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supplier selection process**

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1. Identify poor performing suppliers based on preferred customer matrix and existing evaluation tools followed by a supplier selection process

Nowadays the purchasing function is becoming more and more important as it can be a source of competitive advantage.¹ ² A trend over the years is that purchasers are becoming responsible for less suppliers on average.³ Another shift can also be identified as a consequence of this reason, which is the possibility for purchasers to focus more on relationships with suppliers. As they are responsible for less suppliers more time will be available to intensively work together, many benefits can be derived from a well-developed relation with your supplier.⁴ A term that is related to buyer-supplier relationship is the 'preferred customer status'. In the recent years, this term has gained much interest of researchers and purchasers due to the switch towards a long-term relation approach with suppliers. The concept,⁵ the identification of this status and the strategies around this concept have been described into detail in recent researches.⁶ However, a part that has been slightly neglected till now is whether supplier performance evaluations already give an indication on the preferred customer status of a buyer.

Another important aspect of the purchasing function nowadays is standardization.⁷ It is becoming more and more important for firms to standardize their processes which allows the employees to execute processes in the same way. A standardised process will result in less mistakes made, improved quality, better performance measurability and the time the process takes will be reduced. A question that can be raised therefore is how this process can be standardized. Additionally, as this research concerns the preferred customer status a measure will be tried to see if an estimation can be made whether a firm can become a preferred customer of the new supplier. A reason that this is highly interesting is because of the disbalance between economic and social criteria's in the supplier selection process.⁸ Researchers found that almost 40% are economic criteria, 36% are environmental criteria and only 24% are social criteria. As the preferred customer status considers a more social aspect of the buyer-supplier connection it could possibly be a method to include in supplier

¹ See Trent & Monczka. (1998), p. 4.

² See Endo et al. (2017), p. 265.

³ See Trent & Monczka. (1998), p. 5.

⁴ See Sweeney & Webb (2002), p. 85-86.

⁵ See Schiele et al. (2012), p. 1178-1185.

⁶ See Schiele et al. (2011), p. 1-27.

⁷ See Sanchez-Rodriguez et al. (2006), p. 65.

⁸ See Rashidi et al. (2020), P. 17.

selection. Many important criteria's have been defined which can cause the achievement of the preferred customer status.⁹ However, this is mostly when there is already an established relationship which is not the case with a new supplier.

This research will be a case study at a high-pressure valve manufacturer. The research paper will be structured as follow, it will start by describing the manufacturer in general, their supplier evaluation methods and their supplier selection process. After that, the current literature around the preferred customer status will be discussed and the current supplier performance evaluation methods that are often used by firms. In the next part, the different steps in a supplier selection process will be discussed based on literature, ending with a process proposal in the form of a flowchart. The analysis part will start with a comparison between the outcomes of supplier performance evaluation and the preferred customer matrix to gain a better insight in the predictability of the preferred customer status based in the supplier performance evaluation. At last based on the preferred customer matrix/supplier performance evaluation two cases will be selected to apply the standardised supplier selection approach to. This selection process will also contain the estimation of the preferred customer status for new potential suppliers. In the end this standardised procedure will be evaluated to see where problem arise and more research is needed.

Following this structure this research will answer questions. The first question that will be answered is 'Does the supplier performance evaluation already give an indication on whether a firm is a preferred customer?'. The second question in this research is 'How can supplier selection process of a manufacturer be standardised?'. The second question will also contain the incorporation of the prediction of the preferred customer matrix to see whether this is possible or not.

2. Being a preferred customer is becoming more important in a competitive market

2.1 The growing importance of manufacturing firms to become a preferred customer to gain competitive advantage.

Nowadays, many researchers and purchasers are interested in being a preferred customer as research found positive outcomes of this phenomenon. A definition of preferred customer can be found in the work of Schiele et al (2012): 'A firm has preferred customer status with

⁹ See Kumar & Routroy (2017), p. 2347-2348.

*a supplier, if the supplier offers the buyer preferential resource allocation.*¹⁰ This means among other things that a buyer will get the resources in case of scarcity before the supplier serves the other buyers. The term preferred customer is a term that has already been introduced many years ago however research on this term has grown largely in the last ten years. This could be since there is a more intensive competition between buyers for suppliers, as the number of suppliers is decreasing.¹¹ Therefore the importance of becoming a preferred customer is also growing. Additionally, a shift can be found in the responsibilities that suppliers get which grew strongly in the last few years which makes it important to have a close relationship with your supplier.

One of the many benefits of a preferred customer is the access to the resources of a supplier in times of scarcity.¹² However, this is not the only benefit as it can have a positive influence on the costs of a company as well.¹³ A preferred customer status also has a direct positive effect on the pricing behaviour of the supplier¹⁴, research found that when a buyer is awarded with the preferred customer status a supplier will often offer better prices. Bew (2007)¹⁵ estimated the cost savings for one of the first times and found the preferred customer status lead to approximately 2-4% savings. All in all, the status of being a preferred customer seems to have a positive cost effect however a critical note that needs to be made is that the previous researches did not account for the costs required for becoming a preferred customer.

Next to the cost benefits the preferred customer status also seems to improve the lead time and product quality.¹⁶ The lead time is decreased due to the fact that suppliers are more intensively focussing on how resources can be allocated to their preferred customer, while for non-preferred customers there will be less time spend on making sure the resources are delivered. Additionally to the delivery benefits, the product quality will most probably also increase if the preferred customer status is achieved, this can be addressed to the fact that suppliers have highly skilled employees with a lot of product knowledge and know-how¹⁷ These skilled employees will much more likely be allocated to a preferred customer than a

¹⁰ Schiele et al. (2012), p. 1178.

¹¹ See Cannon & Perreault (1999), p. 439.

¹² Schiele et al. (2012), p 1179.

¹³ See Williamson. (1991), p. 79-80.

¹⁴ See Schiele et al. (2011), p. 15-16.

¹⁵ See Bew (2007).

¹⁶ See Ulaga. (2003), p. 691.

¹⁷ See Handfield et al. (1999), p. 79-81.

regular customer. This material and product knowledge can be used to improve and adapt products or processes to create a higher quality.

A fourth reason for firms to become a preferred customer is that most innovation nowadays are created in an open environment.¹⁸ This means that innovation are not only dependent on internal resources but also on external resources, these external resources are even increasing in importance.¹⁹ Schiele (2012)²⁰ found that a preferred customer status helps firms to access suppliers R&D and ensure cross-functional collaboration. A significant positive effect of preferred customers status on supplier innovations was also found in a research of Ellis et al (2012)²¹. When a buyer is awarded with this status the willingness of suppliers to share their knowledge will increase leading to better chances of successful innovations. Innovation with suppliers create many benefits like cost savings, improved quality and a more efficient innovation process.²²

The preferred customer status can be a source of competitive advantage based on the resource-based view. In the highly competitive markets nowadays the firms are fighting for the same resources and with the preferred customer status these resources can be allocated to your firm instead of to competitors. Due to all these benefits, access to innovation, lower costs, resource allocation and quality it is important that firms are looking into becoming a preferred customer of their supplier.

2.2 The antecedents of a preferred customer: supplier satisfaction and customer attractiveness

The preferred customer status can be achieved by firms but there are some underlying methods that need to be understand when finding out how a firm derives this status. In a research of Schiele et al (2012)²³ a framework was developed about the antecedents of a preferred customer. This research is based on the social exchange theory which focusses on the interdependence of a relationship overtime that changes due to interactions. Based on

¹⁸ See Popa. (2017), p. 134.

¹⁹ See Laosirihongthing et al. (2014), p. 1242.

²⁰ See Schiele. (2012), p. 49.

²¹ See Ellis et al. (2012), p. 1266.

²² See Azadegan et al. (2008), p. 19.

²³ See Schiele et al (2012), p. 1180.

this theory two different antecedents of a becoming a preferred customer were identified: customer attractiveness and supplier satisfaction (figure 1).

One part of the model concerns the customer attractiveness which focuses on the expectations of supplier has of the buying firm. The first time that customer attractiveness was introduced in a buyer-supplier relation was around 2002.²⁴ However, before this customer attractiveness term was introduced already a research found that is important to make a firm attractive to the supplier.²⁵ The importance of attractiveness was already found but not developed in a mature way, the simple advise was to make the supplier feel like they are part of the team. A change of customer attractiveness importance can be addressed to the way of buyers approaching suppliers. In the last twenty years the management approach switched from using a coercive and power point of view to a more relational point of view.²⁶ This shift can also be addressed to the increase of suppliers power due to the decrease in quantity of suppliers.²⁷

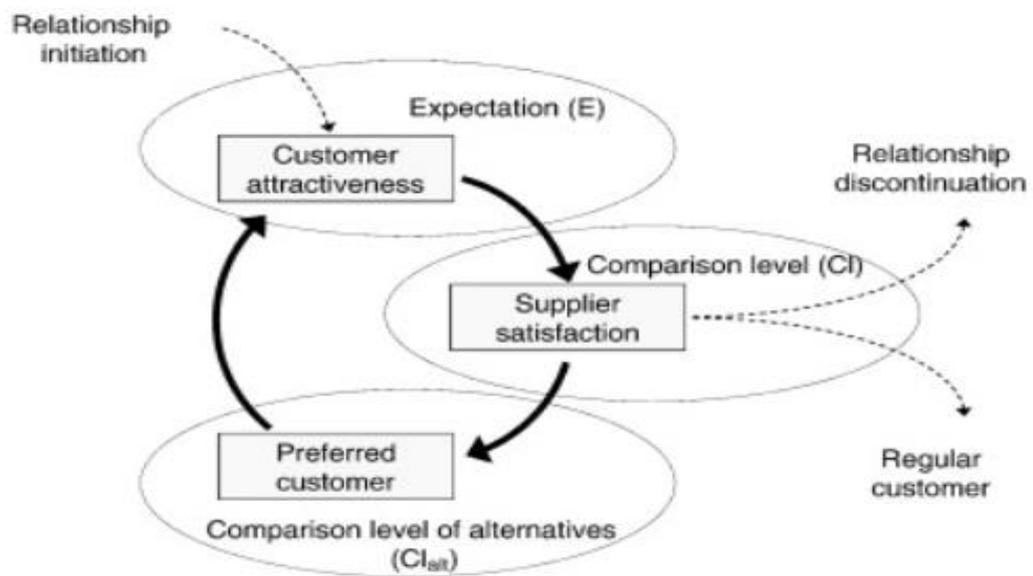


Figure 1: Preferred customer cycle

In the last few years this term of customer attractiveness has been developed much further, as a consequence the definition of customer attractiveness has become much more sophisticated. Customer attractiveness mainly derives from the supplier side however in a

²⁴ See Mortensen (20120, p. 1212.

²⁵ See Galt & Dale (1991), p. 21.

²⁶ See Mortensen (2012), p. 1212.

²⁷ See Cannon & Perreault (1999), p. 439; See Benton & Maloni (2005), p. 18.

relationship their needs be a certain degree of trust and commitment from both sides²⁸ Therefore it is necessary for a firm to also consider the suppliers willingness to put resources into this relationship. Schiele et al. (2012)²⁹ therefore developed the following claim in their research; ‘A customer is perceived as attractive by a supplier if the supplier in question has a positive expectation towards the relationship with this customer. The conditions for this perception of the supplier include an awareness of the existence of the customer and knowledge of the customer's needs. The customer attractiveness is the first antecedent of becoming a preferred customer and will cause the initiation of a relationship.

Supplier satisfaction is a term that can be introduced during the evaluation of a buyer-supplier relationship which is mainly started by customer attractiveness³⁰ In the past years some research has been done on how this supplier satisfaction can be measured^{31 32} however all those researches lacked the connection with other components like customer attractiveness and preferred customer (SOURCE). Schiele et al. (2012) tried to enrich these researches by using the social exchange theory to establish the links between the different antecedents. Based on this theory it was possible to create a framework that shows the directions and linkages of the different antecedents of the preferred customer status.

The degree of supplier satisfaction can be determined on the outcomes of a relationship evaluation. This evaluation can incorporate many different dimensions, for example; order process, delivery process, communication, conflict management and intensity of cooperation.³³ Based on this relationship evaluation the supplier can exceed the expectations or lack performance in comparison to the expectations. In case the outcomes do not meet the expectations a relationship will most probably be terminated according to the social exchange theory, as the costs of the relationship do not meet the expectations.³⁴ Based on these assumptions Schiele et al. (2012) made the following claim; ‘supplier satisfaction is a condition that is achieved if the quality of outcomes from a buyer-supplier relationship meets or exceeds the supplier's expectations’.³⁵

²⁸ See Kovacs et al. (2008), p. 803-805.

²⁹ See Schiele et al. (2012), p. 1180.

³⁰ See Schiele et al. (2012), p. 1181.

³¹ See Essig & Amann (2009), p. 106.

³² See Nyaga et al. (2010), p. 107-108.

³³ See Essig & Amann (2009), p 111-112.

³⁴ See Lambe et al. (2001), p. 8-9.

³⁵ See Schiele et al. (2012), p. 1181.

As companies have different strategies, values and norms it is possible that they use different evaluation criteria to assess the supplier satisfaction. This means that no universal method yet has been developed that exactly measures this antecedent of preferred customer. However, the assumption of the social exchange theory still applies, which means that a relationship will flourish if the buyer exceeds the expectations, but the relationship will be terminated in the case of not meeting the supplier expectations.⁴⁰

2.3 Methods to become a preferred customer as a buyer in the future: exceeding customer expectations in comparison to the alternative customers

A firm can become a preferred customer of their supplier in the case that supplier satisfactions exceeds the expectations. However, this does not consider the other customers that can potentially be served by the supplier. Therefore, the preferred customer circle does also contain the component of comparing alternatives which can serve the firm. The comparison level can be derived from the social exchange theory which can be used by suppliers to compare a degree of supplier satisfaction to the alternatives. Evaluating a relationship needs two different components which have been identified as comparison level (CL) and comparison level alternative (CLa).³⁶

The comparison level can be described as the expectations a supplier has of buyers. These expectations are derived from the feelings that a supplier has, on what he deserves of the relationship.⁴¹ If a relationship does not reach the comparison level it can be described as an unsatisfying or unattractive relationship. This comparison level can be determined based on many different criteria's that can differ per supplier.³⁷ The comparison level alternative additionally takes the other customer options a supplier has into account. If the outcomes of a relationship fall below the CLa a supplier will most likely leave the relationship.³⁸ The relationship will be terminated because the market offers better relationships with other buyers than the relationship with the current buyer.

