to produce internally should be extra carefully considered. Therefore, the following proposition is composed:

III: The less asset specific the product, the more careful internal production should be considered

Now we composed propositions to check whether asset specificity should be included and if it is located rightly in the model, let us continue with the next indicator, product property rights. Firstly, the implementation of the indicator should be considered, so the following proposition is composed:

IV: Product property rights are meaningful to discuss in the make-or-buy decision

Assuming property rights should be included in the model, again the location should be questioned. Firstly, the answer 'no' on property rights is discussed. Since property rights (13) is only inserted before the terminal buy (15), not possessing product property rights make it more likely to end at the buy terminal. Therefore, the following proposition is composed:

V: Not possessing property rights make it more likely to outsource production

Contrary, when product property rights are available, the components to produce should be acquired (if possible) and the product should be produced internally. Accordingly, property rights (13) point towards can resources be acquired (16). Thus, the following proposition is composed:

VI: Possessing product property rights have a positive influence on the likeliness that making the product is the most suitable operation method

Since we composed propositions for the indicator product property rights, let us continue with the third adjustment which has to be discussed, inserting terminal buy semi-finished. Again, the implementation of the terminal should be considered, so the following proposition is composed:

VII: The terminal buy semi-finished is meaningful to discuss in the make-or-buy decision

Assuming buying semi-finished is meaningful to discuss in the make-or-buy-model, let us compile propositions to detect if it is located at the right place. The terminal buy semi-finished is implemented twice in the model. Although both are reached along the same sequence: ability to produce inhouse (which is logical when it is a core process), production is not secret, specialization improves quality, production time does not exceed six weeks, buying is cheaper than making, the product is dependent on internal innovations, and suppliers are able to customize production. Therefore, the following proposition is composed:

VIII: Firms should buy semi-finished products if they are able to produce inhouse, production is not secret, specialization does improve quality, production time does not exceed six weeks, buying is cheaper than making, the product is dependent on internal innovation, and suppliers are able to customize

Since buy semi-finished is a terminal and therefore does not contain a ‘yes’ and ‘no’ option, only one proposition has to be viewed to control for the right location. Thus, let us now continue with the last adjustment which has to be discussed, leaving out indicator review trade-off. Regarding the original model of Tayles and Drury, review trade-off is visible. This decision-moment has the function of revision of the answers given to end at the terminal acquire resources & make. The essence of this decision-moment is viewed as superfluous since every decision-moment should always be considered carefully and thus the decision-moment is left out of the model. Therefore the following proposition is composed:

IX: The indicator review trade-off is not meaningful to discuss in the make-or-buy decision

Since the indicator is left out of the scheme, the location is not questionable.

The nine propositions mentioned above are used in the next section to identify if employees of Firm X have distinctive thoughts about the make-or-buy decision for the cabinets of the Product X than theory suggests.

7.3 Interviewees do not align with the set indicators

Within this section the results of the five interviews are discussed. Recalling, the function of this section is to identify whether the employees of Firm X agree on the changes made within the make-or-buy model and to identify what their advice would be for the make-or-buy decision for the cabinets of the Product X. Herewith, gaps can be identified both: in the model (practical gaps) and at the employees (available knowledge gaps). This section solely provides the results of the interviews, however no value proposition is given yet. Within section 7.4 let us provide a judgement on the results. The interviews are executed along with the propositions listed in section 7.2. When both advised outcomes (model in section 5.6 and interviews in section 7.3) are stated, the differences can be discussed. Therewith can be concluded if the model has practical support, or lacks an indicator, or if employees should be informed about indicators which should be considered during a make-or-buy decision. The conversations are recorded and open coded. Hereafter, the open coded interviews are coded axial and selective. Based on the selective codes the figures in this section are created. To improve readability, the specific figure is placed next to the text where the figure is discussed.

Firstly, let us discuss Figure 7.1. As visible, all the interviewees were more or less concise about their advised operation method. All interviewees at least mentioned that outsourcing would be their preference for the cabinets of the Product X. However since Firm X in some instances produces specialized cabinets for customers, one interviewee argued to produce specials internally whereas another interviewee argues to buy semi-finished cabinets for the specials.

The motivations for the advises of Figure 7.1, is reduced to four distinctive sections: less work effort, money, quality, and adaptability. Hence can be stated that the interviewees believe outsourcing is the most appropriate operation method for the of the Product X, since it reduces

their work effort, saves costs, increases the quality of the cabinets, and lastly outsourcing enables Firm X to adapt on alternating periods of demand.

Now we know the vision of the interviewees regarding the make-or-buy decision for the cabinets of the Product X. Let us take a look at the propositions. Starting with the first proposition:

I: Asset specificity is meaningful to discuss in the make-or-buy decision

In Figure 7.3 the results of the interviews are displayed regarding the importance of

asset specificity in the make-or-buy model. Visible is the dispersion of the interviewees. Where three interviewees believe asset specificity is worth considering, two interviewees do not agree on considering asset specificity in the make-or-buy decision. Hence, based on the interview, no unambiguous answer regarding the first proposition can be given.

The second proposition discussed is:

II: The more asset specific the product, the more practical is internal production

In Figure 7.4, the results of the effect of asset specific products on the make-or-buy decision are shown. Since two out of five interviewees did not regard asset specificity as worth considering, the author did not ask for their vision regarding the effect of

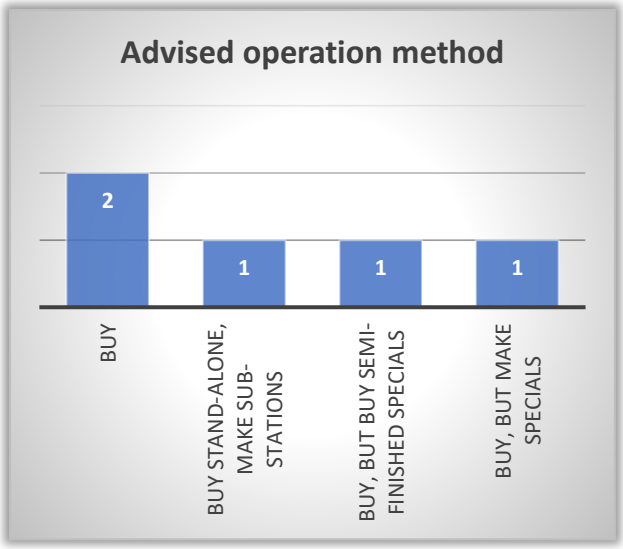


Figure 7.1: Result interview question 1

Figure 7.2: Result interview question 2

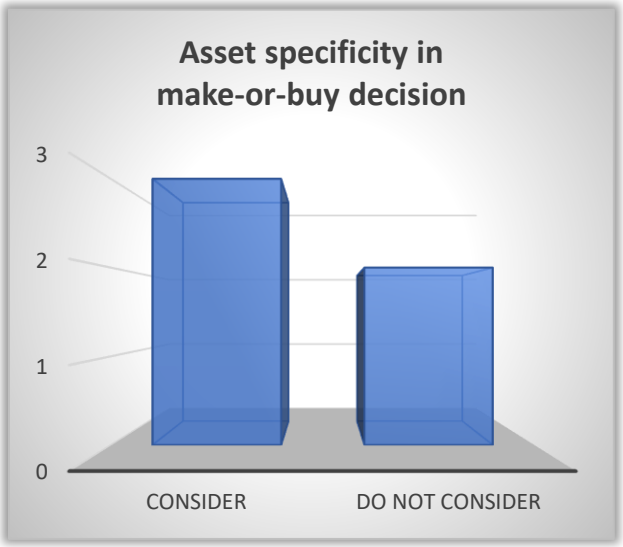


Figure 7.3: Result interview question 3

specialistic and non-specialistic assets. Regarding Figure 7.4, two out of three interviewees mention that products with specific components should be produced internally in correspondence to the proposition. Therefore, can be stated that the interviewees do mostly agree on the set proposition.

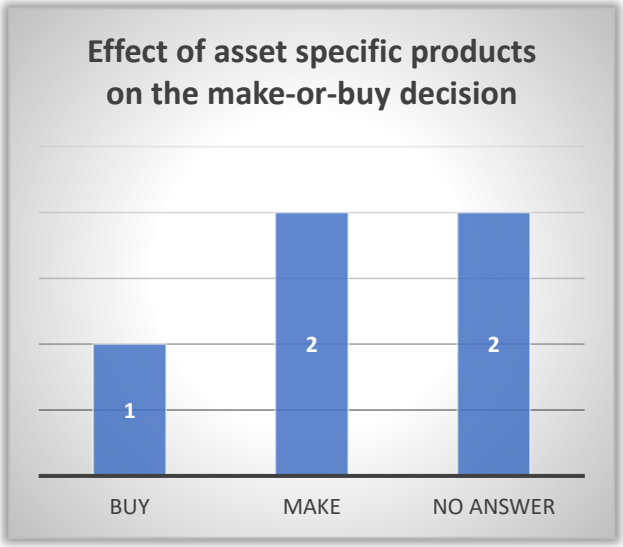


Figure 7.4: Result interview question 4

Identical to question 4, for question 5 solely the three interviewees arguing asset specificity is worthy to consider in the make-or-buy decision are questioned. So,

now let us show the result of the third proposition:

III: The less asset specific the product, the more careful internal production should be considered

Figure 7.5 reveals that the interviewees have varied visions regarding the effects of non-specialistic components on the make-or-buy decision. Therefore, the second proposition cannot be answered with certitude. Let us elaborate on this result in section 8.2. The following propositions is about product property rights:

Figure 7.5: Result interview question 5

IV: Product property rights are meaningful to discuss in the make-or-buy decision

Displayed in Figure 7.6 is the outcome of the interviews. Visible is that 60% of the interviewees do believe product property rights are meaningful to discuss in the make

-or-buy decision, whereas 40% does not see the meaning of valuing product property rights. Therefore can be stated that no concise answer can be given regarding this proposition.