When considering on how to become a preferred customer it is necessary to not only consider the relationship meets the expectations but also to consider the alternatives.³⁹ A preferred

³⁶ See Thibault & Kelley (1959), p. 21.

³⁷ See Essig & Amann (2009), p. 111-112.

³⁸ See Anderson & Narus (1984), p. 68.

³⁹ See Schiele et al (2012), p. 1181.

customer status will be awarded if a buyer is attractive in the perception of a supplier and if the supplier is satisfied with the outcomes. Additionally, the buyer needs to outperform the alternatives otherwise the relationship will be discontinued. When all these facets are present a customer can label a buyer as a preferred customer, which will bring all the benefits like ensured resource allocation and benevolent pricing behaviour.

This process of becoming a preferred customer looks like a passive process however this can be highly influenced by tactics from a buyer.⁴⁰ Nollet et al. (2012)⁴¹ therefore developed a four step model on how to become a preferred customer; initial attraction, performance, engagement and sustainability. It all begins with the initial attraction which means that a supplier needs to be aware of a buyer and its capabilities. This attraction can be done in the future but also a transaction or agreement in the past is an attraction. The next step of becoming a preferred customer is to focus on the performance and make sure that the expectations of the supplier are met.⁴² Meeting the expectations will result in supplier satisfaction which are both components in the preferred customer cycle. The supplier satisfaction can be measured with the five different dimensions suggested by Essig and Amann (2009)⁴³. Buying firms can actively influence supplier satisfaction by focussing on creating value for the relationship with the buyer.⁴⁴ This can be done in direct ways by buying large quantities, ensuring demand and offering good margins. Furthermore, the supplier satisfaction can be influenced by adding value to the relationship by offering innovations, giving access to new markets and collecting market information.⁴⁵

The third step is engagement which means that a buyer needs to make sure that they put continuously effort into the relationship.⁴⁶ Both parties need to make sure that by engaging in this relationship the additional value will increase. A buyer can do this by, for example, having proper communication, staff exchanges or initiate common projects. Furthermore, a buyer needs to ensure operational excellence by standardizing and simplifying the supply chain practices. As a last step of becoming and remaining a preferred customer the buyer needs to make sure that there is sustainability. The sustainability needed in this case is that the buyer is required to keep outperforming the evaluation of the other buyers in the eyes of

⁴⁰ See Nollet et al. (2012), p. 1186-1187.

⁴¹ See Nollet et al. (2012), p. 1188-1191.

⁴² See Nollet et al. (2012), p. 1188.

⁴³ See Essig & Amann (2009), p. 111-112.

⁴⁴ See Walter et al (2001), p. 369.

⁴⁵ See Walter et al (2001), p. 372.

⁴⁶ See Nollet et al. (2012), p. 1191.

the supplier. Tools for keeping this sustainability are frequently measuring performance, risk management, shared performance results and participate in planning events of the supplier.⁴⁷

3. Supplier evaluation methods: Existing tools used by companies and the preferred customer matrix

3.1 Supplier selection and supplier evaluation: separate but complementary

Supplier evaluation and supplier selection are often seen as two different processes within the purchasing function. Supplier selection is focussed on the process of finding and assessing new suppliers⁴⁸ and supplier evaluations concerns the way an existing supplier is assessed on its performance.⁴⁹ These processes find place at different points of time in the supplier relation. Supplier selection finds place already before there is some sort of agreement or relationship between the buyer and supplier. Supplier evaluation finds place during the agreement or relationship between the buyer and supplier. Therefore, much research is done on both topics however not quite often have these two topics intentionally be combined.

Supplier selection concerns the process of finding new suppliers, assessing these suppliers and selecting suppliers. A large part of this process is to assess the potential suppliers on how they will be able to meet the requirements.⁵⁰ After this scoring of potential suppliers the buying firm can decide on which supplier will be contracted. In the supplier selection process a request for quotations (RFQ) is offered in which contains all the information concerning for example the price, lot sizes and technical description.⁵¹ All issued suppliers can then offer their quotations which than have to be quantified by the purchasers of the buying firm. Therefore, the scoring of suppliers in a supplier selection process needs a model with different criteria on which the supplier's RFQ are compared. These criterions can range from quantitative till qualitative criteria.⁵² Based on this comparison the buying firm can decide on which step to take next, for example an external audit or negotiation process.

⁴⁷ See Nollet et al. (2012), p. 1192.

⁴⁸ See Beil (2010), p. 1.

⁴⁹ See Frederiksson & Araujo (2003), p. 366.

⁵⁰ See Choy et al. (2002), p. 216.

⁵¹ See Zeim et al. (2019), p. 56.

⁵² See de Boer et al. (2001), p. 79; See Ho et al. (2010), p. 21.

The supplier evaluation finds place in a later stadium as the contract of the supplier is already established. Based on criteria which are mostly created by the buyer the supplier is evaluated. These criteria can similar to the supplier selection process be both quantitative and qualitative.⁵³ These results can be used to assess whether a supplier meets the criteria or does not. This can support the process of deciding to terminate or pursue the relationship with a supplier. Furthermore, it can act as a start signal to start with a supplier development program to improve the performance so they will meet the requirements in the future.

Even though evaluation and selection are two different process this research argues to see them as complementary processes. Several different arguments can be thought of to support the fact that these processes are complementary. Firstly, the supplier selection process already contains many criteria that are used to assess possible suppliers⁵⁴, this often also referred to as supplier evaluation. Many of these criteria are used before any kind of relationship or agreement but can also be used during the supplier performance evaluation in a later stadium. Furthermore the process of supplier selection and supplier evaluation serve the same goal to reduce purchasing risk and maximize overall value.⁵⁵ That can be the reason that many of the criteria's used in the supplier selection process are similar to the criteria used in the supplier evaluation process.

Another argument can be found based on the social exchange theory used for the preferred customer cycle.⁵⁶ Measuring the supplier satisfaction needs a certain method of supplier evaluation. The comparison level alternative can be much higher than the comparison level which will lead to terminating a relationship with a supplier because there is a better alternative. However, to determine the alternatives there needs to be an overview of the potential performance of other suppliers. This overview already needs the process of benchmarking suppliers. This shows another similarity of supplier selection and evaluation as benchmarking is a part of both processes.

The last argument comes from the same principles, as a supplier evaluation can initiate the search for a new supplier. Based on the supplier evaluation poor performing suppliers can be indicated which can alarm the company that this supplier increases the supply risk. To reduce this supply risk a firm can determine to search for better alternatives in the market

⁵³ See Zeim et al. (2019), p. 57.

⁵⁴ See Chen (2011), p. 1652; See Amin & Chang (2012), p. 6783.

⁵⁵ See Farzad et al. (2008), p. 201.

⁵⁶ See Schiele et al (2012), p. 1181.

which is a supplier selection process. All these reasons support the fact that supplier selection and evaluation are different processes but should not be seen separate from each other as they can support or initiate each other.

3.2 Many different multicriteria supplier selection methods exist but never with the inclusion of a preferred customer estimation.

The supplier selection process is gaining intensive attention due to the increase of importance of your whole supply chain. One of the reasons of increased importance is that the focus of company versus company is switching to supply chain versus supply chain⁵⁷. The importance of having the ‘right supplier’ does stresses the importance for the right method to select the most suitable supplier. Over the years many different methods have been proposed to rank suppliers and support the decision making in the supplier selection process⁵⁸. These methods can be qualitative, quantitative as well as a hybrid. Quantitative methods are often referred to as more structured and were the main used methods before 2003.⁵⁹ Almost all of the supplier selection methods can be indicated as a multi-criteria method, this is logical as supplier selection is one of the most known multi-criteria problems⁶⁰

Konys (2019) classified different supplier selection methods in two main criteria’s: Single model and Combined models⁵⁷. The single models could then be classified again in three different categories; Mathematics, Single Model and Artificial Intelligence. Some examples of mathematics models are AHP, total cost of ownership or linear programming. One of the most know models in the single model category is the multiple regression and cluster analysis. Vasina (2015) and which has been taken over by Taderhoost & Brard (2019)⁶¹ makes a slightly different classification with the categories statistical/probabilistic, MADM, Mathematical programming, Artificial intelligence and methods based on costs.⁶² However, despite the fact that researcher make different classifications the same methods come forward.

⁵⁷ See Konys (2019), p 1629-1630.

⁵⁸ See Schramm et al. (2020), p. 4.

⁵⁹ See Taherhoost & Brard (2019), p. 1030.

⁶⁰ See Yildiz & Yayla (2015). P. 159.

⁶¹ See Taherhoost & Brard (2019), p. 1031.

⁶² See Vasina (2015). P. 37.

The methods that are discussed most in the literature and are often used by firms are⁶³: Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Analytical Hierarchy Process (AHP), Analytic Network process (ANP) or an outranking method. A problem that arises with supplier selection methods is that it can be highly uncertain and some categories in a method can be difficult to score. Therefore, the fuzzy set theory is applied which makes it possible to give ‘fuzzy’ scores to parameters⁶⁴. This fuzzy set theory is then applied to the methods mentioned above (e.g. fuzzy TOPSIS).

All these methods have in common that certain criteria need to be selected on which a supplier will be assessed. The method only influences the way the data is calculated and analysed. The list of this criteria’s which are used for supplier performance evaluation is almost unending. Supplier selection criteria can range from quality to price and from attitude to product development, and much more.⁶⁵ A trend that can be identified regarding selection criteria is the need for more social criteria’s.⁶⁶ Much more economic criteria’s are used in the supplier selection than social criteria’s.

A method that has not yet been described as a supplier selection tool is the preferred customer matrix. This matrix does capture a relational part of the buyer-supplier which could enhance the social assessment of a supplier selection process. Much research has been done on the enablers of a preferred customer status⁶⁷. A problem with all these enablers of a preferred customer status is that they can almost only be assessed in the case that there is already an existing relationship. Some financial enablers can be estimated like the purchasing volume, which could potentially be like the volume at the current supplier. Growth potential can also be estimated by looking at which products could be allocated to the supplier in the future. Another measurement that is possible to predict is the cultural fit between the buyer and supplier.⁶⁸ All in all this possibility of predicting the preferred customer status before a relationship is established has not been done before, despite the need of assessing more social criteria’s during the supplier selection process.

⁶³ See Yildiz & Yayla (2015). P. 169; see Schramm et al. (2020), p.4.

⁶⁴ See Vasina (2015). P.42

⁶⁵ See Taherhoost & Brard (2019). P. 1029

⁶⁶ See Rashidi et al. (2020). P.17.

⁶⁷ See Routroy (2016), p. 1178-1180.

⁶⁸ See Schiele (2012), p. 48.

3.3 Evaluation techniques used by manufacturing firms to identify poor performing suppliers: cost and delivery centred methods

3.3.1 Objective methods can be used to identify the performance of a supplier

Almost all manufacturing firms nowadays have some kind of system to evaluate the performance of their suppliers. In highly competitive markets it is important to know how your suppliers are performing to give a signal if action need to be taken regarding that supplier. This is mostly done in a continuous way to indicate immediately if a supplier is under-performing. Objective methods have in common that there is not much or almost none bias in the outcomes which can be allocated to the intervention of humans.⁶⁹ Most of this data could be derived from enterprise resource systems which store all the data from the actions that are performed that relate to the firm activities,⁷⁰ an example of such a system is SAP, Oracle, ISAH or PeopleSoft.⁷¹ Nowadays these system can sometimes even combine the data from other companies with the internal data, this could be beneficial to communicate supplier evaluation and improve supplier development.⁷²

Throughout every supplier performance measurement several key performance indicators need to be determined. These key performance indicators can have a different degree of importance between companies, however for most firms a similar set of KPI's can be found.⁷³ In most firms the quality, costs and delivery are of the highest importance to determine the degree of supplier evaluation.⁷⁴ In addition to these three KPI's a firm can think of adding management, relationship, technology or innovation to their supplier performance.⁷⁵ With the last one, innovation, becoming more and more important overtime as the creation of innovations with suppliers is increasing.⁷⁶

One of the methods that could be used to measure the performance of suppliers is the weighted-point method, also sometimes referred to as the 'linear averaging method'.⁷⁷ every category on which a buyer would like to measure the performance of the supplier will be

⁶⁹ See Stueland (2004), p. 3.

⁷⁰ See Umble et al. (2003), p. 241-242.

⁷¹ See Scheer et al. (2000), p. 57.

⁷² See Chen (2001), p. 374.

⁷³ See Xie et al. (2011), p. 453.

⁷⁴ See Dickson (1966), p. 14; See Ho et al. (2010), p. 22.

⁷⁵ See Xie et al (2011), p. 453; See Schaltegger et al. (2014), p. 277.

⁷⁶ See Pulles et al. (2014), p. 409.

⁷⁷ See Willis & Huston (1993), p. 1; See Monczka et al. (2015), p. 311

given a weight,⁷⁸ categories like quality, price and delivery can be included in this analysis. The outcomes per variable can then be multiplied with the weight of that variable which gives the total performance score of a supplier. This is one of the most common methods as it not complicated and easy to introduce. The total score can be used to compare it to possible alternatives to see whether a better option is present. A downside of this method is that a certain category with a high score can compensate a category with a low score,⁷⁹ which could cause performance problems in the future. Therefore, it is sometimes necessary to include non-compensatory or partly-compensatory rules to prevent this from happening.⁷² The nature of this method is objective however depending on the variables that are included in the evaluation this method can also be slightly subjective.⁸⁰

Another method that is commonly known in the supplier evaluation literature is the cost-ratio method.^{81 82} This is a much more complex method than the weighted-point method as it is necessary to have a mature cost-accounting system.⁷⁴ The cost-ratio method consists of four different steps to assess the performance of a supplier. According to Timmerman (1986) firstly the costs associated with the delivery, service and quality should be identified. Next these costs are expressed as a ratio of the costs of the total value of the purchase. After calculating the ratios all these ratios should be computed which give an overall cost ratio. This ratio is applied to the total unit price to find create a net adjusted cost picture. The cost-ratio method is based on the principles of the total cost of ownership theory which states that a buyer should look at both the indirect an direct costs when making a decision on which product to buy.^{83 84} The difficulty of this method lies in the fact that it can sometimes be quite difficult to determine the right price of categories like delivery, quality and services, therefore there is a high need of a good cost-accounting system.

The term objectivity is often preferred in measurement of supplier performance as it means that there is less bias due to human perception. However, almost none of the methods that are used can be classified as solely objective. In most supplier performance measurements, a combination is made between objective and subjective categories and trying to limit the

⁷⁸ See Windy et al. (1968), p. 33.

⁷⁹ See Dulminn & Minnino (2003), p. 179.

⁸⁰ See Willis & Huston (1993), p. 1.

⁸¹ See Timmerman (1986), p. 4.

⁸² See Monzcka et al. (2015), p. 311.

⁸³ See Monzcka & Trecha (1998), p. 7.

⁸⁴ See Ellram (1995), p. 5.

degree of subjectivity.⁸⁵ The most important thing is that while interpreting the results of such an objective measurement that you should always take into account the human bias.

3.3.2 Subjective methods like cross-functional scoring models can be used to measure supplier performance

Not only objective methods are used to evaluate the performance of suppliers, subjective methods can be used as well and are often preferred by the managers.⁸⁶ The benefit of using subjective methods is that it does not need a highly developed system to subtract the data from. As a consequence, it is much easier to introduce these subjective methods to analyse the performance of suppliers. One of the main problems with subjective performance measurement is that there is a high probability of bias due to human interpretation.⁸⁷ However, in a research on firm performance measurement it was found that subjective methods are not necessarily less trustworthy as it gave similar results as the objective methods used.⁸⁸ Therefore it is important for firms to also consider subjective methods as it brings benefits like lower cost and it is easier to introduce which makes it more accessible for all sized firms.⁸⁹

One example of a simple subjective supplier performance evaluation method is the categorical system method.⁹⁰ Firstly, the performance categories should be defined on which a supplier would be measured. After defining these criteria, a score is given to all categories with a simple categorical score. These scores can for example be satisfactory, neutral or unsatisfactory.⁹¹ A total score is then computed out of all the scores for the different categories which indicates if a supplier is performing well. The difficulty with this categorical system method is that all categories have the same weight which is quite often not the case due to different in importance of the categories to the company.⁹² Furthermore, it is heavily depending on the person who is scoring the supplier and his expertise. However benefits to this method is that it is cheap and does not need much data from any kind of system.⁸⁴ In addition, the categorical system makes it possible to include employees from

⁸⁵ See Stueland (2004), p. 3.

⁸⁶ See Zulkiffli & Perera (2011), p 3.

⁸⁷ See Dodgson et al. (2009), p. 20.

⁸⁸ See Song et al. (2005), p. 265.

⁸⁹ See Timmerman (1986), p. 5.

⁹⁰ See Timmerman (1986), p. 3; See Monzcka et al (2015), p. 311.

⁹¹ See Timmerman (1986), p. 3.

⁹² See Ho et al. (2010), p. 22.

different kind of expertise to rate the suppliers which can give a better representation of the actual performance.⁹³

With the categorical system method being one of the simplest subjective methods more subjective methods have been developed. Another subjective method that can be used is like the weighted-point method however this time it will include weightings of different professionals.⁹⁴ To avert confusion it will have the name of cross-functional scoring method in this research. Different business experts need to assess which criteria are the most important for them and score them accordingly to their importance. The business expertise s can differ greatly in what they think is important for the supplier evaluation. For example, engineers can value quality much more while purchaser value costs much more. After weighting the different criteria, these criteria need to be operationalized with measurements relevant to that function. Scoring all these different business units will lead to a total score which represent not only the purchasing function but also the other functions. Overall, this method can therefore give a much better representation of the actual supplier performance than the performance measurement applied only based on the knowledge of the purchasers. A downside of this method is that there is much more coordination involved to gather all the weights of the different functions. This higher degree of coordination also implies that it will take more time and therefore will be more costly.⁹⁵

Even though a distinction is made between objective and subjective methods it is impossible to assume that a method is solely subjective or objective. All methods should be applied carefully and considering the degree of subjectivity as this can potentially falsely influence the supplier performance evaluation.⁹⁶ However, this does not mean that firms should not use subjective methods as it can also have the benefits like a more companywide supplier performance evaluation due to cross-functional scoring.

3.4 Preferred customer matrix as a tool to identify potential poor supplier-buyer relationships: a buyer's perspective

There are many different supplier performance evaluation that show if a supplier is performing sufficiently or is under-performing.⁹⁷ A basic goal of supplier evaluation is to

⁹³ See Zijm et al (2019), p. 58.

⁹⁴ See Moser (2007), p. 107.

⁹⁵ See White (2005), page. 1388.

⁹⁶ See Muckler & Seven (1992), p. 441.

⁹⁷ See Frederiksson & Araujo (2003), p. 366.

assess whether a relationship should continue or should be terminated or a development program should be started to meet the internal and external demand. Another tool to define whether a relationship should be continued or effort should be put into developing the relationship further is the preferred customer matrix.⁹⁸ This matrix looks at if a supplier is worth investing time and effort in as it will (potentially) give benefits in the future. These benefits can range from access to innovation,⁹⁹ cost reduction¹⁰⁰ to preferred resource allocation. This method of analysing the suppliers comes from a buyer's perspective to see whether the supplier is worth investing time into.

The preferred customer matrix developed by Schiele (2012) consist of four different quartiles in which suppliers can be classified (figure 2). These classifications are given the following names: King, Black Knight, Squire and Quacksalver. All four classifications come with their own strategy that should be applied to the buyer-supplier relationship, from a buyer's perspective. The suppliers are classified into these categories based on two different dimensions. On the y-axis the buyer status with the supplier, which can be a standard customer or a preferred customer. And on the x-axis the competitiveness of the supplier, which can be low or high. These two dimensions will be discussed in more detail in the next section of this research.

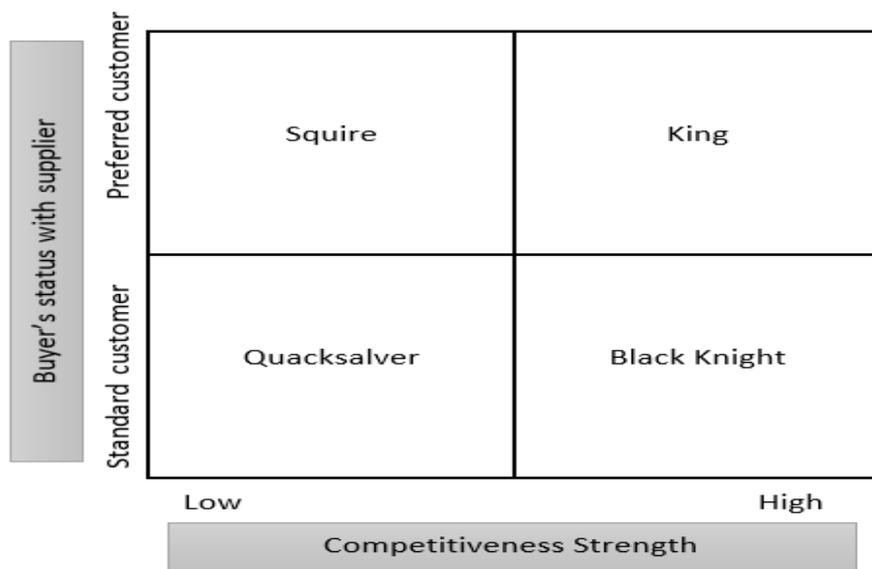


Figure 2: Preferred customer matrix

⁹⁸ See Schiele et al. (2012), p. 48-49.

⁹⁹ See Schiele et al (2012), p. 49.

¹⁰⁰ See Bew (2007)

The 'king' status is acquired when a supplier scores high on the competitiveness and is a preferred customer.⁹⁹ The name king is derived from the fact that buyers should treat these suppliers as kings. A tactic could be to train specialized purchasers to interact with these kinds of suppliers. A generic strategy that should be applied to this group is to work closely together which makes it possible for a buyer to attain competitive advantage.¹⁰¹ This competitive advantage is derived from the access to the supplier's innovativeness but also through the steady supply in times of scarcity.⁹⁸

The 'squire' status is given to suppliers that are not scoring high on the competitiveness but have awarded the buyer with the preferred customer status. These suppliers should be kept in the portfolio only if there are no better alternatives in the market. Furthermore, a supplier development program could be highly useful for these suppliers as they have already awarded you with the preferred customer status. Developing the supplier can be easier than attaining the preferred customer status from another supplier as there could already be another buyer that needs to be outperformed. Therefore, the name 'squire' is given as a squire is trained by a highly skilled knight which makes it possible for the squire to become highly skilled as well in the future.⁹⁸

The 'black knight' status is assigned to suppliers that are highly competitive but did not award the buyer with the preferred customer status. These suppliers offer a threat to the competitive advantage of a buyer as they potentially give the resources and innovativeness to other buyers. Schiele (2012) proposed two different actions or strategies which can be applied to this kind of situation. Firstly, a supplier could try to find another supplier or a second-tier supplier that can be classified in the 'squire' quartile and make a supplier development program, to on the long-term gain competitive advantage from them as they develop themselves to the 'knight' status. Another option is to acquire this preferred customer status which can be very hard. However, it can be acquired by looking at the different criteria that are important to suppliers ranging from hard financial to the trust-based criteria.¹⁰²

The last quartile is the 'quacksalvers' which are not competitive and do not award you with the preferred customer status. Quacksalvers means a person that is selling medicines but does not have much medical knowledge and does not show any empathy with their buyers.

¹⁰¹ See Schiele (2012), p. 48.

¹⁰² See Bew (2007), p. 2-3.

In the case of business nowadays that means that a quacksalver does not give any competitive advantage and does not maintain a good relationship. Therefore, it is advisable for suppliers that fall into this category to search for other opportunities, especially if the supplier is providing critical parts of the products.⁹⁸

3.5 The underlying dimensions of a preferred customer matrix: Buyer's status and supplier competitiveness

The preferred customer matrix consists of two different dimensions named the buyer's status and the supplier competitiveness. Based on these two dimensions the generic strategy can be determined on how to approach the supplier. The buyer's status can range from standard customer to preferred customer which seems to be a clear dichotomy and is therefore less vulnerable to discussions. The supplier competitiveness can range from low to high which is more of an ordinal variable and therefore much more discussion can be caused on where to place a supplier. As in the previous chapter the preferred customer status is discussed into detail, which concerns the buyer's status variable this chapter will look much more into the supplier competitiveness dimension.

Chikan and Gelei (2010) stated the definition of firm competitiveness as follow; '*The capability of a company to perceive changes in both the external and internal environment and to adapt to these in a way that the profit flow generated guarantees the long-term survival of the firm*'.¹⁰³ Another definition but with a lot of similar components is given by Buckley et al (1988); '*Competitiveness is synonymous with a firm's long-run profit performance and its ability to compensate its employees and provide superior returns to its owners*'.¹⁰⁴ In this research the firm competitiveness should be translated to the supplier competitiveness but the definitions stay the same. Both definitions use the word long-term which means that the firms' competitiveness is not based on the short-term performance of a company, but it concerns a longer period. However, there is no complete alignment yet on which variables should be included in determining the competitiveness of a firm.

In the past mostly financial indicators were used to determine the firm competitiveness.¹⁰⁵ These financial indicators are for example the costs, market share and growth rate.¹⁰⁴ But the downside of using only financial indicators is that financial indicators are based on the

¹⁰³ Chikan & Gelei (2010), p. 31.

¹⁰⁴ Buckley et al (1988), p. 177.

¹⁰⁵ See Singh et al. (2008), p. 534.

past while firm competitiveness is focussed on the future.¹⁰⁶ However financial indicator, costs, is still one of the main competitive priorities together with quality, flexibility and delivery.¹⁰⁷ A more extended version of the main firm competitiveness drivers was made by Vilonova (2009).¹⁰⁸ This model combined different competitiveness researches and divided the all the priorities into five different categories; Performance, Quality, Productivity, Innovation and Image.¹⁰⁷ Performance included financial indicators like the market share, growth rate, profit.¹⁰⁷ The quality dimension is concerning the products and services as well as meeting the demands of the customer. The productivity dimension contains the increase in production but also the usage of less resources. Innovation is a dimension that was not used by Singh et al (2008) but is becoming more important and is now often included into measuring the competitiveness of a firm.¹⁰⁹ The last priority is the image of a firm as this gives a feeling to the customer of what they can expect from that company.¹¹⁰

A dimension that is gaining more and more attention nowadays is social corporate responsibility (CSR).¹⁰⁹ Researchers mainly found that CSR can also be a source of competitive advantage.¹¹¹ However, this dimension is not included as the relationship with the other dimension is not completely clear yet. McWilliams and Siegel (2001) found a positive effect between the degree of CSR and financial dimension leading to firm competitiveness. Furthermore, Carlisle and Faulkner (2005) found that CSR is related to reputation which can cause competitive advantage¹¹². In the future this dimension can possibly be integrated into supplier competitive models as there is much interest nowadays into the subject of CSR.

Another aspect of firm competitiveness is that it cannot be measured by only looking at an individual firm. Firm competitiveness can only be measured by comparing the firms with other firms to see whether one can outperform the other. A firm that has good practices in place does not necessarily have a high competitiveness as there can be competitors that are outperforming them. On the other hand, a firm that just has moderated practices can still have a high competitiveness as there are no other companies that outperform them.

¹⁰⁶ See Buckley et al (1988), p. 177; See Singh et al. (2008), p. 534; See Chikan & Gelei (2010), p. 31.

¹⁰⁷ See Singh et al. (2008), p 528.

¹⁰⁸ See Vilanova et al. (2009), p. 60.

¹⁰⁹ See Cetindamar & Kilitcioglu (2010), p. 13.

¹¹⁰ See Kay (1995), p. 6.

¹¹¹ See McWilliams & Siegel (2001), p. 118.

¹¹² See Carlisle & Faulkner (2005), p. 413.

Therefore, it is necessary to look at the whole picture of all companies that are competing instead of measuring a single company.

4. A company that produces high pressure valves for power generation, oil & gas and petrochemical industry.

4.1 Background information of HP valves: a company that produces high pressure valves since 1981

This report will be written internally at HP Valves, which core business is producing medium to high pressure valves for oil and gas industry, power generation and the petrochemical industry. The origins of HP Valves come from the Dijkers Hengelo company which was specialized in producing industrial valves. In 1981 HP valves originated from an innovative spin-off of the Dijkers Hengelo company which lead to a more modern and flexible production. This resulted in the expansion of products portfolio by adding different pressure classes, sizes and applications.¹¹³ In 2006 HP Valves became a subsidiary of the Indutrade AB group which focusses on developing and manufacturing of high-quality industrial products. HP valves is the largest subsidiary of the Indutrade AB group which mainly consist of small entities.¹¹⁴ HP valves moved to a completely new facility in 2006 due to the strong growth and expanded the facilities in 2008. The factory is located in Hengelo (OV) on the High Tech Systems Park. With approximately 120 employees this company can be classified as medium sized firm.¹¹⁵

HP Valves changed from a manufacturing to a project-oriented approach overtime which was caused by the change in demands of the customers. This also created the following mission-statement: *“Building a strong international and reputable name in medium and high pressure industrial applications by developing partnerships with customers and servicing their flow control problems in the most complete, efficient, innovative, and reliable way possible at a competitive price by using our employees’ expertise along with continuous improvement to provide solutions that offer high added value to our customers, stakeholders, and the environment.”*¹¹⁶ Their focus therefore is on building relationships instead of doing

¹¹³ See HP Valves (2020a).