Next, let us discuss the following proposition:

V: Not possessing property rights make it more likely to outsource production

In Figure 7.7 the results of the interviews are shown. Visible again is the dispersion of answers from the interviewees. Where two interviewees do not agree on this proposition, two agree and one totally agrees on this proposition.

Continuing, the sixth proposition is discussed, namely:

VI: Possessing product property rights have a positive influence on the likeliness that making the product is the most suitable operation method

Obvious, in Figure 7.8, is that the interviewees disagree on the proposition that having property rights forces firms to make the patented product.

The following proposition discussed is:

VII: The terminal buy semi-finished is meaningful to discuss in the make-or-buy decision

In Figure 7.9 an analogous answer of the

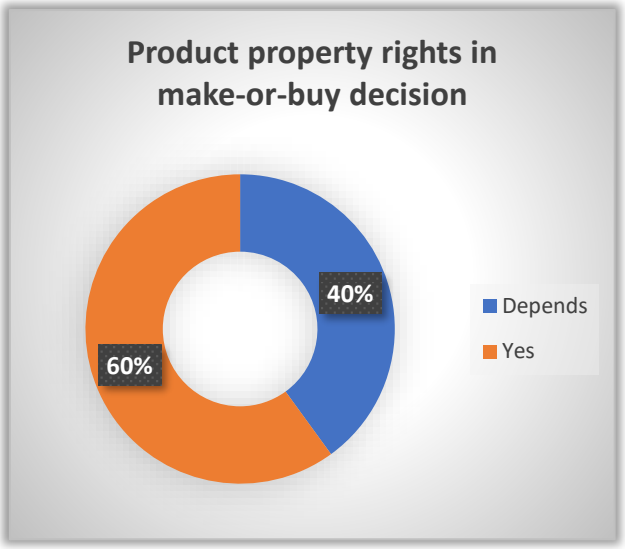


Figure 7.6: Result interview question 6

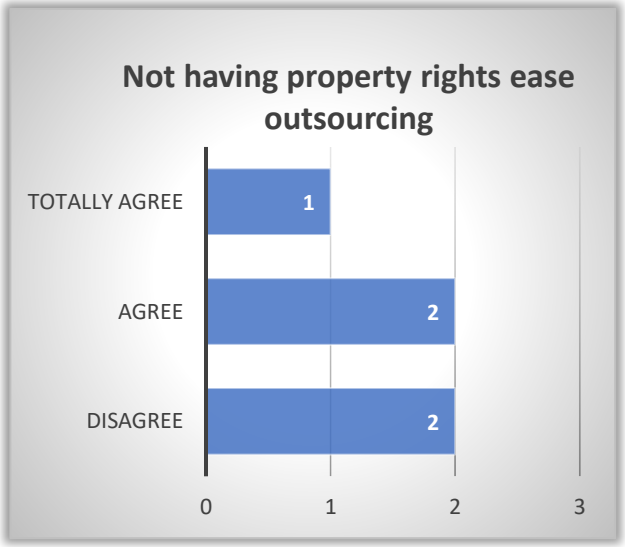


Figure 7.7: Result interview question 7

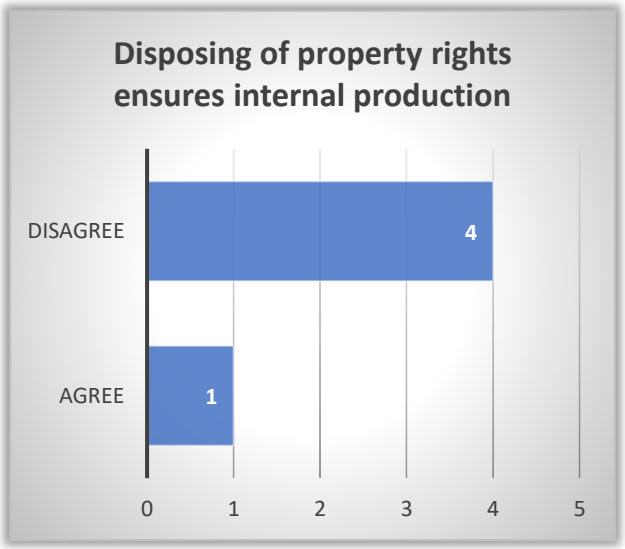


Figure 7.8: Result interview question 8

interviewees is visible. All interviewees do believe buying semi-finished goods to be meaningful to consider in the make-or-buy decision. This result is corresponding with the listed proposition and therefore we can assume the terminal buy semi-finished to be an useful addition in the adjusted model.

The next proposition sketches situations in which the terminal buy semi-finished is suitable according to the interviewees. Since all interviewees value the terminal buy semi-finished products as meaningful, all interviewees pictured situations in which they found it meaningful. Therewith, they give a response on the following proposition:

VIII: Firms should solely buy semi-finished products if they are able to produce inhouse, production is not secret, specialization does improve quality, production time does not exceed six weeks, buying is cheaper than making, the product is not dependent on internal innovation, and suppliers are able to customize

The responses in the interviews are summarized to the following situations: ability, supply base, uncomplicated work, money, quality, and uniformity. Here we can see that some of the indicators in the proposition are acknowledged by the interviewees, namely: ability, money, and quality. The response not matching the make-or-buy model, are: uniformity,

Figure 7.9: Result interview question 9

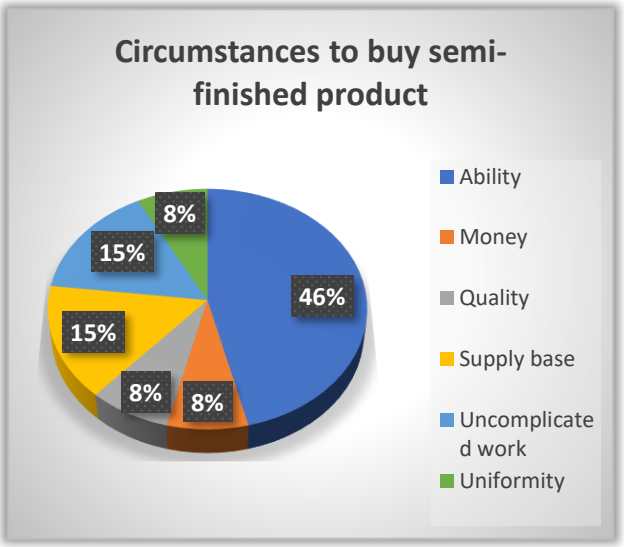


Figure 7.10: Result interview question 10

uncomplicated word and supply base. Where supply base might have some connection with internal innovation (since it is easier to outsource products of the supply base which are not dependent on internal innovations) uncomplicated work and uniformity as reasoning to buy semi-finished goods is not supported. Additionally, the interviewees did not mention product secrecy, production time, external innovation, and ability to customize as reasons for buying semi-finished goods, where the make-or-buy model (Model 5.1) does regard these indicators. Surprising is that the interviewees did not mention any of the indicators the manager fulfilment wanted to regard in the make-or-buy decision.

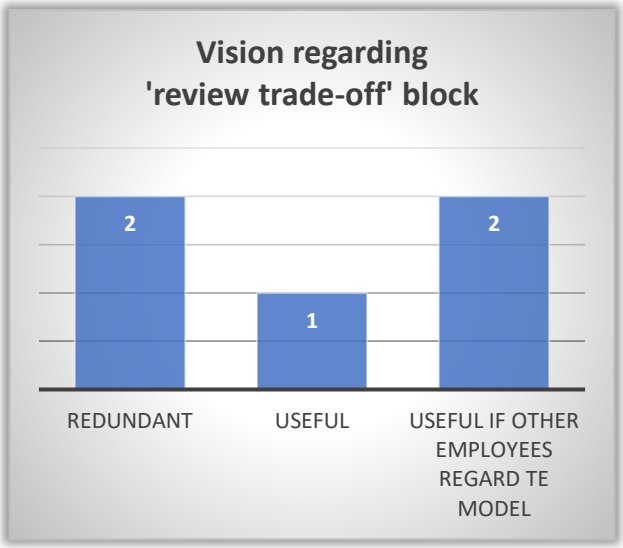


Figure 7.11: Result interview question 11

The last proposition to discuss is the following:

IX: The indicator review trade-off is not meaningful to discuss in the make-or-buy decision

In Figure 7.11 is visible, that only one interviewee found it useful to implement the block 'review trade-off', as it is used by Tayles and Drury, in the model. However two interviewees argued that it is solely useful when another employee regards the model and preferably an employee with other concerns.

7.4 Valuing the results

Concluding, it is clear there is quite some disagreement between the desired result, determined via the make-or-buy model, and the vision of the employees of Firm X. Contradicting to the findings of the literature, the interviewees would mainly like to outsource the full cabinets of the Product X. Because they expect outsourcing would improve their adaptability, reduces their work effort, saves costs and improves quality. Additionally, interviewees do not give a concise answer regarding the implementation and effects of asset specificity and product property rights on the make-or-buy decision. Corresponding to the literature, the interviewees do regard buying semi-finished goods as a production method. But the mentioned circumstance to buy semi-finished goods is slightly different than is mentioned in the literature. Lastly, some employees do regard the block review trade-off as useful, but in another role.

7.4.1 It is not advisable to buy the cabinets

Let us first discus the difference in the preferred operation method. When we take a closer look at the adjusted model (Model 5.1), we can conclude, price differences and relying on internal innovation withheld the cabinets to end at terminal buy (15), since property rights are not in to play and the supplier is able to customize production. Concluding, the friction between the results of the make-or-buy model and the employees of Firm X is solely based on the consideration of price and internal innovation.

Firstly, they believe that outsourcing is cheaper than making seems not to be true (based on the information we got from suppliers). Previously we identified the cost price to increase when production is outsourced.

Proceeding with internal innovation, remarkable is that no interviewee mentioned internal innovation as motivation for their advised operation method or circumstances for buying semi-finished products. Hence the indicator internal innovation is not valued by the employees of Firm X.

If we take a closer look to valuing internal innovation in the make-or-buy decision, internal innovation is inserted, since section 3.2 explained the following: "*However, this operation method still partially contains the disadvantages of not maintaining secrecy of production, and ignoring market developments.*" Where 'this operation method' refers to buying semi-finished goods. Especially, the last part of the citation is of importance. The disadvantage of buying semi-finished goods is, among others, that market developments are partially ignored. So, buying the product is most advisable for reacting on market developments. However, market developments can be ignored when your internal innovations are leading to the market innovations. So, products which rely on internal innovation are not advisable to be outsourced. Therefore, decision-moment internal innovation directs products relying on internal innovation towards buying semi-finished goods. Since it reduces the disadvantage of ignoring market innovations if modules relying on market innovations are bought and modules relying on internal innovations are made.

Now we know the theoretical reason for implementing internal innovation in the make-or-buy model, let us look if the source of innovation practically applies to the situation of the cabinets of the Product X. When the research and development department innovate the cabinet it is, for example, imaginable the voltage for the control computer changes. Since such innovations are figured out internally, thus not available to the market, it could be the case the firm, to which is

outsourced, is not able to manage those innovations in a renewed cabinet. Secondly, internal innovations are directly exposed to other firms, which is not preferential.

So, the theoretical framework emphasizes the importance of valuing the source of innovations in the make-or-buy decision. Moreover, we can state that the valuation of the source of innovation also applies to the make-or-buy decision for the cabinets of the Product X.

Since cost increase and internal innovation is important to regard in the make-or-buy decision, I do not prefer to buy the cabinets.

7.4.2 Decision-moment asset specificity is useful in the make-or-buy decision

In Figure 7.3 is visible that two out of the five respondents do not value asset specificity as valuable in the make-or-buy decision. However, as respondent 2 mentions, Firm X works on smart customization. Smart customization is executed by the water system department of Firm X. What they practically mean with smart customization is, changing water products so that components can be used in many products. As respondents 2 mentions, smart customization actually corresponds to asset specificity. So, Firm X already works on reducing asset specific products, because it eases production and reduces mistakes at the administration. So, we can mention asset specificity to be useful in the make-or-buy decision.

7.4.3 Decision-moment product property rights is not applicable on the cabinets

Now we regard the propositions of product property rights (proposition IV,V, and VI). Again, three out of the five interviewees should consider product property rights, an equal number to asset specificity. Which is not convincing to confirm the proposition. On the fifth proposition the results are slightly positive, however the sixth proposition is more notable, because four out of the five interviewees do not agree on the proposition. This contains that the interviewees do not agree on the essence that firms having product property rights always should produce internally. When reconsidering this proposition applied on Firm X, the argumentation of the interviewees is understood. Since Firm X has product property rights in software, this can never be copied by external parties, because it is well protected via source codes. Therefore, the property right theory is not applicable in this case of the cabinets of the Product X. Hence, for the cabinets of the Product X, product property rights are not considered. However, since this research aims to provide a make-or-buy model for Firm X, which is applied on the cabinets of the Product X, other products may be tested with this model. Since not all products of Firm X have product property rights in software, it is important to insert the decision-moment product property rights in Model 5.1.

7.4.4 The terminal buy semi-finished products is useful in the make-or-buy decision

In Figure 7.9 we can see that the employees mention the option to buy semi-finished products as useful in the make-or-buy decision. Since this results corresponds to the literature, we can assume the implementation of the terminal buy semi-finished products as useful. When looking at the situations in which the employees regards buying semi-finished goods as useful, differences to the literature appear. Where the interviewees value: ability, supply base, uncomplicated work, money, quality, and uniformity as indicators to consider buying semi-finished goods, the literature and the manager fulfilment value: ability, product secrecy, quality, production time, costs, source of innovation, and customization as indicators to consider. So, ability, costs and quality overlap, but supply base, uncomplicated work, and uniformity are not valued by the literature. Furthermore, product secrecy, production time, source of innovation and customization are not mentioned as indicators by the interviewees. The three indicators of the interviewees not covered by the literature, do not seem valuable to the author as additional indicators, since no supportive data is available. The indicators: product secrecy, production time, source of innovation, and customization are acknowledged by the literature and management, but are not mentioned as indicators by the interviewees. Although, production time and customization are defined by the management, they are not clear for the executives. Furthermore, product secrecy is valued by the author as an indispensable indicator, so it is retained. However, the disagreement on property rights is acknowledged as explained in section 7.4.3.

7.4.5 Changing the function of the box review trade-off

The last proposition regarded the availability of the block ‘review trade-off’, which is left out of the adjusted model. Even though some interviewees agreed on the redundancy of the block, another advice came forward as well. Two interviewees mentioned that the block could be useful if other employees and preferably employees with other concerns review the result of the make-or-buy model separately. This argumentation is acknowledged by the author. However, reviewing the model should not solely be done when approaching terminal ‘acquire resources and make’, but in any case. Since adjusting the operation method in a non-advisable manner could have a dramatic impact for firms.

7.5 Summary of the chapter

Within this chapter we composed nine propositions in order to check whether the employees of Firm X support the changes made in the make-or-buy model. Hereafter these propositions are tested and the results are displayed in section 7.2. Based on these results we can state that there

is disagreement between the results of the literature review and the opinion of the employees of Firm X. Firstly, the employees of Firm X advise to buy the cabinets, whereas the desired situation based on the make-or-buy model is to buy semi-finished cabinets. The advice of the employees to buy the cabinets seems not preferential, because buying results in increasing costs and internally discovered innovations are revealed to the market. Furthermore, the proposition to value asset specificity in the make-or-buy decision is not approved by the employees. However, the water system department is already busy with redesigning products to ensure components can be used in multiple product. The underlying reason for 'smart customization' is to improve the production process and reduce mistakes at the administration. Due to the acknowledged advantage of non-asset specific products, we can mention that asset specificity is important to value in the make-or-buy decision. Another contradiction to the theory appeared when we were not able to confirm the propositions of product property rights. The Product X has product property rights on software and this software is protected against copying. Thus, in cases like the Product X, products with property rights can be outsourced. Since the indicator is of importance is cases where product property rights are not protected against copying, it is not deleted in the make-or-buy model. But when using the make-or-buy decision, the argumentation that products protected against copying can be outsourced. Within section 7.4.4 we concluded that buying semi-finished goods is useful as terminal in the make-or-buy decision. However, the employees of Firm X mention: supply base, uncomplicated work, and uniformity as indicators to buy semi-finished goods. Since no support for these three indicators is found, they are not implemented in the make-or-buy model. Lastly, we concluded that it is useful if other employees and preferably employees with other concerns execute the make-or-buy model separately.

In the next chapter we continue on the valued results by listing the available gaps between make-or-buy model and the vision of the employees of Firm X. So, we use the information that buying the cabinets of the Product X is not advisable, asset specificity should be considered in the make-or-buy decision, product property rights should not always be considered in the make-or-buy model, buying semi-finished goods as terminal is good to consider in the make-or-buy model, and employees with different concerns should execute the make-or-buy model before blindfolding on a single result.

8. Improvements for the current situation

Within this chapter we regard what gaps are available which withheld Firm X from reaching their desired situation. When we know the available gaps and how the gaps can be remedied, the desired situation can be implemented. In section 8.1 the methodology for this chapter is discussed. In section 8.2, we first find an answer on question 3a: *"What gap is observed which withheld Firm X to reach the desired situation?"*. Hereafter, in section 8.3, question 3b: *"How can the observed gap be bridged?"* is discussed. In section 8.4 we give a summary of chapter. This chapter solely provides the method and results to bridge the observed gap, however no value proposition is give yet. Within the next chapter we provide a judgement on the results. If you are solely interested in a concise list with instructions for change, see chapter 11.

8.1 Desk research as methodology

In order to identify available gaps, let us firstly use the current situation for comparison with the desired situation. Hereafter, the results of the interviews, displayed in section 7.3, are compared with the desired situation in order to observe additional gaps which are not directly visible in the current situation. Then, the researcher proposes solutions to bridge the observed gaps. So, we use the information identified in chapter 2.2, and 7.4 to observe and bridge the gaps.