¹¹⁴ See Indutrade (2018), p. 76.

¹¹⁵ See HP Valves (2020b).

¹¹⁶ HP Valves (2020c)

single business exchanges. HP Valves thinks that cooperation and information sharing can improve the quality of the product and services overtime.

Technology is integrated within the whole production process of HP Valves. They make use of the ERP-system ISAH which gives the possibility to trace every move of products and processes within the company. With the help of microprocessors all materials can be tracked to handle order-picking and inventory management. In the past HP Valves experimented with automatic driving vehicles handling the internal logistics. Unfortunately, this experiment was stopped as the results were not satisfying.¹¹⁷ This shows that they are trying many different methods to enhance their productivity.

On the purchasing side HP valves does a lot of business with international suppliers and mainly focusses on single sourcing and creating relationships with their supplier. An example of this is the cooperation with Key Valve Technology (KVT) in South-Korea which was founded in 1998 and since then was cooperating closely with HP Valves. In 2009 HP Valves acquired KVT, expanded the product portfolio and gained access to their knowledge and strengthen both positions within the high-pressure valve market.¹¹⁸ The purchasers of HP valves make use of the Kraljic Matrix¹¹⁹ and the account portfolio to determine their strategy per product. The Kraljic Matrix and the account portfolio are combined in a confrontation Matrix to classify suppliers and to analyse the distribution of the power between HP Valves and their supplier. The main focus of HP Valves lies on creating strategic long-term relationships with their supplier. Their purchasing goals are defined as follows: be professional, reliable, efficient, innovative, competitive, deliver a high-added value.¹²⁰ Due to the focus on long-term relationships, HP valves mainly uses single sourcing however they have a second or third option which can supply their plant. Another important aspect of the HP Valves purchasing function is that they invest a lot in the techniques of forging and pouring parts which makes the costs of switching high. When switching to new suppliers these sunken costs need to be considered as it could be that staying with the same supplier is the better option. HP Valves pays some attention to being a preferred customer but without using the term preferred customer, in their documents it is referred to as a preferred position towards the supplier. To assess the purchasing maturity of HP Valves the maturity matrix of

¹¹⁷ See HP Valves (2020d)

¹¹⁸ See HP Valves (2020e)

¹¹⁹ See Kraljic (1983), p. 111.

¹²⁰ Inkoopsbeleidsplan HP Valves (2017-2018), p. 4.

Schiele (2007) was filled in.¹²¹ Overall the scores (table 1) are quite moderated with a total score of 42%. Especially the planning and process organisation can be improved on.

Category	Score
Planning	25%
Organisational Structure	54%
Process Organisation	41%
Human Resource and Leading	44%
Controlling	48%
Total	42%

Table 1: Purchasing Maturity assessment HP Valves

4.2 The supplier performance evaluation tools of a manufacturer of high-pressure valves.

Supplier evaluation is a part of HP valves to manage the suppliers and inspect where there is need for action. The supplier evaluation methods are described in the purchasing policy plan of HP Valves however after the plan of 2017-2018 this plan is not described in detail anymore. Therefore, this chapter will discuss the supplier performance measurement process based on the provided information in the purchasing policy plan of 2017-2018 of HP Valves. The goals of supplier performance measurement process within HP valves is to identify improvement possibilities and support decision making on which suppliers to replace. The supplier performance evaluation of HP Valves consists of subjective as well as objective measurements.

Based on several criteria the suppliers are evaluated on their performance. These criteria are derived from the most important purchasing goal; Reliability, Competitiveness, competitive Prices and Innovation.¹²² Three main criteria are defined on which suppliers are evaluated: Performance, Quality and Support towards the competitive position of HP Valves. These criteria are later split into different sub-criteria, which together create a total score for the main criteria. Different weights have been allocated to the main criteria based on the importance to the business of HP Valves to calculate an overall average score. The weights are as follow; Performance (50%), Price/Quality (30%) and Competitiveness (20%) (see appendix 1). These criteria are continuously communicated to the suppliers to improve transparency and already start the conversation for further improvements.

¹²¹ Schiele (2007), p. 285-291.

¹²² Inkoopbeleidplan HP Valves (2017)

The performance criteria, which consists of one sub-criteria, is mainly related to the delivery reliability. The sub-criteria are the timely delivery, concerning the degree to which deliveries are not exceeding the delivery date. A score of 1-10 is given for the sub-criteria, which roughly means that a supplier who has a 0-54% on-time delivery will score a 1, 75-79% on-time delivery will score a 6 and a 100% on-time delivery scores a 10. All the other scores are in between those percentages. The data for this criterion is extracted from the ERP system (ISAH) and is completely objective.

The second main-criteria is the Quality which consists of four sub criteria: Number of deviation registrations, origin of deviation registrations and the on-time delivery of certificates. The number of deviations is measured by the number of delivered products that do not meet the specifications agreed on in the contract. Origin of deviation registrations is focussed on the different kinds of deviations, which can range from only the wrong packaging material to completely wrong sizes and coatings. The last criteria are the certificates that need to be delivered with the products, HP Valves tries to maintain a high standard and therefore requires a lot of certificates to ensure the quality. This criterion measures the degree to which certificates are delivered with the products on-time. The total-score of the main-criteria Quality is composed like the Performance criteria with 0-54% scores a 1, 75%-79% scores a 6 and 100% scores a 10 with all the other numbers in between. This category is measured objectively with data however some data is lacking in the ERP system therefore this research will not focus on this category.

The last criteria are the competitiveness of the suppliers, more detailed it is the degree to which a supplier can support the competitiveness of HP Valves. Three different sub-criteria together create the total score for this main-criteria; Flexibility/Responsiveness/After-care, Price-quality balance and innovation. This competitiveness criteria is fully based on the subjective measurement method in the form of a questionnaire that is filled in by the purchase, sales and/or quality department. For these sub-criteria a total of 11 measurement criteria are developed which can be scored a 0-10, 0 being extremely bad and 10 being excellent. The scores of this questionnaire are filled in the ERP system which ensures that the information is accessible for everyone.

The objective supplier performance evaluation was done semi-annually, and the subjective questionnaire is filled in annually and is only considered annually. Not all suppliers of HP valves are evaluated because this will be an inefficient way to allocate their resource as

evaluating suppliers is a time-consuming process. Only the most critical suppliers, based on four different dimensions, are evaluated based on the above mentioned main-criteria, sometimes not all main-criteria are present in the evaluation as they are not applicable to the supplier. A supplier is classified as critical based on the product (how much does it add to the final product), purchasing volume, supply risk and durability of the relationship. The target was for HP Valves to at least have a total score of 8 for the suppliers. Even though this process was explained in detail in the purchasing plan of 2017-2018 the process has been neglected after 2017 or different reasons. First, the evaluation of suppliers was too much time-consuming. Furthermore, not all suppliers were willing to participate in this process which lead to a lack of data. After 2017 no supplier evaluation data has been gathered at HP Valves.

4.3 The unstandardised supplier selection process of a high-pressure valve manufacturer.

In the manufacturing business it often occurs that a supplier is underperforming which indicates that action needs to be taken. The manufacturer can initiate a developing process to get the supplier to the acceptable performing level. Another option is that the manufacturer starts looking for a new supplier which is the beginning of a supplier selection process. At HP valves similar process can be seen in which the supplier performance evaluation process does initiate a supplier developing program. At HP valves the supplier evaluation process does often not lead to a new supplier selection process as there is little knowledge on how to approach this process. This chapter will discuss the different stages of the supplier selection process (identification/benchmarking/selection) that currently are in place at HP Valves.

The first step of the supplier selection process is the identification of suppliers. HP Valves has many skilled purchasers with large networks within the industry. These networks are the main source of supplier identification as the purchasers can suggest a supplier out of their own network as a potential new supplier. However, this makes HP Valves highly dependent on their purchasers, if a purchaser leaves the company this can cause problems as their will be a loss of knowledge and network. Another supplier identification source the purchasers of HP Valves make use of is supplier tradeshow. On average HP Valves visits around 3 a 4 trade shows a year in Germany and the Netherlands. Trade shows in other countries for example Asia which is also a large sourcing area in the high-pressure valve industry are neglected. Another interesting method is that HP Valves often looks at the suppliers of the

competitors. HP Valves keeps track of the suppliers that are used by their competitors as this can be a potential source of supply. A downside of doing business with the supplier of your competitor is that the competitor already established a relationship with the supplier which can make it difficult to get a good deal with them. Furthermore, HP Valves maintains an approved supplier list that indicates which suppliers can always be used on a daily base. A benefit is that the approved supplier list also assesses the risks involved for that supplier and product based on a FMEA analysis¹²³.

The next step in the supplier selection process is the benchmarking of the suppliers that are identified as potential suppliers. This step in the process is highly lacking at HP Valves which can cause inconsistency in the decision-making process of new suppliers. Now this step in the supplier selection process is mostly done by 'guts feeling', which could lead to different purchasers making different decisions. The purchasers of HP Valves consider the purchasing goals which are defined in the purchasing policy plan. This process is not maturely developed and often stagnates by comparing prices and delivery reliability comes forward during a conversation with the purchasers of HP Valves.

The last step in the supplier selection process is the selection of the suppliers based on the benchmark between suppliers. This process is not structured within HP Valves and is executed based on feelings and the knowledge of the purchasers. A benefit of this way of approaching the supplier selection is that unnecessary steps can be skipped, fully trusting on the knowledge of the supplier, which can speed up the process. But this also brings some downsides as a relatively new purchaser does not have any guidelines on how to deal with the selection of a supplier. Furthermore, it can be much more difficult for a purchaser to defend the choices he/she made; with a standardised process this problem can be limited. A step that is taken by HP Valves to ensure the capabilities of the supplier is by visiting the supplier to judge whether the supplier can supply them. Additionally, the supplier needs to possess certificates to ensure the quality and conform with all the regulations in the high-pressure valve industry. HP Valves requires for most suppliers a ISO9001 certificate and depending on the product an additional ISO14001 certificate.

HP Valves tries to innovate their products which could lead to new products. These new products often need new suppliers if there is a completely different technology behind it and the existing suppliers are not capable of supporting this new technology. As the quantity of

¹²³ Inkoopbeleidplan HP Valves (2017)

orders is mostly low in the beginning of a product cycle the choice is made to start with single sourcing. After manufacturing the new product for a period, the new supplier is evaluated, and the choice is sometimes made to start with a second source. Dual sourcing is only used if the first supplier does not meet the desirable level, for example a low successful delivery rate, a second source could be the solution to that problem. Despite the possibility of dual sourcing HP valves prefers single sourcing because it improves the chances of a long-term relationship and in addition the quantities are quite slow.

5. Methods: Supplier evaluation and supplier selection process

5.1. Anova test to assess the alignment between supplier performance measurement tools and the preferred customer matrix

This research will check 21 suppliers on their strategic value to HP Valves, competitiveness and their relationship with HP Valves. A checklist (see appendix 2) will be filled in to identify whether HP Valves is a preferred customer and if the supplier is competitive . The suppliers which will be used in this research have been identified by HP Valves as their most important and critical suppliers. Additionally, there will be an option in the data gathering process to provide extra suppliers if the respondent, in this case the purchaser of HP Valves, thinks that another supplier should also be included. The suppliers that are included in the preferred customer check are listed below in table 2. Later, two suppliers were added, ISEF srl. and IAV Drehteile, because the purchasers were interested in how those two performed within the preferred customer matrix.

2. ASCO-controls BV (Nederland)	14. KB Schmiedetechnik GmbH
3. AUMA Benelux BV*	15. Key Valve Technologies ltd.*
4. Dongkang Metal*	16. L.E. Jones Company
5. Dichtomatik	17. Marini Cipriano
6. Drehmo GmbH*	18. Rotork B.V.*
7. Rotork UK ltd*	19. Straub Armaturen Service GmbH
8. Frewo Metaal	20. Trislot NV
9. Gurtek Metal San	21. Valley Spring Co. Ltd
10. Dong eun Forging Co., Ltd	22. Winsert incorporated
11. HJ Valve Co. Ltd.*	23. IAV Drehteile
12. ISEF s.r.l	

Table 2: Most important suppliers HP Valves (project purchasing)*

The data will be gathered by using a preferred customer checklist which is derived from Schumacher et al. (2011).¹²⁴ Three different categories will be tested: strategic supplier, competitive strength and preferred customer. This checklist has a set of questions per category where the suppliers can score points between 1-5. If a supplier scores a 3,0 or higher for a certain category it can be classified as strategic, competitive and/or giving a preferred customer status depending on the category. The threshold of 3,0 is used as the limit to classify a supplier into a certain category of ‘King, Black Knight, Squire and Quacksalver’. The checklist has been slightly adapted by adding two new categories to measure the strategic relevance of the supplier. The categories which are added, are concerning the quality and certificates a supplier can deliver. Another addition is the criteria ‘pressure holding components’ which means that if a supplier delivers a product that is directly related to a pressure holding component it becomes more strategic for HP Valves. In the preferred customer dimension also one criteria is added concerning the communication with the supplier. A good communication is valued by HP Valves and the literature supports that this can be an indication of a preferred customer status.¹²⁵

The checklist per supplier will be filled by a purchaser of HP Valves, depending on who is responsible for that supplier. All the questions will be filled in based on the knowledge of the purchasers about the supplier except for two questions. The last two questions of the category ‘preferred customer’ will be filled in based on financial data of HP Valves and the supplier

¹²⁴ See Schumacher et al. (2008).

¹²⁵ See Hald et al. (2009), p. 968.

as these are financial questions. The most recent available financial data will be used, which is from the year 2019. For all the suppliers in table 1 this data will be given a score. The purchasing volume will be derived from the financial purchasing overview of HP Valves 2019. The turnover of the suppliers will be derived from the following databases: Orbis, LexisNexis or Dun&Bradstreet. All the financials were calculated to euros with the applicable change rate. Despite the wide range of financial databases not all the suppliers had financial data available. A source of this problem is that several the supplier were a subsidiary of a larger company/group and did not have individual financial data. Together with the purchasing professional of HP Valves an estimation has been made on the turnover of these specific suppliers.