8.2 Four gaps are observed

Recalling section 2.3, we concluded that currently Firm X buys semi-finished cabinets. More specific, Firm X buys the cabinet including mounting plate, but makes all other modules. Furthermore is mentioned that Firm X handles make-or-buy decisions by delegating the choice to a multidisciplinary team whom regard the regularity of the purchase in combination with delivery time, price differences, MOQ, and production speciality.

The second gap observed is about the indicators which should be considered in the make-or-buy decision. Currently, a multidisciplinary team executes the make-or-buy decision based on: regularity of the purchase in combination with delivery time, price differences, MOQ, and production speciality, whereas Table 4.1 lists different indicators which should be considered

in the make-or-buy decision. Solely the indicators delivery time, price differences, and production speciality are covered in Table 4.1. Contra, currently during executing the make-or-buy decision, Firm X does not regard: asset specificity, uncertainty, needed knowledge, available knowledge, property rights, and scalability.

So, between the current situation and the desired situation two gaps are observed. However, between the results of the interviews and the desired situation additional gaps are observed.

Clear is that all interviewees have their preference in outsourcing the fully equipped cabinets. Their motivation is that outsourcing fully equipped cabinets would improve adaptability, reduces their work effort, is cheaper, and improves the quality of the cabinets. Positive is that adaptability, costs and quality are indicators which are also considered in the adjusted model. However, it is remarkable that reliability and flexibility are key indicators for the management, but these indicators are not acknowledged by the interviewees. Furthermore the interviewees considered little decision-moments, where for example the decision-moment ‘core process’ was not even mentioned in the interview. Hence, it seems indicators for the make-or-buy decision are not clear to the interviewees and, even more shocking, their argumentation is not even in line with the management. This observed gap between the results of the interviews and the desired situation is also observed between the current situation and the desired situation. Furthermore, the employees of Firm X mentioned: supply base, uncomplicated work, and uniformity as indicators to buy semi-finished, however no motivation can be found for implementing these indicators. So, we found extra motivation for the availability of the first two observed gaps.

The third observed gap is that the decision-moment product property rights is different in practice. The property right theory states products with property rights should always be produced internally to be protected against copying. However, during the interviews is identified that Firm X has product property rights on software, but this software can never be copied due to source codes. Hence outsourcing should not be problematic.

The fourth observed gap is that it is functional for a multidisciplinary team to execute the make-or-buy decision individually. This gap is observed during the interviews. At first the author deleted the block ‘review trade-off’, however two of the respondents mentioned in could be functional, but in another role. If a multidisciplinary team, consisting of employees with different concerns, executes the make-or-buy decision individually, subjectivity is filtered out of the make-or-buy decision.

8.3 Informing employees is fundamental to bridge the observed gaps

Basically, the first two observed gaps can be remedied by the same solution. Hence, let us discuss the two gaps together. To ensure the desired situation is implemented, the employees should acknowledge the underlying motivation for the desired situation. Hence, the weighted indicators should be presented and explained towards a multidisciplinary team which executes the make-or-buy decision. Solely when this multidisciplinary team is inspired about the weighted indicators of this research, they will use the adjusted model for executing the make-or-buy decision. Consequently, both gaps can be bridged. Since acknowledging the indicators of the make-or-buy decision ensures the multidisciplinary team to use the model, and thus to find the same desired situation. When the desired situation is acknowledged by the multidisciplinary team, Firm X is able to implement this desired situation.

The third identified gap is, product property rights should not be considered when product is protected against copying. So, this gap is not applicable on the case company, but has its interest in the adjusted model in section 5.6. This gap can be bridged by mentioning that the decision-moment property rights should be considered with care and does not fit for all products. Solely products were duplication is possible when production is outsourced should be regarded here.

The fourth and last gap is, the block ‘review trade-off’ is more useful than was considered by the author in the first place. Clearly, this gap does not involve the case company, but regards the adjusted model. Since the block was left out of the model of Tayles and Drury, but some interviewees came up with great input, it convinced the author to view the block in another perspective. Moreover, this gap can be bridged by informing the readers of this research that multidisciplinary discretion has to be in place before applying a specific operation method. Resulting, parallelism increases the reliability of the conclusion of the make-or-buy model. Having multidisciplinary parallelism invalidates the statement of Ford and Farmer (section 2.2): “The make-or-buy decision is generally not taken with a strategic perspective, but with a subjective opinion.” So, it is advisable to compose a multidisciplinary team which executes the make-or-buy decision individually.

8.4 Summary of the chapter

Summarizing, four gaps are observed:

1. The current operation method is not advisable
2. The make-or-buy decision is executed based on weak indicators

3. Product property rights should not be considered in case a product is protected against copying
4. Reviewing the make-or-buy model by a multidisciplinary team reduces the subjectivity and improves the result.

These gaps can be bridged by:

1. Informing the multidisciplinary team about the indicators which are recommended to consider during the make-or-buy decision
2. Informing the multidisciplinary team that the indicator product property rights should not be considered in case a product is protected against copying via source codes
3. Composing a multidisciplinary team where functions are represented which are specialized in at least one decision-moment of the make-or-buy decision

We use the solutions to bridge the observed gaps in the next chapter, were we conclude the key findings of this research and show the practical implementations of the key findings.

9. Analysis of the gathered data

In this chapter, the key findings of this research are discussed. This study aims to investigate in what way it is advisable for Firm X to make or buy cabinets of the Product X produced in the Netherlands. In order to achieve this, a theoretical model is adjusted based on the five ground theories for the make-or-buy decision. To test the adjustments, nine propositions are composed. Those propositions are tested by executing interviews with five employees of Firm X who have a direct connection with the make-or-buy decision. Additionally, the current and desired situation of Firm X for executing the make-or-buy decision is investigated. Based on the desired situation, which is retrieved from the adjusted model, gaps are identified which Firm X should bridge to reach their desired situation. In this chapter, firstly the key findings are listed. Thereafter, the practical implementations of the key findings are discussed. These practical implementations are a subjective advise from the author.

9.1 Key findings of this research

Recalling, the main question of this research is:

"In what way should Firm X make or buy the water system panels of the Product X of Firm X B.V. delivered from the Netherlands?"

For Firm X it is advisable to buy semi-finished cabinets of Product X.

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The second key finding reveals that four gaps are observed in the current situation which withheld Firm X to reach the desired situation, namely:

1. The current operation method is not advisable
2. The make-or-buy decision is executed based on weak indicators
3. Product property rights should not be considered in case a product is protected against copying
4. Reviewing the make-or-buy model by a multidisciplinary team reduces the subjectivity and improves the result

The third key finding is that the make-or-buy model theoretical is justified, however practically the make-or-buy model is not supported by the employees of Firm X. More specific, no decisive answer is given by the employees of Firm X on the consideration of property rights and asset specificity in the make-or-buy decision for the cabinets of the Product X. The doubts about product property rights as decision-moment are acknowledged by the author, since products can be protected against copying via e.g. source codes. But, the consideration of asset specificity in the make-or-buy decision is valued by the author as indispensable, since asset specific products should be internalized (to reduce risk).

9.2 Practical implementation of the key findings

In order to make the key findings palpable, this section specifically explains the manner to practical implement the stated key findings. Thus, this section can be seen as a guide which explains practically how to effectuate the key findings.

Additionally the multidisciplinary team does not consider the right indicators for the make-or-buy decision. Hence, it is advisable that the entire department is informed via a seminar. During this seminar, all the attendees should be informed about the requirements of Firm X's production. These requirement should be part of the corporate culture and therewith have to be admired by the employees of the fulfilment department. Therefore, these requirements should be expressed as corporate values. Practically, these requirement can be presented via a presentation, but visible and practical aspects should be inserted in the presentation in order to feel the four requirements. Besides the seminar about the requirements, solely the employees who have the power to execute make-or-buy decisions within Firm X, should be informed about all the specific indicators to consider when executing a make-or-buy decision, which are: strategic resource, asset specificity, uncertainty, needed knowledge for production, available knowledge in the firm, product property rights, flexibility, scalability, reliability, and profitability.

The second key finding is the gap analysis, explained in chapter 8. In the gap analysis, we again showed that it is advisable for Firm X to regard other indicators in the make-or-buy decision. But, another key finding, observed in the gap analysis, is that Firm X should compose a multidisciplinary team whom execute the make-or-buy decision individually and hereafter compares the outcomes. Within this multidisciplinary team, functions should be represented which dispose over specialized knowledge of at least one decision-moment of the make-or-buy model. Practically the following functions should be represented in the multidisciplinary team: manager fulfilment, manager production,, manager supply chain engineers, business controller finance, supply chain engineers, marketing manager, quality engineer and quality engineer. Prior to the meeting, the specific employees should provide the others of the multidisciplinary team with the needed information, so everyone is able to answer all decision-moments. In appendix V, a script is listed for the execution and needed functions for the make-or-buy model.

The third key finding is that the make-or-buy model is theoretical justified, but it is not fully supported by the employees of Firm X. We identified asset specificity and product property rights lack practical support of the interviewees. Hence, these indicators should be considered consciously. It is recommended to test the adjusted model first on a non-core product to identify if the advises work in practice. So, before applying the make-or-buy model on all products, Firm X should start by testing single products with little financial consequences.