The comparison between the preferred customer matrix and the evaluation systems of HP Valves is from a descriptive nature. Based on a statistical test the difference between the groups of strategic vs non-strategic, competitive vs non-competitive and preferred vs non-preferred customer will be checked with the supplier evaluation data that is available of HP Valves. An ANOVA analysis will be used as there are two different groups in every analysis and multiple evaluation criteria that are used at HP Valves (Delivery, Price/Quality, Innovation and Flexibility/Responsiveness). The focus will lie on the subjective evaluation with some objective data on the delivery. A reason for not applying a MANOVA analysis to the different groups of the preferred customer matrix is that the sample size is quite small which means that in that case the assumptions of a MANOVA could not be fulfilled. The reason for not using a regression analysis is that much of the data is vulnerable to subjectivity. A regression analysis can therefore give results which are not trustable. Furthermore, the data set is too small to exactly tell something about the degree to which an independent variable changes the dependent variable. The ANOVA test is more robust and can indicate whether there is an actual difference between the groups.

Later, during the research one evaluation criteria was added to the analysis, delivery reliability, because all the other data is derived from 2017 and the delivery reliability could be derived from 2019. The supplier performance evaluation data of HP Valves will be derived from their ERP system (ISAH). All the three categories are measured from a scale of 1 to 10 which means that it can be treated as a metric variable. Two suppliers (ISEF srl. and IAV Drehteile) were not in HP VALVES purchasing portfolio at the time of supplier performance measurement which means that they were excluded in the comparison of three evaluation criteria (Performance, quality and competitiveness).

5.2. Methods for the supplier selection process

5.2.1 Five methods to identify potential suppliers

A supplier selection will be initiated when the current supplier is underperforming or there is no supplier at all. The first task in the supplier selection process is to identify the suppliers that can potentially serve your demand.¹²⁶ There are many different methods to find these suppliers that companies. One of the most common methods used by companies when searching for suppliers is by looking at their approved supplier list, almost 70% of companies use this method to identify suppliers.¹²⁷ The approved supplier list consist of suppliers that are meeting the requirements to supply your firm. A supplier can be added to this list based on old trade relationships or previous supplier selection processes. If a supplier needs to be found this is one of the first methods a purchaser will look at. Also, HP valves makes use of a ASL which also scores the risk every product/supplier brings with them. Companies that use approved supplier lists are often even putting restrictions on buying materials or services from suppliers that are not on the approved supplier list.¹²⁸

A problem can arise when there is a need for a supplier but there is no supplier on the approved supplier list. This could be the case in situation where a new material is needed or the supplier had a monopoly in the market before. In this case more effort needs to be put into the identification of potential suppliers which can be benchmarked. There are many different methods that a firm in such a case can use to identify suppliers; Trade magazines, supplier databases, trade shows, personal networks or third party assistance.¹¹⁰ Before looking at these channels to find suppliers the company already needs to have a clear idea on what product they are looking for. With the support of these supplier identification channels a shortlist can be created of suppliers that seem to have the capabilities to offer the products or services. Suppliers that are identified through these channels can later be added to the approved supplier list.

The simplest method of finding suppliers is by start looking at the internet which is also one of the cheapest methods. The internet nowadays provides much information about the

¹²⁶ See Ye et al. (2014), p. 340.

¹²⁷ See Plank & Kijewski (1991), p. 40.

¹²⁸ See Plank & Kijewski (1991), p. 38

products companies are offering.¹²⁹ Most manufacturers have their own website with the products and specifications which gives an indication on whether they have the capabilities to produce your demand. A downside of this method is that company websites contain information provided by the company itself which can be biased and give a different view than the actual reality. Another method is to use supplier databases, these databases contain a wide range of suppliers that provide many different products. This does not mean the internal databases like the approved supplier list, but the external databases called directories that track suppliers all over the world. If a purchaser does not have much knowledge yet about a market this can be an additional starting point to find suppliers and gain information about the materials.¹³⁰ Examples of these directories are: ThomasNet (North-America), MFG.com, HIS engineering360, AliBaba and Europages.

Another method to find suppliers is by using the expertise knowledge of the purchasers within your firm. Especially purchasers that have worked on a specific commodity for a long time will have a large knowledge base about the suppliers within their commodity. This can also be an argument to give purchasers a commodity as a task instead of switching them all the time.¹¹² A downside of this method is that this will only indicate suppliers within the network of the purchasers which could neglect other possible supply sources. Purchasers can also find suppliers by attending trade shows organized all over the world.¹¹² These trade shows are often organized for special markets or commodities and many different suppliers will be participating in these events. Purchasers can enlarge their network during these shows and inform themselves on what is currently possible within the market. Next to tradeshow a supplier can keep informed about potential supplier through reading supplier journals which contain a lot of specific information about several suppliers. A downside of supplier journals is that there is only a limit number of suppliers that are included.

The last method is closely related to the method of knowledge of your own suppliers. The purchaser can attain information about suppliers through non-competitors that are sourcing materials closely related. Through these non-competitors a purchaser can enlarge its network and find new suppliers, this is called therefore second-party or indirect information to identify new suppliers. Additionally, purchasers can keep track of the purchasing activities

¹²⁹ See Handfield (2006), p. 166.

¹³⁰ See Handfield (2006), p. 165.

of their direct competitors to see where they get their materials from. Their competitors' source can be a supply source for them in the future.

5.2.2 Benchmarking of potential suppliers: cost analysis combined with prediction of the preferred customer status

The supplier identification step will most probably result in a shortlist of suppliers that fulfil the requirements to supply a certain product. However, due to the high processing costs it is not beneficial to do business with all the suppliers on this shortlist. That reason calls for a further assessment of the suppliers' capabilities. Many different benchmarking methods have been proposed in the literature which can be classified as five different clusters; mathematical programming, artificial intelligence, expert systems, MCMD methods and multivariate statistical analysis.¹³¹ These methods can support a more objective decision making in the supplier selection process. However, in this research the cases for a supplier selection process are initiated based on a preferred customer analysis. Therefore, it makes sense to assess the new potential suppliers also based on a similar framework to see whether they outperform the existing supplier.

As the preferred customer matrix is using many criteria's concerning the relationship it is difficult to assess a new supplier using this matrix because in this state there is no established relationship yet. Therefore, it is necessary to remove one of the criteria for the competitive strength dimension. The question 'service position of 2nd tier suppliers' will be removed as it is difficult to assess this without doing business with a supplier and suppliers are often not willing to share their whole supply network with you. The other two criterions for the competitive position dimension will remain in the assessment of the new suppliers. A prediction will be made on how they are technological developed and how strong they are in the market. The checklist can be found in the appendix (see appendix 3).

The last category 'preferred customer' will need some changes as well since most questions are relational based which are difficult to answer with no established relationship. Only the questions about the purchasing volume and the share of turnover of your supplier will remain the same as a prediction can be made of these two questions. All the other questions will be removed as they are only assessable after a relationship is established. Due to this removal some other categories will be added assessing the potential relationship of a supplier. A good

¹³¹ See Kirytopoulos et al. (2008), p 496-497.

indicator of a good working relationship in the future is the national culture of the supplier's country.¹³² This will be added to the preferred customer assessment to capture the relational part. A comparison will be made between the buyer's country (Netherlands) and the suppliers country based on Hofstede's dimensions, if there is a large difference a low score will be given. The last criteria added will be focussed on the potential to growth the purchasing volume at the new supplier. This criteria is added due to the reason that there will be a low purchasing volume at the beginning of a new supplier. However, if there is a potential to source more materials from a supplier the position of the buyer can improve.¹³³ This category will also be of a more predictive nature than based on quantifiable data. This is not necessarily a problem as a research found that often 'soft' criteria (unquantifiable) are more important than 'hard' criteria predicting the performance of a supplier in the future (quantifiable).¹³⁴

The adapted preferred customer matrix for the supplier assessment in the supplier selection process does measures the potential relation and the competitiveness of the supplier. However, from a practical point of view other assessments needs to be made as well. It is necessary for example to take the costs, product quality and maturity of the supplier, and so on, into account otherwise the relational components are measured but the operational are lacking. Most of these dimensions are assess during an external audit at the potential supplier's site. With the collected data it is useful to assess the suppliers based on for example an analytical hierarchy process (AHP) which ranks the suppliers based on several criteria's that are corrected based on their importance. As a complete external audit is not possible, this research will stick to a cost analysis and the prediction of the preferred customer status. A cost analysis can already give a good comparison between suppliers supporting the supplier selection decision.

5.2.3 Selection of a supplier: additional considerations need to be made after the supplier benchmark

Benchmarking of the potential suppliers can be seen as a rational support tool to choose the supplier. However, a benchmark does not immediately mean that a supplier is already chosen

¹³² See Barry et al. (2008), p. 122; See Schiele (2012), p. 48.

¹³³ See Pulles et al. (2016), p. 134.

¹³⁴ See Kannan & Tan (2002), p. 11.

as there are still many decisions to be made. A purchaser needs to consider whether it is worth switching supplier, if the sunken costs are high and the difference between the current and the potential suppliers are small it can be less useful to switch supplier.¹³⁵ This process needs special attention at HP Valves as these switching costs are often quite high due to the high investment already done with the supplier. Before a supplier is selected a calculation needs to be made to see whether it is worth switching supplier. Switching costs is a collective name for many different costs: supplier identification/evaluating/testing, product and process redesign, additional purchasing equipment, employee training and technical help with the change.¹³⁶ When the switching costs are lower than the expected benefits of the new supplier it is worth switching, otherwise it will be better to stay with the same supplier.

Another consideration that needs to be made is the strategy whether a single or dual sourcing tactic should be used. Especially when two suppliers score like each other in the preferred customer/AHP analysis this question arises. Using dual sourcing (diversification strategy) reduces the supply chain risk and can increase leverage of the buyer and competition between suppliers,¹³⁷ but can also decrease the willingness of suppliers to put effort into the relationship. Furthermore, a dual sourcing strategy is more expensive than a single sourcing strategy due to the fact that instead of one contract, two contracts need to be maintained and the loss of economies of scale.¹³⁸ On the other hand single-sourcing (winner takes it all strategy) also causes competition between suppliers but increases the supply risk due to the lack of a second supply option¹³⁹ This needs to be considered based on the outcomes of a benchmark however a strategy can already be formulated beforehand.

A formal procedure is needed to finalize the supplier selection procedure within HP Valves. This consists mostly of entering the proper data to their ERP systems starting with the procedure of adding a supplier to the approved supplier list (P04.04). The last part is to actually buy the materials at the supplier which is following the 'inkoop artikelen' (P12.01). The last parts are important as it follows a standardised method that is already in place which reduces the process time and mistakes made during the process. After selecting and going through the formal processes which can differ per company it is important to track the new supplier closely in the beginning. This is important as in the beginning of a relationship with

¹³⁵ See Avgeropoulos & Sammut-Bonnici (2015), p.1

¹³⁶ See Pick & Eisend (2014), p. 186.

¹³⁷ See Wagner & Friedl (2007), p. 701

¹³⁸ See Constantino & Pellegrino (2010), p. 28.

¹³⁹ See Yang et al. (2012), p. 203.

your supplier it is most likely to have some errors, like wrong deliveries or misunderstandings. Tackling this problem in the beginning of the relationship will help prevent future mistakes.

5.3 Process proposal: Deriving a custom chart standardizing the different stages of supplier selection process of a high-pressure valve manufacturer

This chapter contains a proposal on how to approach the complete process of supplier selection. This process is captured in a flowchart which step by step leads a purchaser through the supplier identification/benchmarking and selection process. ISO 5807 is used as the standard to develop a flowchart,¹⁴⁰ the general rule is that the flowchart will flow from top to bottom and from left to right. Six different shapes will be used to indicate flows (arrows), terminals (ovals), decisions (diamond), documents, measure methods (cloud) and processes (rectangle) in the supplier selection process. The flowchart will be based on the previous three chapters that discussed the identification, benchmarking and selection of a supplier.

The flowchart (figure 3) starts with a terminal block ‘supplier selection process’ indicating the subject of this flowchart. As a first step in this process a process needs to be executed to determine for which supplier an alternative source needs to be found. This is not actually part of a normal supplier selection process however in this research, combining supplier evaluation and selection it makes sense to include it as they are complementary to each other. A preferred customer analysis can be used to identify problematic supplier as well as regular supplier evaluation methods. Based on both methods a supplier can be found that is underperforming and which needs replacement. If none can be found the flowchart will end and the company should keep monitoring their suppliers to keep track of suppliers that will potentially underperform in the future.

¹⁴⁰ See Myler (1998), p. 22-23.

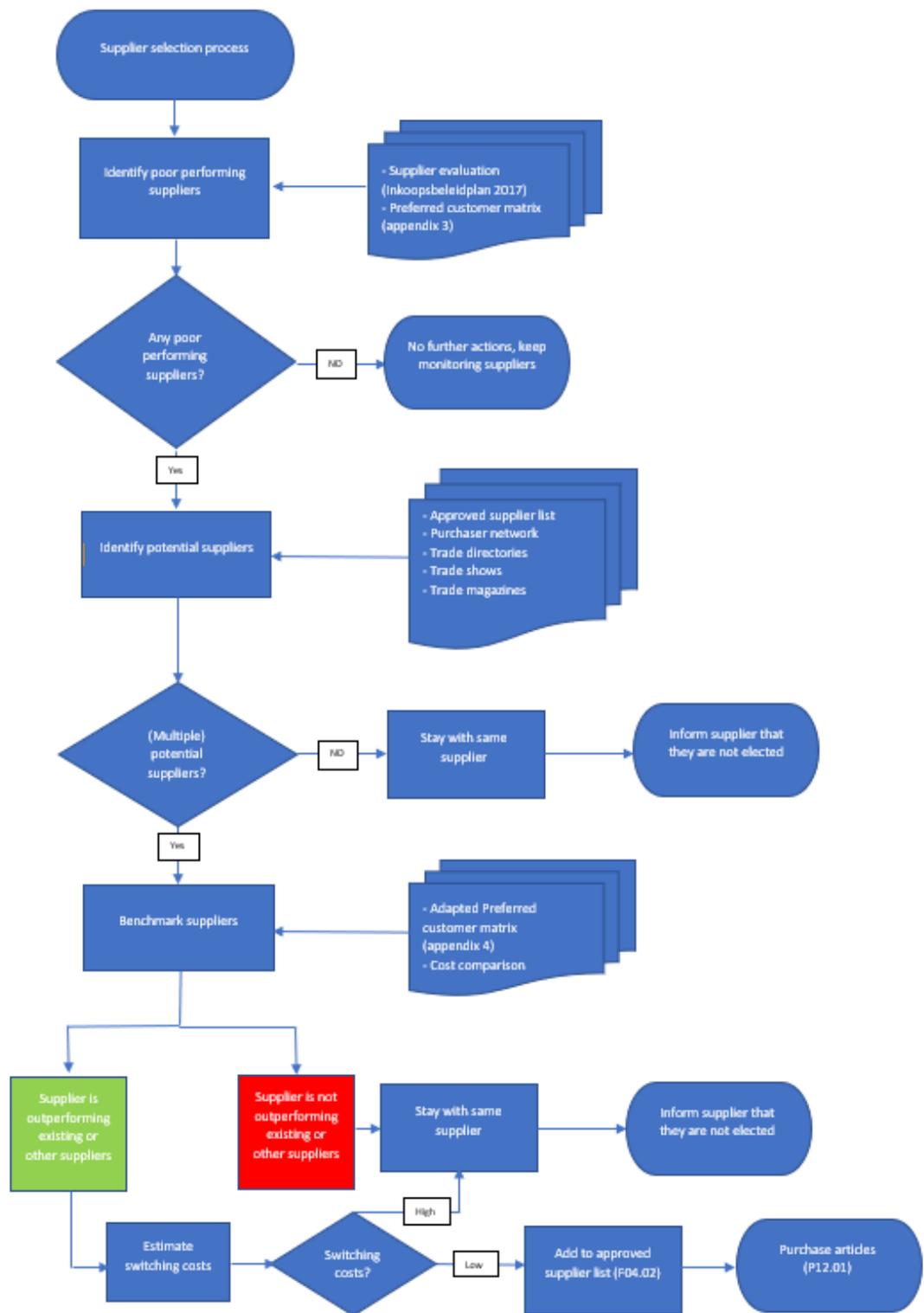


Figure 3: Custom flowchart supplier selection process HP VALVES

When a supplier is identified which is underperforming and needs replacement the first step will be to identify potential new suppliers. The most positive outcome is that there will be a shortlist of suppliers that meet the requirement to supply the plant. The shortlist can be created with suppliers identified with help of the ASL, purchaser network, trade directories, trade magazines and trade shows. If there are one or more potential suppliers besides the already existing supplier, the flowchart will move to the benchmarking process. If no other supplier can be found it is necessary to stay with the same supplier and start working intensively on a supplier development program to get the supplier on the proper level or work towards a preferred customer status.

The next step is the benchmarking process which is most time consuming. In this research suppliers will be compared based on the potentiality of attaining a preferred customer status in the future. Additionally, a purchaser needs to take operational measurements into account like costs, delivery promises and quality. The operational measurements can contain a multicriteria method to hierarchical benchmark the suppliers. It can be useful to also assess the current supplier as well in this analysis as it can clearly show the difference with the potential suppliers. In this research it will not be possible to do an external audit and therefore a multicriteria method to assess the suppliers is not possible, therefore a cost comparison will be made of the supplier to also take the operational side of the benchmark into account. If none of the suppliers is outperforming the current supplier, the company should stay with the current supplier. Otherwise the flowchart will go to the next process which is estimating the switching costs. Switching costs should be estimated and when they are high it will be beneficial to stay with the same supplier. Low switching costs means that the process of supplier selection can be finalized by the formal steps of adding the supplier to the approved supplier list (P04.04) and the purchase of material (P12.01).

This flowchart will be tested with two underperforming suppliers, the suppliers will be chosen based on the preferred customer analysis, HP Valves supplier performance measurement and in deliberation with a HP Valves purchaser. Firstly, the material will be described into detail to gain a bit more technical understanding of the product. Thereafter, the flowchart will be executed as far as possible with the information that can be collected. During this process the flowchart will be checked on inconsistencies as well as processes that do cause problems or should be further developed in the flowchart. This research will mainly focus on the first parts of the model, identification and benchmarking of suppliers. The switching costs will not be analysed because an assessment of many different disciplines

together with an external audit are necessary to make a proper switching costs analysis. However, even though this part will not be applied it is important to keep it in mind for an official supplier selection process as it can influence the end decisions that are made.

6. Findings: Supplier evaluation and execution of the supplier selection custom flowchart

6.1 Identification of poorly performing suppliers: no indication of a preferred customer status based on the supplier performance evaluation

This section will discuss the results from the analysis of the evaluation methods. Firstly, the data for the preferred customer matrix was collected and secondly the data for the supplier performance measurement was extracted from the ERP system. The section will be ordered in a similar way, starting with displaying the results of the preferred customer matrix, secondly displaying the results of the supplier performance measurement of HP Valves and as the last step both measurements will be compared to see whether the supplier performance measurement already gives an indication on the possession of a preferred customer status.

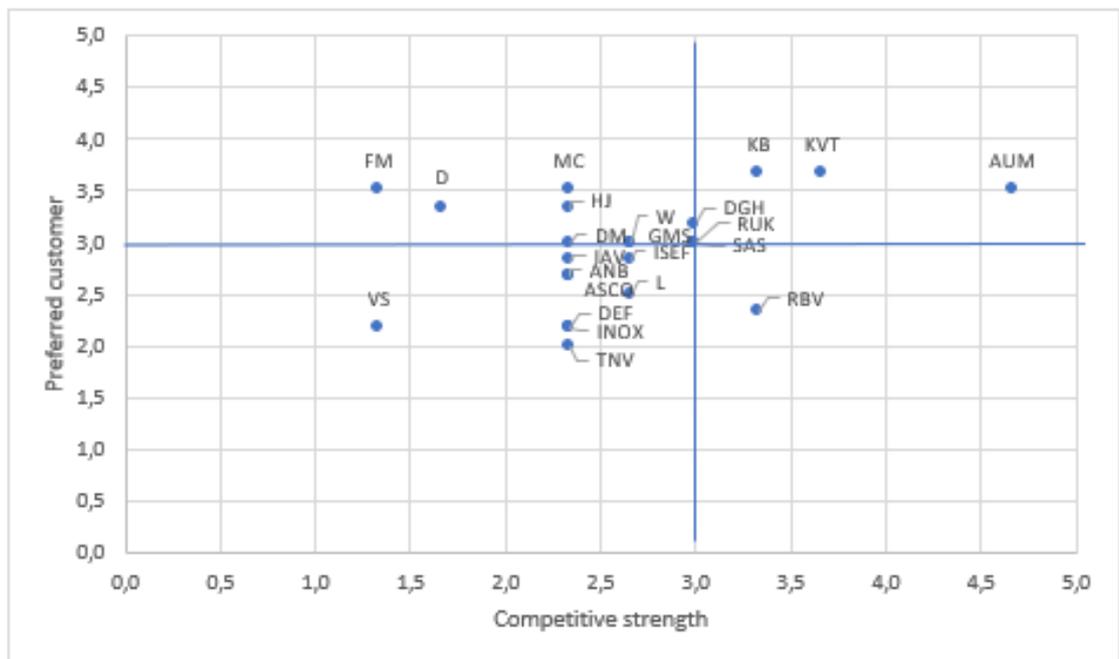


Figure 4: Preferred customer matrix existing suppliers HP Valves (abbreviations see appendix 1)

Several different points come forward looking at the preferred customer matrix (Figure 4). Only three of the suppliers, KB Schmiedetechnik, Key Valve Technology and AUMA Benelux are established highly into the Knight quadrant, which is the best quadrant. Only

Rotork BV is in the quadrant of the Black Knight, almost all the other suppliers are centralized in the preferred customer matrix. One of the remarkable things is that a lot of suppliers are not classified as competitive strong players in their market, the mean score for this component is 2,59 for which seventeen suppliers are classified as not competitive strong (table 2). The number of preferred customer and non-preferred customers are much more balanced with a mean score of 2,91. Ten suppliers are classified as non-preferred customer and thirteen as preferred customer (table 3). One of the worst performing suppliers is Valley spring Co ltd (VS), scoring low for the competitive strength and low score for the preferred customer status. For all the abbreviations within the preferred customer matrix see appendix 4.

	Mean	Standard deviation (SD)	N No	N Yes
Strategic supplier	2,84	0,88	14	9
Competitive strength	2,59	0,73	17	6
Preferred Customer	2,91	0,51	10	13

Table 3: Descriptive statistics preferred customer matrix

Table 3 shows the descriptive statistics of the supplier performance evaluation executed by HP Valves. The goal of HP Valves is to reach at least an eight for all the categories however none of the subjective categories reach close to it. The flexibility/responsibility category scores highest with an average score of 7,06 followed by the price/quality score of 6,74 and the lowest score of 6,65 for the Innovation criteria (Table 4). Additionally, the degree of deliveries on time have been measured as this could be derived from more recent quantifiable data. The suppliers of HP Valves score quite low with an average percentage of 51,87 of deliveries that are done in time (Table 4). The individual scores per supplier for the three different categories are shown in table 5.

	Mean	Standard deviation (SD)
Flexibility/responsibility	7,06	0,88
Price/quality	6,74	0,61
Innovation	6,65	0,88
Delivery on time	51,87	22,65

Table 4: Descriptive statistics supplier performance evaluation

Company	Responsibility/flexibility	Price/quality	Innovation	Average
Asco Numatics Benelux	6,85	7,15	8,00	7,33
ASCO-controlsBV (Nederland)	7,65	7,00	7,50	7,38
AUMA Benelux BV	7,65	7,13	7,13	7,30
Dongkang Metal	5,78	6,20	5,08	5,69
Dichtomatik	8,25	7,35	7,00	7,53
Drehmo GmbH	6,88	6,95	6,63	6,82
Rotork UK ltd	8,05	5,90	7,25	7,07
Frewo Metaal	7,50	6,85	6,75	7,03
Gurtek Metal San	6,50	6,85	7,00	6,78
Dong eun Forging Co., Ltd	8,00	8,00	8,00	8,00
HJ Valve Co. Ltd.	6,61	5,44	4,83	5,63
INOX MECC s.r.l	6,30	6,30		6,30
KBSchmiedetechnik GmbH	6,70	6,75	6,38	6,61
Key Valve Technologies	6,47	6,49	6,42	6,46
L.E Jones Company	8,00	7,00	7,00	7,33
Marini Cipriano	7,35	6,80	6,50	6,88
Rotork B.V	5,20	5,45	5,00	5,22
Straub Armaturen Service GmbH	6,85	6,85	6,50	6,73
Trislot NV	8,00	7,00	7,00	7,33
Valley Spring Co. Ltd.	5,75	7,15	6,00	6,30
Winsert incorporated	8,00	7,00	7,00	7,33

Table 5: Supplier performance evaluation score per supplier

Making a comparison between the non-strategic group and the strategic group, a higher score for every category can be identified for the non-strategic group including the delivery on time than the strategic group (table 6). The flexibility/responsibility score has a difference however the t-test shows that this is not significant ($P > 0,05$). The price/quality and the innovation category have a significant difference ($P < 0,05$), which means that the non-strategic suppliers score significantly higher. The additional category, delivery on time, scores 10 percent points higher for the non-strategic group however this is not a significance

difference ($P > 0,05$). For the category's flexibility/responsibility, price/quality and innovation ISEF and IAV Drehteile are excluded due to the fact that there is no data available, for the delivery on time these two suppliers are included.

	Mean (SD) (non-strategic)	Mean (SD) (strategic)	Significance
Flexibility/responsibility	7,30 (0,79)	6,67 (0,92)	0,106
Price/quality	7,02 (0,91)	6,29 (0,65)	0,016
Innovation	7,02 (0,58)	6,09 (0,98)	0,036
Delivery on time	55,86 (21,6)	45,67 (24,1)	0,303
N	13	8	

Table 6: T-test classification based on strategic suppliers

Table 7 shows the results of the t-test with a classification based on the buyer's status with the supplier. None of the different categories turn out to have a significant difference ($P > 0,05$). The non-preferred customer group of suppliers scores slightly higher for the price/quality and the innovation category. The preferred customer group of suppliers scores slightly higher for the flexibility/responsibility and delivery on time however none with a significant difference.

	Mean (SD) (non-preferred)	Mean (SD) (preferred)	Significance
Flexibility/responsibility	6,97 (1,12)	7,12 (0,73)	0,708
Price/quality	6,88 (0,74)	6,66 (0,53)	0,429
Innovation	6,93 (1,10)	6,50 (0,74)	0,308
Delivery on time	50,80 (19,85)	52,69 (25,35)	0,848
N	8	13	

Table 7: T-test classification based on preferred customer

The last test that is performed is the t-test with a classification based on the competitive strength of the supplier. A problem with this t-test is that the non-competitive group is much larger than the competitive group. Therefore, this t-test needs to be interpreted carefully. In general, it seems that the non-competitive group is scoring higher for all the categories. The T-test did not find any significant differences between these groups.

	Mean (SD)	Mean (SD)	Significance
	(non-competitive)	(competitive)	
Flexibility/responsibility	7,24 (0,86)	6,63 (0,80)	0,152
Price/quality	6,80 (0,62)	6,60 (0,60)	0,519
Innovation	6,78 (0,93)	6,34 (0,71)	0,322
Delivery on time	53,9 (22,75)	46,00 (23,34)	0,473
N	15	6	

Table 8: T-test classification based on competitive strength

6.2. Application of the custom process for two different materials/commodities

6.2.1 Application of the custom flowchart for a spring manufacturer

6.2.1.1 Case 1: Information about compression springs for which the custom chart is applied

The first supplier for which the flowchart will be tested is a supplier that is manufacturing compression springs. The supplier now is Valley Spring Co Ltd. but they do not score very high for the supplier performance measurement as well as the preferred customer matrix. For the supplier performance measurement they scored an average of 6,30. The main problem of Valley Spring Co Ltd is that they are lacking in communication and have a lot of late deliveries which means that HP Valves is building stock to reduce the supply risk. On the other side Valley Spring Co Ltd is offering really good prices which is beneficial to the company, this is the main reason that HP Valves is still doing business with them. The preferred customer matrix Valley Spring Co Ltd scored and 2,17 for the buyer's status with supplier and an 1,33 for their competitive strength. Valley Spring is not close to a (technological) competitive market leader in the spring industry. Furthermore, the relationship has been difficult with a lack of communication about late deliveries.