These three aforementioned practical implementations are further discussed in chapter 11. But first the limitations of the research and recommended future research are discussed in the following chapter.

10. Analysis of the boundaries

Since we discussed the conclusions of this research, now let us elaborate the other side of the coin. Therefore, this chapter first evaluates the limitations of this research. Hereafter suggestions are provided for further research.

10.1 Limitations of the research

The first limitation lies in the theoretical framework of this research. Notably, five theories (ground theories) are selected as basis to certify the practical requirement for the make-or-buy decision. Hence it could be the case that more indicators should be considered in the make-or-buy decision, which are not considered in this research.

The second limitation has its origin in the adaptions made on the original model of Tayles and Drury. Since, the selected indicators are valued by plusses and minuses. However, those reviews contain subjectivity. Hence, this limitation could involve indicators are valued positive, where the influence in the model is too little (single plus). Because of the positive review, no changes regarding that indicators have been made in the model.

The third limitation is forthcoming from the previous limitation. Since solely the indicators derived from the literature are tested, the decision-moment in the original model are assumed to be true. Little decision-moments are eliminated from the model.

The fourth limitation regards the adjusted make-or-buy model in this research. Namely, the decision-moments in the adjusted make-or-buy model are located where the author believed they function the best. Even though, the location is questioned during the interviews we cannot provide a decisive answer since no scientific studies are performed to clarify the location in the model. Resulting, it could be the case some decision-moments are located false.

The fifth limitation involves the writing process. During the research process, developments regarding the situation of the cabinets for the Product X continued. Hence, this research encloses data issues. Especially the current situation is subject to this limitation and should therefore be considered with care.

The sixth limitation approaches the measurement in this research. The propositions are tested on only five interviewees. Furthermore, not all of the interviewees are in the power to execute the make-or-buy decision for Firm X. However, selection is chosen, because they all have an affection with the make-or-buy decision and a wide variety of visions is generated in this manner.

The seventh limitation derives from the approached suppliers. All the data from the suppliers were retrieved via the purchasers. Hence, no market research is executed to identify if suppliers are available whom e.g. calculate cheaper prices. So, no definitive answer can be given about the most suitable supplier. Additionally, the market fluctuates constantly, so it could be the case new suppliers enter the market, or prices change over time. Therefore, the practical implementation of this research should be reviewed regularly.

Although this research does contain limitations, they are surmountable. Since quantitative research is able to enclose the rightful indicators it eliminates limitation 1, 2, 3, 4, and 6. How the limitations specifically can be eliminated is discussed in the following section.

10.2 Future research

Because of the limited time frame of this research, qualitative research is executed. However gathering quantitative data from both, within the firm and outside the firms' borders, would have enabled this research to produce a more reliable outcome. In more detail, future research should be executed by testing via structural equation modelling (SEM). Analysing the indicators via this method would generate a definitive answer about the exact indicators of the make-or-buy decision. Since firm specific indicators play a special role, the model should be generated by data from both within and outside the borders of Firm X.

Second, additional research should be performed on the suppliers. Extensive market research would improve the possibility of finding the right conclusion on specific decision-moments, e.g. decision-moment make $\leq$ buy cost. When additional market research is executed, the reliability of the answers for the decision-moments and therewith the conclusion of this research improves.

11. Instructions for change

This research investigated in what way it is advisable for Firm X to make or buy the cabinets of the Product X. Within the conclusions, the key findings of the research are listed, thereafter the practical implementation of the research are provided. Since those sections function as detailed explanation, this chapter lists the forthcoming recommendations from the key findings and practical implementation.

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Secondly, it is advisable to inform the multidisciplinary team whom execute make-or-buy decisions about the indicators which cover the make-or-buy decision. Solely when the multidisciplinary team acknowledges the applied indicators, they will use the model as handguide for other products of Firm X.

However, to mitigate the risk of shortcomings in the model, the third recommendation is to apply the model on some products which do not have radical effects on the financial well-being of the firm. The moment practical shortcoming are identified, it is recommended to improve Model 5.1. Consequently, the make-or-buy model will be practically accepted and useful to apply on strategically more risky products.

The fourth recommendation arises from the results of the interviews (section 6.3). Since the box review trade-off was valued as superfluous, but some interviewees explained it could be useful to test the outcome at different employees with distinctive concerns. So, Firm X should compose a multidisciplinary team which executes the make-or-buy decision individually. We mentioned before that Firm X already executes the make-or-buy decision in a multidisciplinary team, however little functions are represented. So, in appendix V, a script is displayed for the functions which should be involved in the make-or-buy decision. Visible, in appendix V, each function is linked towards at least one decision-moment. Upfront, information should be spread towards all involved functions. Then, every employee should apply those information on the make-or-buy model. Hereafter the involved functions should meet to discuss their outcome.

Fifthly, recommended is to use the make-or-buy model as guideline for products where the competitive advantage for Firm X can be improved. So, for example, spending effort to investigate the make-or-buy decision for a screw is a waste of time. Hence, solely products which have a direct influence on gaining competitive advantage should be tested on the make-or-buy decision.

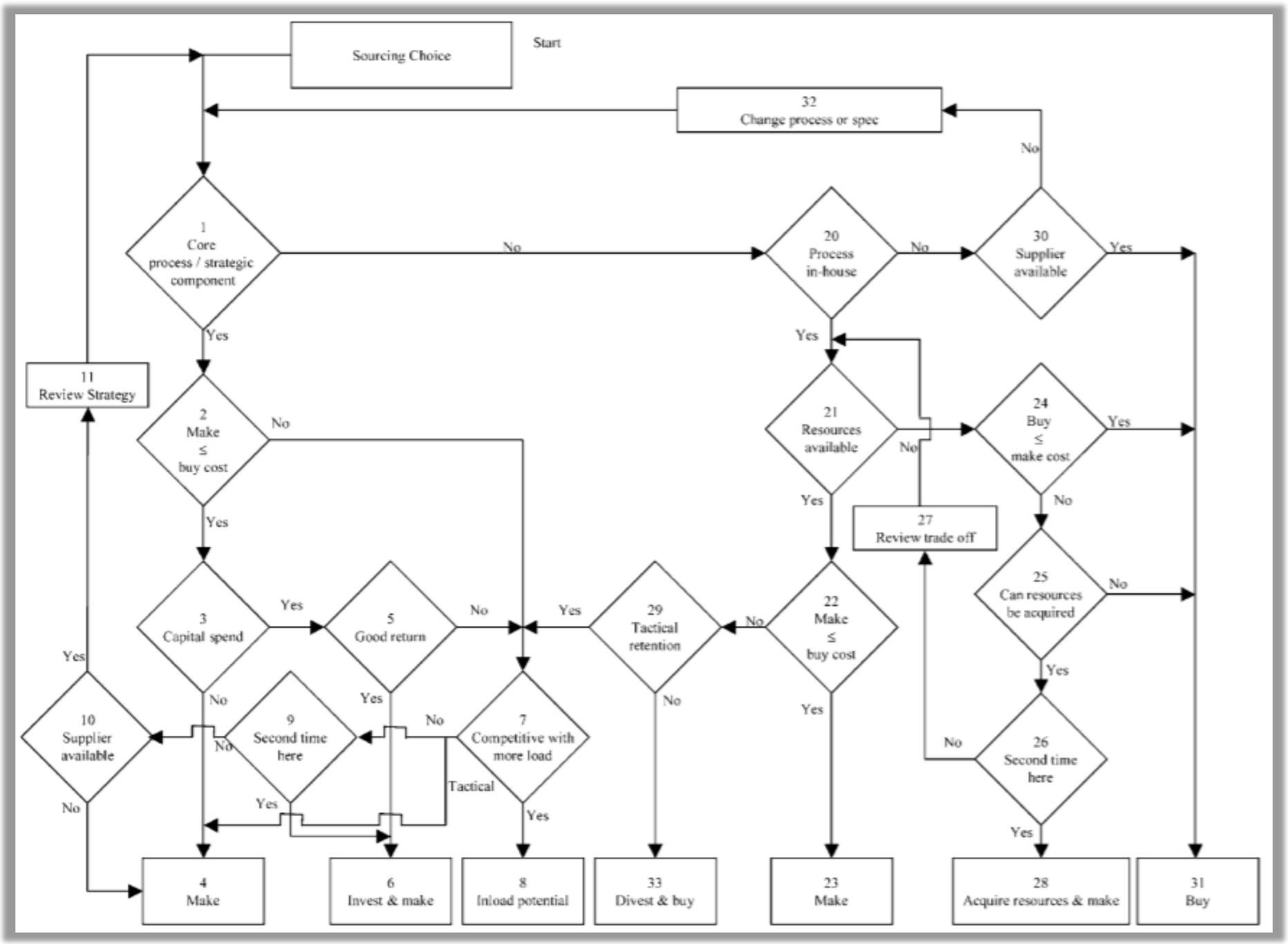
Sixthly, we recommend to review products yearly via the make-or-buy model. Especially in the technology the market changes rapidly (Shen et al., 2014). Market changes have direct influences on prices and competitors. Hence, it is important to review the make-or-buy decision regularly. Padgett and Mulvey (2007), advise to review strategic positions yearly.