In 2017 some action was taken concerning Valley Spring Co Ltd. The spring supplier reviewed all the prices to meet the demands of HP Valves, this is one of the main reasons that HP Valves is still doing business with this supplier as the prices are extremely low now. The prices were dropped on average by approximately 23%. An alternative supplier that was asked for a price proposal at the same time is Lesjefors Forge. This supplier was almost like the initial prices of Valley Spring Co Ltd but could not meet the reviewed prices. At the

moment the approved supplier list contains two different suppliers, Valley spring Co ltd and Ferro Springs. Ferro springs is the old supplier of springs but after 2009 no purchases have been placed at that supplier and can therefore be neglected.

Valley spring Co ltd is selling a wide range of springs differing in size and materials. The springs are used at HP valves in pneumatic actuators, specifically compression springs. The smallest springs that are bought by HP Valves have a size of 140x108x128,5mm and the largest are 312x255x230mm. All the springs that are bought consist of the same materials 51CR.VA.4, Chrome Vanadium. Another important specification of the springs is the wire thickness which ranges from 18mm to 31,5mm. Next to these specifications it is necessary for the supplier to have an ISO9001 to ensure quality. One of the difficulties with this product is the size of the compression springs. Many suppliers can produce springs, as it is a quite generic product, but their processes are not suited to produce springs as large as needed by HP Valves. The spring business is quite large with many different suppliers serving different markets.

Another aspect of this product is the finishing surface treatments of the springs. This is a criteria's which is subordinate to the prices, it is not necessary for the springs to be painted black however it is a positive feature for a supplier to be able to do this. A list was created of all the springs that are manufactured by Valley Springs and an estimation of their annual quantities based on the last three years. In the last year a total of 1500 springs was ordered divided over 20 different kinds. This list will be used to make a price comparison between the potential suppliers.

6.2.1.2 Case 1: Execution of the custom chart to find and assess new potential suppliers

After analysing the products, a first group of criterions were made to identify potential suppliers. The supplier does need to fulfil the requirement concerning the wire diameter. Additionally, the purchasers of HP Valves were interested in global sourcing opportunities as well as domestic options. This is also one of the criteria's that influenced the search of new potential suppliers. As a start to identify suppliers the approved supplier list was inspected but only Valley Springs (current supplier) and Ferro springs (past supplier) were listed. Based on previous experience these two suppliers were not reached out to again. Secondly, a short discussion with the purchaser of HP Valves was used to identify suppliers within his network. This discussion did not lead to suppliers that were added to the list of potential suppliers as they did not meet the requirements. Next, the trade directories were

consulted which lead to satisfying results. Via the 'Europages' trade directory one supplier was identified as a potential source of supply, Tevema. Tevema is one of the leading spring suppliers which is located in Amsterdam and multiple other cities in Europe. Unfortunately, they were not able of producing springs with the required wire size but they gave some other options of Dutch suppliers who could deliver these products, ATV springs and VIOD. Additionally, the other trade directories were consulted which lead to a potential supplier in China, Kathysia, which was found via AliBaba. The other trade directories did not give any matching suppliers. A search via internet gave two more potential suppliers, SE Asia located in Malaysia and Xiangtan Spring Factory in China, however after the initial mail they responded that they are not able to produce the springs. Therefore, the process was repeated and one more supplier was added; Elitesprings in Maylysia. Normally more methods can be used to identify potential suppliers, like trade shows, however in a short time period it was not possible to use this method. The absence of this method was partly compensated by the discussion with the purchaser of HP Valves as trade shows are also meant to expand your network.

The suppliers mentioned in the previous section were approached with a request for quotation (RFQ). In this request for quotation suppliers were asked to fill in prices and delivery time. Additionally, the prices were asked in the case the supplier did also perform the finishing treatment, black powder coating. Several different suppliers gave a response with a full quotation, in the case of Elitesprings and Kathysia it was given in USD which made it necessary to recalculate those prices to euros. ATV springs also responded however they did not give a full quotation and will therefore be neglected in the operational benchmark of the suppliers. The results of the RFQ's is shown below in table 8. Valley spring Co ltd. displays the price which is annually spend on springs at HP Valves, this is already a low price. The Dutch supplier, VIOD, is much more expensive and will therefore be less interesting. Kathysia, the Chinese supplier is offering even lower prices than Valley spring Co ltd. is doing now, this is a highly interesting supplier for HP

Valves. The last supplier that send back a quotation is EliteSprings which is almost on the same price as the current supplier. The delivery time of all the suppliers is like each other and can therefore be neglected. A problem with Elitesprings and Kathysia is that they

are using 50CR.VA4 instead of 51CR.VA4.

Supplier	Total Annual Price	Delivery Time	Coating
Valley Spring Co ltd.	€ 47.539,50		Yes
VIOD	€ 75.043,55	3-4 weeks	Yes
Kathysia	€ 29.869,14	3-4 weeks	Yes
EliteSprings	€ 50.022,42	3-4 weeks	Yes

Table 9: Operational benchmark suppliers' case 1

Another method to benchmark the potential suppliers is the usage of the preferred customer matrix. In this case the preferred customer matrix is more of a predictive tool to see whether HP Valves can become a preferred customer at the suppliers. In the matrix can be seen that only one of the suppliers is a strong leader in the market of springs which is Kathysia (Table 9). This supplier is one of the biggest Chinese suppliers of springs and is also supplier of the Chinese government. Valley spring is one of the weakest suppliers looking at the competitive market position. In contrast with the operational benchmark ATV springs is included in this matrix as it was possible to make a preferred customer estimation for them as well. In terms of the preferred customer status it seems that it will be quite difficult for HP Valves to become a preferred customer of a spring supplier. The main problem that arises is the fact that the purchasing volume spend on springs is quite small, in combination with the fact that a lot of spring suppliers deliver products to large industries like car manufacturers. These two points make it almost impossible for HP Valves to become a preferred customer at the identified suppliers.

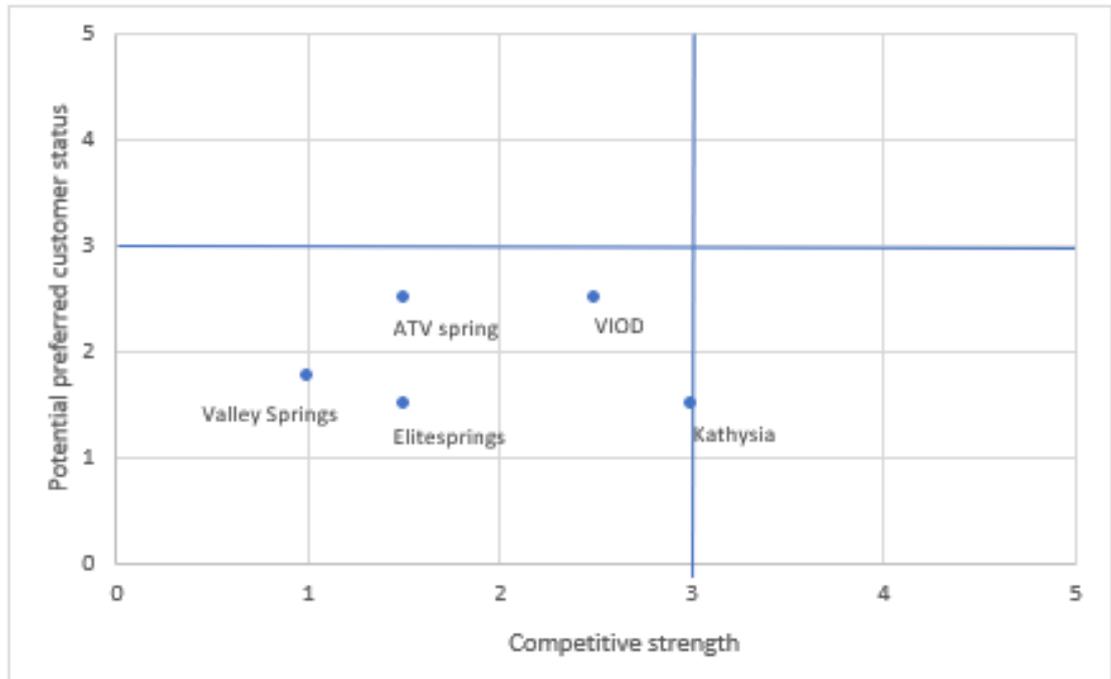


Figure 5: Prediction preferred customer matrix case 1

6.2.2 Application of the custom flowchart for a valve stem manufacturer

6.2.2.1 Case 2: Information about valve stems for which the custom flowchart is applied.

A second case in which the supplier selection flowchart will be used is for the supplier Inox Mecc. In the preferred customer matrix this supplier scored 2,33 for competitive strength, 2,17 for the buyer's status with supplier and 2,60 for strategic dimension. These scores mean that HP valves is not a preferred customer at Inox Mecc and that Inox Mecc is not a competitive strong player in their market. Not only for the preferred customer matrix the scores for this supplier are low but also the general supplier performance evaluation is not close to meeting the desired eight. A score of 6,30 was achieved for both the categories flexibility/responsiveness and price/quality. Furthermore, a delivery on time rate is 28% which is also far below the average of HP Valves suppliers. All in all Inox Mecc is underperforming according to the preferred customer matrix and the supplier performance evaluation which make it a suited to be the second case in which the supplier selection process flowchart will be used.

Inox Mecc is a manufacturer of valve components for the oil/gas and energy industry. Their production plant is in the north of Italy close to Milan. This manufacturer offers

many different components; stems, bonnets, closures, gates, flanges, seats, bodies, supports & trunnions, ring joint gaskets.¹⁴¹ All of these products are focussed on the valve industry, which is their main market. In the past most of these components that were bought from Inox Mecc were bought at a competitor, IAV Drehteile. Nowadays, both suppliers are used but most of the business is done with Inox Mecc. The total purchasing volume at Inox Mecc is about €90000 over the year of 2019, which does not make it one of the largest suppliers of HP Valves.

Now HP Valves has a problem with Inox Mecc due to the fact that Inox Mecc would like to raise the prices of their products. For years Inox Mecc has offered their products for low prices and a high quality however these prices were exceptionally low that the materials costs were exceeding the selling price. However, the low prices are one of the reasons why HP Valves is interested in this supplier but if they change this in the future, which is expected, it becomes interesting to search for better alternatives. Additionally, to the price a reason for choosing Inox Mecc as a supplier is the machinery they use to produce the stems. Normally for these kinds stems a bit of metal is scraped away to make the screw thread but Inox Mecc uses a method where a bit of the metal is pushed into the product which makes the screw thread much firmer.

A list of approximately 90 different stems was created for which a new supplier would be interesting. As sending out a RFQ for almost 90 different products would take a long time the decision was made to select around fifteen different items for which a RFQ will be send to potential stem suppliers. These fifteen different items are responsible for around 80% of the total number of stems bought by HP Valves. Additionally, to the prices the delivery time will be asked in the RFQ to see whether there is a large difference in delivery time. To get a proper quotation all the delivery conditions and drawings will be send to the supplier.

This case was executed in co-operation with one of the purchasers of HP Valves since this product needs a much higher technical knowledge than the products in case 1. Therefore, the purchaser of HP Valves also responded to questions of the suppliers regarding the technical properties of the items to get a good quotation. During this process the identified

¹⁴¹ See InoxMecc (2020).

suppliers were contacted and if they did not respond two weeks later a reminder was send to them to make a quotation.

6.2.2.2 Case 2: Execution of the custom chart to find and assess new potential suppliers

After analysing the different criteria's, a supplier needs to fulfil to produce the stems the process of identifying different suppliers was started. Firstly, a look was taken at the approved supplier list to see which suppliers were already in the portfolio of HP Valves that can produce these items. Two different suppliers were found which are Inox, there current supplier, and IAV Drehteile which is also supplying a large part of the stems for HP Valves. Next, a conversation was held with the purchaser of HP Valves to see if there were any suppliers in his network. One supplier was identified with this method which contacted HP Valves via the mail, ContiGroup an Italian supplier. After contacting ContiGroup, they replied that they do not have the capabilities of supplying these materials. No other suppliers were identified with help of the network of the HP Valves purchaser.

Next in the process of identifying potential suppliers a look was taken at the trade directories, Europages followed by AliBaba. Via Europages only one company came forward which is IAV Drehteile, therefore this website did not add any potential suppliers. AliBaba was also consulted, this led to one supplier that seemed to be capable of supplying stems, WTS Scaffolding which is a Chinese manufacturer. As HP Valves was interested in more suppliers than identified by the trade directories the search was continued by using the search machine Google. This led to many suppliers that seem to have the capabilities of producing high pressure valve stems. The following suppliers were identified: DLD stem (China), Shdebo (China), RolexEngineers (India).

The operational benchmark was done with four different suppliers as two suppliers (WTS scaffolding and RolexEngineers) did respond that they do not have the technical capabilities of producing the required items or did not respond at all. The benchmark started by looking at the prices, it could be seen that the Chinese suppliers are offering much lower prices than the European suppliers. DLD stem did not quote two items but still the total annual price would be much lower than the European suppliers. However, the problem that arises with the Chinese suppliers is the fact that they do not supply the same material as used currently. Also, a large problem with the chines suppliers is the fact that they do not have the capabilities to meet the smoothness of the stems ($RA < 0.4$). This does not mean that those suppliers are not interesting anymore as the smoothness is not required for every product

and some products can also be made with the other proposed materials. Therefore, later in the custom flow chart it will mean that the switching costs will be much higher due to design adaptations and supplier training. Furthermore, it could be necessary to keep two suppliers as some items will still need to be manufactured by one or another as they do not both have the same capabilities.

Supplier	Total Annual Price	Delivery Time	Material	Smoothness Ra<0.4
INOX Mecc	€ 224.746,00	6-8 weeks	1.4112	Yes
IAV Drehteile	€ 300.850,30	8 weeks	1.4112	Yes
DLD stem*	€ 49.003,35	8 weeks	420	No
	€ 70.170,90		431	No
Shdebo*	€ 9.599,00	8 weeks	AISI 420	No

*Table 10: Operational benchmark suppliers' case 2. *incomplete quotation*

In the preferred customer matrix (figure 6) of the second case a similar outcome can be seen compared to the first case. None of the suppliers seem to have a high potential of awarding HP Valves with the preferred customer status in the future. This fact is mostly due to the low purchasing volume of HP Valves in comparison to the turnover of the supplier. Based on the preferred customer matrix IAV drehteile would be the best option to buy all the stem materials however the operational benchmark shows that IAV Drehteile is much higher in price (table 10). The competitive strength of the European suppliers is

much high than the Chinese suppliers which is like the operational benchmarks as the European suppliers can meet the required smoothness and material.