12. Appendices

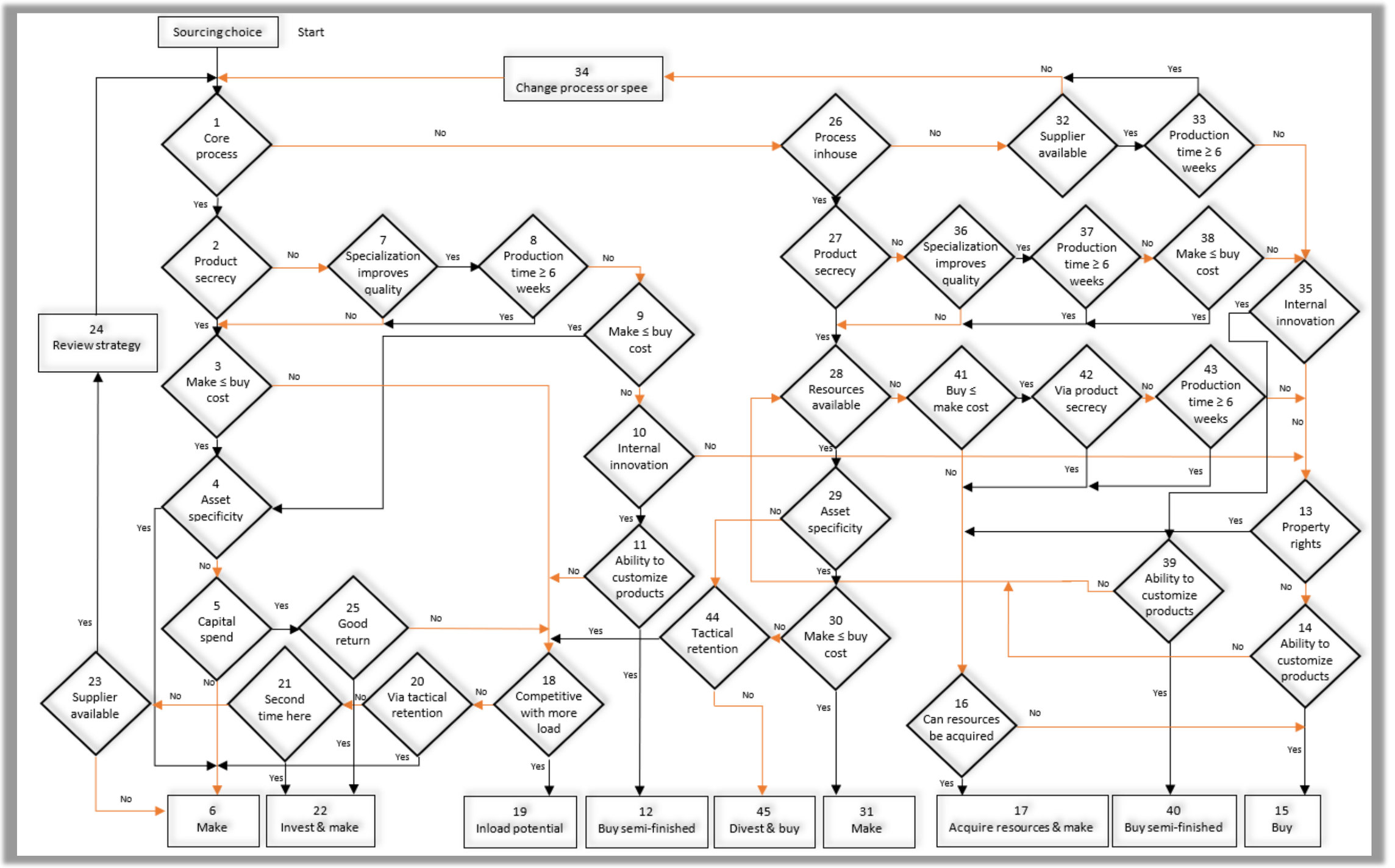
Appendix I: Planning

Chapter	section	period																			
		week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10	week 11	week 12	week 13	week 14	week 15	week 16	week 17	week 18	week 19	week 20
1. Introducing the problem																					
	1.1																				
	1.2																				
	1.3																				
	1.4																				
	1.5																				
	1.6																				
	1,7																				
	1.8																				
	1.9																				
	1.10																				
2. Identifying the current situation (IST)																					
	2.1																				
	2.2																				
	2.3																				
3. Literature regarding the make-or-buy decision																					
	3.1																				
	3.2																				
	3.3																				
	3.4																				
	3.5																				
4. Selecting existing models																					
	4.1																				
	4.2																				
	4.3																				
5. Adapting the selected model																					
	5.1																				
	5.2																				
	5.3																				
	5.4																				
	5.5																				
	5.6																				
	5.7																				
6. Identifying the desired situation (SOLL)																					
	6.1																				
	6.2																				
	6.3																				
	6.4																				
7. Practicability of te model																					
	7.1																				
	7.2																				
	7.3																				
	7.4																				
	7.5																				
8. Improvements for the current situation																					
	8.1																				
	8.2																				
	8.3																				
	8.4																				
9. Analysis of the gathered data																					
	9.1																				
	9.2																				
10. Analysis of the boundaries																					
	10.1																				
	10.2																				
11. Instructions for change																					

Appendix II: Make-or-buy decision-making model of Tayles and Drury A3 version



Appendix III: Adjusted make-or-buy decision-making model A3 version



Appendix IV Detailed explanation of the model

This model aims to support firms to determine the most suitable operation method for their product. The model generated in this chapter is an adjusted version of the model of Tayles and Drury. The reason for modifying their model lies in the basis of the ground theories for the make-or-buy decision in combination with tailored prerequisites of the case firm. In this section the model is discussed gradually, where often is agreed on the argumentation of Tayles and Drury. The next paragraph is long and goes into detail, therefore it is advisable to have a look at the model after reading a sentence to understand each statement made in the model. In order to create a better feeling of the explained text, the discussed decision-moments are delineated at the right hand side. Additionally, in the adjusted model, 'yes' and 'no' are placed above the arrow if possible, and otherwise left from the arrow.

When starting to determine the sourcing choice, firstly, the strategic contribution of the product should be questioned, by regarding if the product is a core process/ strategic component (1). If the product is viewed as a core process/ strategic, the next logical decision-moment is, is production secret (2), since secret products should never be outsourced. By directly questioning if production is secret, the model filters out the opportunity to end at a buying terminal when production should kept secret. The moment production is secret, the next question should be if making is cheaper than buying (3). Even though buying is not an option when buying is cheaper, but production is secret. This decision-moment (3) ramifies the scheme towards firms which should on the one hand make, or invest and make, while on the other hand should inload extra production (for example by also producing for partners/ or acquire competitors), or review their strategy. Next, when making is cheaper than buying, asset specificity should (4) be regarded. When asset are not specific for the tested product in the model, so the firm already disposes of all components, the firm should directly make (6). The moment assets are product specific, the next logical question is, what are the extra costs for producing the

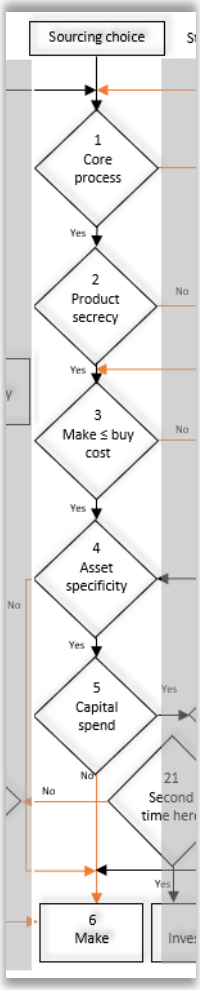


Figure 4.1: Decision-moment 1-6

product inhouse, capital spend (5). If no capital has to be spent in order to produce the product inhouse, firms should make the product (6). Now let us go back to product secrecy. If production is not secret, the firm should regard if specialization improves the quality (7). Outsourcing has the function that firms can focus on other internal produced products, and thereby enables firms to improve the quality not only of the other products but also of processes within the firm (section 3.2). So, firms which outsource production should only do so if outsourcing improves the quality. It is acknowledged that this decision-moment involves subjectivity, therefore visions from multiple layers and departments should be considered. If specialization does not improve quality, firms should continue by regarding if making is cheaper than buying products. Another hurdle to determine if production can be (partially) outsourced is the firms' prerequisite of production time is not equal to or longer than six weeks (8). If the production time is equal to or longer than six weeks, Firm X should not produce external. In all distinctive manners to execute the model, costs should be considered. So when production is not secret, specialization does improve the quality of the firm and production time is not equal to or longer than six weeks, all facets for (partially) outsourcing are in place, however when costs to buy ensure a loss in profit buying would not be advisable. Therefore, When production time does not exceed six weeks, the next decision-moment is (9) make ≤ buy cost. The moment buying is cheaper, Firm X should study if they rely on internal innovations (10) and therefore are able to outsource. In section 2.2 is mentioned that firms buying semi-finished goods react too late on external innovations. So, only in case external innovation are not needed to innovate, thus firms relying on internal innovations, buying semi- finished products is advisable. But, when making is

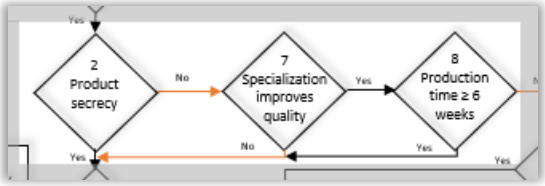


Figure 4.2: Decision-moment 2,7,8

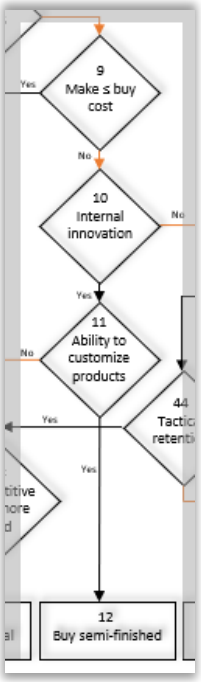


Figure 4.3: Decision-moment 9-12

cheaper than buying the product, especially for a core product firms would not like to have lower profits, should be continued with asset specificity (4) in order to determine what kind of internal operation method is advisable. When is known that internal innovations mainly improve the product, Firm X requires suppliers to be able to customize production (11). If so, buying semi-finished goods (12) is most suitable as operation method. However if suppliers are not able to customize production, competitive with more load (18) must be regarded. If firms have no secret production, specialization does improve quality, production time is shorter than six weeks, buying is cheaper than making the product and innovation improves quality, but the suppliers are not able to adapt on changes, outsourcing or buying semi-finished goods is not suitable for Firm X, thus should be regarded if the assets of the product are specific in order to determine if the firm on the one hand should inload potential or on the other hand (invest &) make. Now let us go back to internal innovation (10). So we have regarded the option that the firm relies on internal innovation. However if the firm does not rely on internal innovation, the availability of product property rights (13) should be regarded. The reason for this subsequent decision-moment, lies in the property right theory, which states that products with related property rights should never be outsourced since product property right provide firms with high bargaining power. The moment a product does have property rights, the firm should check whether the resources can be acquired by the firm (16). An example for this matter is: a firm identifies the need for a specific product and in order to secure the product against competition they buy patents for the product, however the firm actually has not made any supplier contact, so it is not known if the needed resources can be acquired. This situation could especially be suitable for start-ups. When property

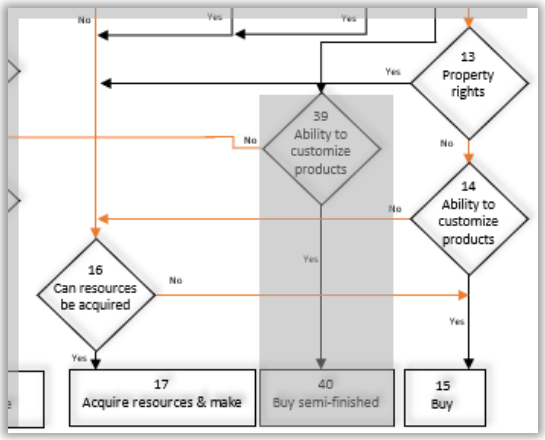


Figure 4.4: Decision-moment 13-17

rights do not play a role, the last hurdle to outsource is to determine if suppliers are able to customize production (14), since this is a prerequisite of Firm X before production may be outsourced. The moment suppliers are able to customize production, firms should buy the product (15). But in case suppliers cannot produce customized products, firms should determine if resources can be acquired (16). When all resources can be acquired, firms should acquire resources and make the product (17). Only, in case resources cannot be acquired, there is no other opportunity than to buy those resources (15) or to face out of the product. Thus, Firm X should accept that suppliers does not have the ability to customize production or stop selling the product when Firm X sticks to their flexibility requirements. Now we discussed sequence 13, 14, 15, 16 and 17, let us go back to make ≤ buy cost (3). We discussed the case were making is cheaper than buying, so in turn, now the case is discussed were buying is cheaper than making products. If production is secret, but buying is cheaper, firms should still internalize production. As an example, Coca Cola has a secret production, but it could be the case that another firms e.g. Pepsi produces their cola way cheaper via external parties. Resulting Coca Cola loses their competitive position and might become more competitive by outsourcing to the same party as Pepsi. In moments like the example, firms should not directly externalize production and therewith reveal their product. However, it could be the case that maximizing production towards the potential of the firm (18) reduces the costs of producing per litre subsequently Coca Cola becomes more competitive. If firms become competitive with more load (18) they can for example acquire other firms to increase the demand for their cola. Thus, if firms become competitive with more load, they should inload their potential (19). If firms do not become competitive with more load, the next

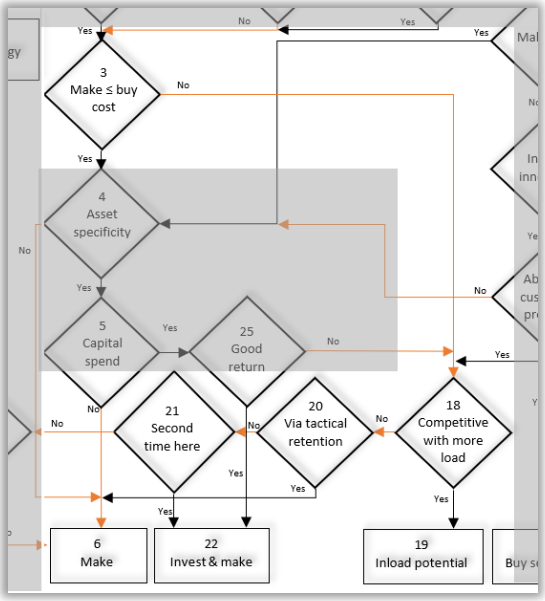


Figure 4.5: Decision-moment 3, 6, 18-22

decision-moment is via tactical retention (20). However we do not regard tactical retention (20) at this moment since it has its connection with via tactical retention (44) and is explained in a later stage. So, we continue with second time here (21). The decision-moment second time here (21) is needed for circulation reasons. However let us first discuss 23 (supplier available) before discussing 21. The moment 18 is answered with 'no', firms should identify if suppliers are available (23). If no suppliers are available firms only can make (6) the product or stop selling the product (which is comparable to the situation of decision-moment 16). When suppliers are available firms should review their strategy, since: buying is cheaper, firms are not competitive with more load, and suppliers are available, but production is secret or specialization does not improve quality or production time exceeds the six weeks. In this case, the firms should especially review 1,2,7,8 and preferably change the requirements of or the view towards the product. Since 24 introduces the opportunity to end in a vicious cycle, 21 is inserted in the model to ensure after revision that the model ends at a terminal. The moment second time here is answered yes, the firm should invest and make (22), and therewith might lose their competitiveness which could result in lower profits. Consequently, there is a high chance the product will be regarded as a non-core process in the future. Let us now go back to 5 (capital spend). It is discussed that if no capital has to be spend firms should make (6), however when capital has to be spend, the next logical question is if the investments generates a good return (25). If so, it is worth investing, thus firms should invest and make (22). Only when investments have no good return, firms should question if they become more competitive when producing a bigger load. In order to understand this thought, the example about Coca Cola, explained before, is applicable again. Since decision-moment

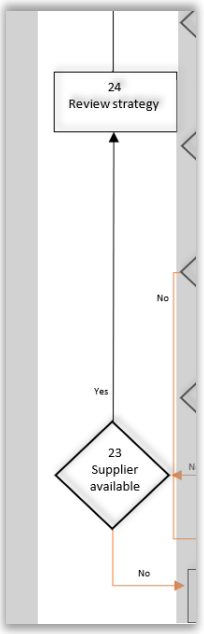


Figure 4.6: Decision-moment 23-24

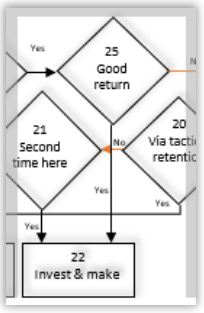


Figure 4.7: Decision-moment 22, 25

1 to 25 are explained above and the other decision-moments are reached when answering no on core process (1), let us go back to 1. The moment core process is answered no, the next logical step is to check whether the firm is able to produce inhouse (26). This is a matter of knowledge and skills, but also of warehouse capabilities etc. Additionally, this is a first check to direct products towards outsourcing. If firms are not able to produce, the most likely scenario is to buy or to ensure you become able to produce, but we come later to that. First, when processes can be runned internally, firms should wonder if production is secret (27), since secret products are not desirable to outsource. When production is secret, firms should additionally question if resources for production are available within the firm (28). The moment products are secret, but resources are not available, investments have to be done, where again careful consideration preparatory have to be done. When firms do dispose of the needed resources, the next following step is to regard if the available assets are product specific (29). This might seem a strange step, because when the resources are available before firms produce the measured product, is looks obvious that the required resources are not product specific. This is true, however, it could also be possible for firms that a specific product is out of their production, but some kind of old machine is still available, but not used at the moment. This scenario is especially likely when a new version of a product is launched. However, therefore it is needed to answer both decision- moments with care. The moment asset specificity is not the case, costs should be considered. So, the decision-moment, producing is cheaper than buying (30) is the next step. Other than the sequence of 3 and 4. Asset specificity is consciously placed above make ≤ buy cost at this place. The reason for this reverse sequence, is because decision-moment 3 is placed under ‘core process’ and

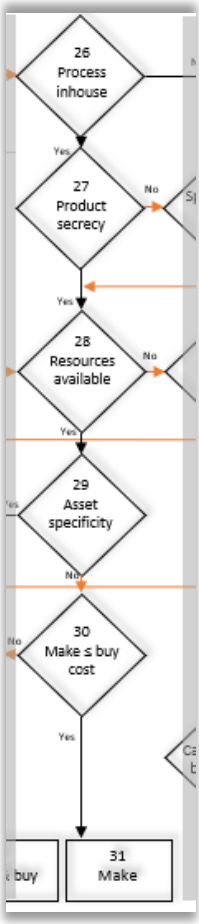


Figure 4.8: Decision-moment 26-31

therefore does not point out to outsourcing, but solely to the possibility to maximize production via 18. When mass producing, asset specificity is not of importance since the asset might be product specific, but the product is produced in high volumes and therefore the asset specific investments have less magnitude. However when the product is a non-core process, there is less necessity to make the best profits (as in the case of core process), and it could be tactical to shift towards outsourcing production, even when making is cheaper than buying. In cases like those, firms may decide to specialize for example. Now this is clarified, let us continue with make ≤ buy cost (30). When making is cheaper than buying, all circumstances are available to make the product (31). In order to explain decision-moment 32, we go back to process inhouse (26). Assuming firms are not able to produce inhouse, the next logical step is to check whether suppliers are available (32) to produce the product. The moment firms are not able to produce, but suppliers are not available, the product cannot be produced in any way, so firms should change their process (34). Changing a process could connote, ensuring the firms is able to produce the product by buying specific equipment. However, when suppliers are available, the reliability requirement of Firm X should be regarded (33). If suppliers are available, but production time exceeds six weeks, Firm X should not buy regarding their requirements, therefore the only option is to change their process in this situation (34). Other, assuming the supplier is able to produce within six weeks' time, internal innovation (35) should be regarded. When firms rely on internal innovation, it is not practical to outsource, but since the firms is not able to produce (26), they should outsource the part which is not dependent on the internal innovation. Alternative, if the product does not rely on internal innovation at all, the product may be outsourced completely. If the product does not rely

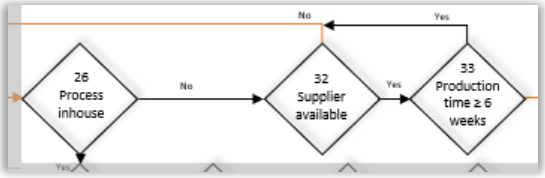


Figure 4.9: Decision-moment 26, 32-33

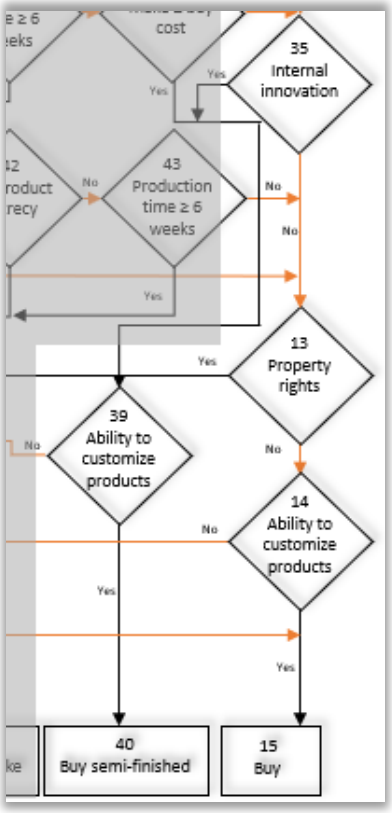


Figure 4.10: Decision-moment 13-15, 35, 39-40

on internal innovations the last hurdle before the terminal buy is property rights (13) of the product should be regarded. This part of the model is already explained above and because of unneeded iteration not explained another time. Let us go back to 27 (product secrecy). We already discussed the situation where production is secret, so now let us look at the situation production is not secret. When production is not secret, outsourcing could be an option, however outsourcing should solely be done if specialization improves the quality of the firm (36), production time of the supplier is shorter than six (37) weeks, making is cheaper than buying (38), the firm does not rely on internal innovation (35), there are no property rights (13) available for the product, and suppliers are able to customize (14). Since this situation is the same for sequence 7, 8, 9, 10, 13, 14, which is explained before, we do not go into detail here. Additionally, when firms do rely on internal innovation (35), firms should see if suppliers are able to customize production (39). If so, firms should buy semi-finished product (40). Contrary, if suppliers are not able to customize, firms should regard if the needed resources are available within the firm, since this is a prerequisite to identify is investments have to be made and thus what operation method is suitable. Therefore, is continued with 28 (resources available). Assuming resources are the moment of making the make-or-buy decision not present in the firm, they should view if buying is cheaper than making the product (41), because if buying is cheaper, it makes no sense to acquire the resources. Although, when buying is cheaper than making, firms should still acquire the resources is production is secret (42), production time exceeds six weeks (43), Property rights come into play (13), or customers are not able to customize production (14). When production is secret, or production time exceeds the set requirement of six weeks, firms should investigate if they are able to acquire the

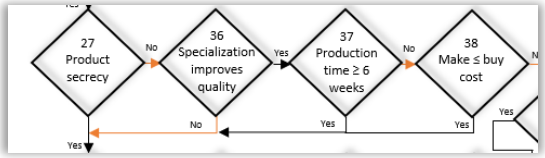


Figure 4.11: Decision-moment 27, 36-38

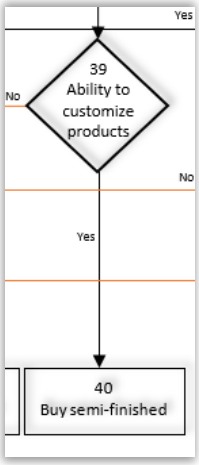


Figure 4.12: Decision-moment 38-40

Figure 4.13: Decision-moment 28, 41-43

resources (16). However, if resources cannot be acquired there is no other option to buy the product or phase out of the product. So, if resources are not available (28) firms can either acquire resources or outsource production, but many hurdles need to be passed in order to make it useful to buy products. However, even when production is secret, production time exceeds six weeks, there are product property rights. or suppliers are not able to customize production, if resources cannot be acquired by the firm, beggars cannot be choosers.

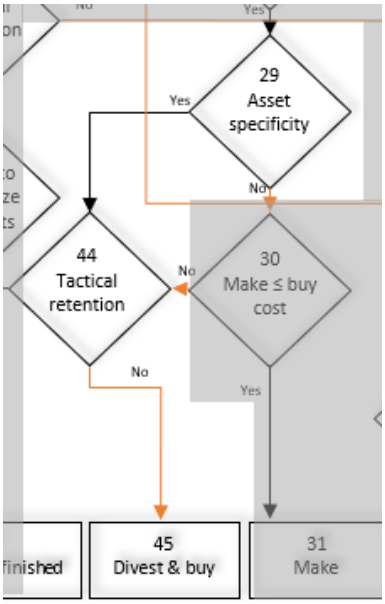


Figure 4.13: Decision-moment 29, 44-45

Now we nearly discussed nearly the full model, let is explain the three decision-moments left over: 44, 45, and 20. To discuss those, let us go to 29 asset specificity. The assumption of no asset specificity is already discussed, so we focus in this part of asset specific products. If special asset are needed for production, firms should question whether it is tactical to retain producing internally (44). This is of importance for firms since, in some cases making the product is useful to enable customers to buy more products of Firm X for example. Furthermore, property rights can also be regarded as tactical input to retain producing. However should be acknowledged that tactical retention is sensitive to firm specifics, hence lists with pros and cons should be composed in order to take a mature decision. When it is tactical to retain producing, but buying is cheaper than making, the firms should question whether they become competitive with more load (18), which questions if maximizing production would increase the competitiveness of the firm. When firms do not become competitive with more load, 20 (via tactical retention) is the next decision-moment. This decision-moment is somewhat special, however since it is tactical to retain making the product, you do not want to end up with a buying terminal. Additionally, firms do not become competitive with more load and the resources are all available (44 can only be reached when 28 is answered with yes), so inload potential, and invest and make or no option as operation method. This indicates if it is tactical to retain producing, and firms are not competitive with more load, the only operation method is making (6). Contrary, when it is not tactical to retain producing, firms should divest (again, since 44 can only be reached via 27) & buy (45) the product.

Appendix V: Script adjusted make-or-buy model

Table 12.1: Functions which should be questioned per decision-moment

Decision-moment	Function
Core-process	Manager fulfilment
Product secrecy	Manager fulfilment
Make ≤ buy cost (buy ≤ make cost)	Business controller finance
Asset specificity	Supply chain engineer
Capital spend	Manager production
Specialization improves quality	Manager marketing / quality engineer
Production time ≤ 6 weeks	Strategic purchaser
Internal innovation	Manager supply chain engineers
Ability to customize products	Strategic purchaser
Property rights	Manager fulfilment
Can resources be acquired	Strategic purchaser
Competitive with more load	Manager fulfilment
Supplier available	Strategic purchaser
Good return	Business controller finance
Process inhouse	Manager fulfilment
Resources available	Manager production
Tactical retention	Manager fulfilment
Review strategy	All
Change process or spee	All
Via tactical retention, via product secrecy, second time here	None

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