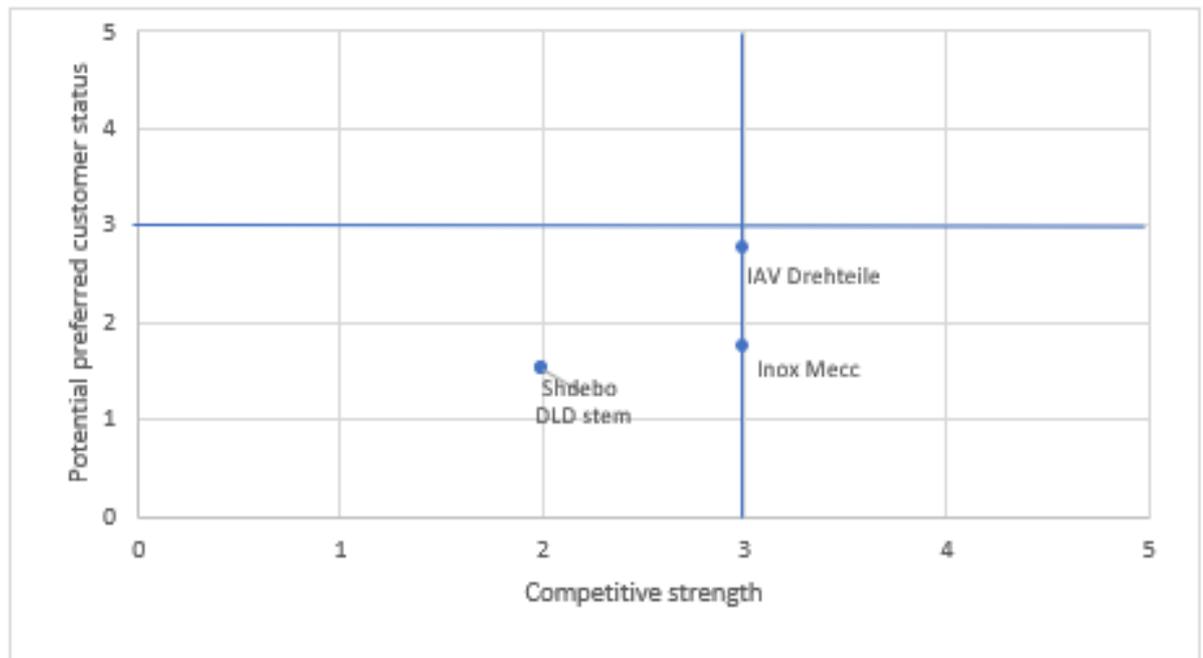


Figure 6: Prediction preferred customer matrix case 2

Overall, it seems that HP Valves is somewhat in a locked-in situation where only their current suppliers (IAV Drehteile and Inox Mecc) can deliver all the products. Staying with these suppliers has as a consequence that annually much money will be spent on these items while there are other cheaper alternatives. Another option to counter this situation is to start using an additional supplier like DLD stem. For some of the stems they do have the capabilities and another kind of material will not lead to any problems. Therefore, the administration costs, stock costs and transportation costs will increase. However, in the future with a lot of supplier development and investments the Chinese supplier could get the knowledge to produce the other stems as well. All in all, it means that choosing for one of the European suppliers will be more expensive for the product costs but the Chinese supplier will be more expensive considering the switching costs. A multiple sourcing strategy will be the third option but will bring more additional costs with it and will weaken your position towards the supplier as the purchasing volume per supplier will decrease.

6.3 Evaluation of the custom supplier selection process chart of a High-pressure Valve manufacturer

This chapter will discuss the problems and benefits that arose during the application of the supplier selection process chart. It will be structured as followed, beginning with discussing the identification step of the process chart, next the benchmarking process and lastly the chart will be discussed. The steps of analysing the current suppliers using the preferred customer matrix and the supplier performance evaluation will not be discussed as this is already explicitly discussed in other chapters.

Starting with the supplier identification step in which this research followed a structured method of looking at different methods in the following order: ASL, purchaser network, trade directories and the web. The approved supplier list was a starting point of the identification process and does often only bring forward a supplier that is a current supplier or was a supplier in the past but is not used anymore. The purchaser network already became more interesting as this gave suppliers that were not yet in the portfolio of the company. A downside of this method is that it more focussed on the local scale and did not oppose many suppliers from abroad. Also, this method needs to be used with caution as not necessarily every supplier that tries to network with the purchasers can produce the products. The third method used were the trade directories, which were mainly Europages for the European market and Alibaba for the Asian market. This method was not yet used by HP Valves and lead to many potential suppliers that could produce the items needed. The main benefits of these methods are the large number of suppliers that come out of the search machine and there are no costs involved (for these two trade directories) except from the labour cost. Especially, for the first case it seemed to be a good method to use as the product was quite generic and many suppliers do have the right capabilities. For the second case this method was less successful because the product was much more complicated and the trade directories picked out many suppliers that were not in the high-pressure valve stem business. Another downside of this method is that not all companies are listed on trade directories, therefore it could be that potential suppliers are neglected if a purchaser only looks at this method. The last method is the usage of the web. This is a method that cannot be neglected as almost every company nowadays has a website which can be found based on key words. Via this method also suppliers that were not listed in the trade directories could be identified however also some overlap was found.

The next step in the process was to benchmark the identified suppliers which in this case a RFQ was sent out for price and delivery time. Furthermore, as in this research the preferred customer status stood central an estimation was made whether HP Valves could become a preferred customer. The RFQ's were speaking for themselves and did not have much specific problems. A problem however that was more of an industrial cause was that many of the Asian suppliers did not work with the same materials as opposed in the drawing of the items, therefore it was sometimes difficult to make a comparison. The preferred customer matrix was additionally used to make a prediction and this could potentially be a good addition to normal benchmarking of suppliers. A preferred customer matrix could be decisive in the case suppliers score quite similar for the other benchmarking criterions. A problem that arose during the estimation of the preferred customer status is that in the literature not many criterions are yet developed to make a prediction of the preferred customer matrix for new suppliers. The preferred customer matrix is based on a relationship that is already established which is not applicable in the case of a potential supplier. Therefore, mostly the share in the supplier's turnover is decisive in whether a customer can become a preferred customer.

Overall, the supplier selection custom chart is a good standardised method of finding and selecting new or additional suppliers. A purchaser unfamiliar with the process can use this chart to find new suppliers in a structured way instead of getting lost in the process. For more skilled purchasers it can be a nice addition to see which methods can additionally be used for identifying and benchmarking new suppliers. The benchmarking process could involve a more in depth-analysis which also assess the quality of the supplier and compares it, for example an analytical hierarchy process could be used. In this case that was not possible because no supplier visits could be made. That is also the reason why the last part of the flowchart is not executed however it is important to keep those steps in mind as the literature and practice show that those steps always need to be taken into account when deciding on doing business with a new supplier. What can be seen in the second case is that sometimes already with the benchmarking results the switching costs needs to be considered as different options have different switching costs which will influence the end results.

One addition that can be made to the custom supplier selection chart is at the beginning of the chart before starting with the identification of suppliers. During the execution it came forward that it is really important to have as much technical knowledge as possible which enable the purchaser to make a shortlist of criteria's which a supplier needs to fulfil to actually be capable of supplying For a purchaser that is already in the business for a long

time this step will be less important as they already have gathered this knowledge over the years. However, for a new purchaser it is highly recommended to firstly gain as much technical knowledge as possible as this will save time later in the process.

7. The supplier evaluation tools of a high-pressure valve manufacture does not take the preferred customer status into account.

Suppliers that are indicated as a preferred customer based on the preferred customer are expected to score better on many different dimensions like delivery rate, price and innovation.¹⁴² In this case study at a high pressure valve manufacturer this connection could not be found. In most of the t-test that were applied no significant difference could be found between the high scoring group and the low scoring group, except from one case in which a distinction was made between strategic and non-strategic suppliers. In that case a significant difference could be found for price/quality and the innovation dimension, however, the non-strategic group was scoring higher for these dimensions than the strategic group.

One t-test that needs to be looked at specifically is the one which made a distinction between preferred customer and non-preferred customers. In none of the dimensions a significant difference could be found, furthermore, not for all the categories the preferred customers scored higher than the non-preferred customers which was expected based on previous researches. Therefore, the next section will discuss some possible explanation of why this is found based on reasoning and conversations with the purchaser of HP Valves. Furthermore, it will discuss what step could be made by HP Valves in the future.

For the innovation dimension a simple reason could be thought of to explain the non-significant difference between the preferred and non-preferred group. In the high-pressure valve industry they work with a lot of standards and certificates to ensure that no problems will occur at the plants on which the products are used. As these standards are preferred by HP Valves it could mean that they do not value other ideas that much on the product level as this will need many adaptations on site as well when the valves are installed. However, this does not give an explanation on why HP Valves would not value innovation on the process level as this could improve the production and administration costs. For the other dimension,

¹⁴² See Bew (2007); See Schiele (2012), p. 48-49.

price/quality, no significant difference could be found which is remarkable as normally a preferred customer supplier would offer better quality and prices.¹⁴³

For the delivery rate a slight difference (not significant) can be found, with preferred customers having a slightly better delivery rate. This would be in line with literature about resource allocation to a preferred customer,¹⁴⁴ but this difference was expected to be larger. Another remarkable point is the fact that the overall delivery rate is quite low with 51%, this can be due to the industry of forging and melting which is often lacking on delivery performance. For HP Valves this would be one of the main action points to ensure better delivery performance by means of searching for better suppliers or supplier development programs. Now they are working on replacing one of the forging suppliers with another one because of the lack in delivery reliability, this shows the urge of this problem.

In general, the comparison between competitive and non-competitive suppliers give similar results as the previous analysis in this research. The non-competitive group is scoring better for every category than the competitive group but non-significant. In general, this means that scoring better in a preferred customer matrix does not necessarily mean that the supplier will score higher for supplier evaluation as well. Two reasons could be thought of to explain why suppliers do not score higher for supplier evaluation if they are scoring higher for the preferred customer matrix in this case. Firstly, the main part of the supplier evaluation is subjective and therefore can be biased by humans. As a counter-argument the delivery rate was also tested and did not seem to have a better value for high scoring suppliers in the preferred customer matrix as well. Secondly, the preferred customer matrix used in this research comes from a buyer's perspective however a supplier can think differently about their customers (buyer). Therefore, it could be useful in the future for HP Valves to think about analysing their status with the supplier from a supplier's point of view as it could provide different results but useful insights in their relationship. One of the potential reasons for the supplier performance evaluation not taking the preferred customer status into account is that HP Valves is scoring only moderate for the purchasing maturity assessment. A firm that has a much higher score could have different results.

¹⁴³ See Bew (2007)

¹⁴⁴ See Schiele (2012), p. 48-49.

8. A preferred customer matrix can serve as an additional indication to initiate a supplier selection process to replace poor performing suppliers

8.1 Managerial implications: The preferred customer matrix could be included in the supplier performance evaluation and the customer supplier selection flowchart can standardize the supplier selection process

8.1.1 The preferred customer matrix can be included in the supplier performance evaluation

In this research it was found that no relationship can be determined between the preferred customer matrix and the scores in the generic supplier performance evaluation. In the literature it is opposed many times that the preferred customer status would lead to many benefits for the customer which makes it interesting to focus on achieving this status. For managers it is therefore important to see whether they are a preferred customer or not. If a manager or purchaser sees that they are not a preferred customer at an important supplier action could be taken to switch supplier or see how they can become a preferred supplier.

Theoretically if the supplier performance evaluation did already give an indication whether a supplier is a preferred customer or not this could already be used as a measurement of the preferred customer status. This relates back to the question if the supplier performance evaluation does already give an indication on the preferred customer status with suppliers. The answer to the question is that this research found that this is not the case and sometimes even the opposite is true. Especially for the strategic versus non-strategic group it seemed that the non-strategic group scored much higher than the strategic group.

For the managers this is an interesting conclusion as some action points could follow from this. Firstly, managers could consider including the preferred customer analysis to their supplier performance evaluation. As a result, the managers will be more aware of the fact that a preferred customer can bring many benefits. Furthermore, it gives an additional indication beside the generic supplier performance evaluation on which suppliers action could be taken on. For example, supplier development, investment in the relationship or even searching for new suppliers. This analysis will capture more of the relational part of the buyer-supplier relation than the supplier performance evaluation on its own. Since it captures

mostly a relational assessment and only a small part of the competitive strength it remains necessary for firms to also make use of generic supplier performance evaluation.

8.1.2 A custom chart for the supplier selection process can improve the standardization of the supplier selection process

In many different areas firms are trying to get as much standardization as possible to make work less time consuming and to set standards. This research looked at the standardization of the supplier selection process of a high-pressure valve manufacturer. After doing literature research on the different steps and methods in the supplier selection process a custom chart was created to approach this process (Figure 3). This chart consisted out of different steps namely, identification, benchmarking and selecting. After the process proposal in the form of a custom flowchart it was tested with help of two real cases, which were selected based on the first part of this research.

The main question at the beginning of this research was if the process of supplier selection could be standardised. The answer to this question is that the process can be standardised by for example a flowchart which gives a good overview of every step that needs to be taken to come to the end of the process. So, implications from this research are that the usage of a method structures the process of supplier selection which makes it less vulnerable to mistakes. For example, by using all the supplier identification methods it is less likely that a good supplier will be neglected due to only focussing on one method. However, during the process of identifying new suppliers it came forward that a purchaser needs to be creative and ask around in the industry to collect as much potential supplies as possible. The advice therefore will be to use the list of methods proposed in this research but always try to find more suppliers by using other creative methods.

The next part in the flowchart concerns the benchmarking of the identified suppliers. In this research that part consisted of estimating the preferred customer status and a more generic operational comparison. In general, the advice to HP Valves would be to develop a standardised method of benchmarking which makes it easier to justify choices that are made towards management and other stakeholders. Another remark is that a benchmark can sometimes be difficult because of for example other materials that are used in countries. This means that despite standardising your benchmarking process you should always be aware of other factors and results cannot always directly be interpreted.

In the second case the part after the benchmark came forward, switching costs. This topic is not discussed into much detail in this research however the second case showed that even without in detail discussing this topic it should always be considered. A company should see the result of the benchmark and estimating the switching costs as an intertwined process. Not looking at both of those steps together before deciding will end in higher costs than expected and potentially a better supplier will be neglected. As a manager it could therefore be interesting to make a method to estimate the switching costs.

Overall, it can be concluded that a custom chart for the supplier selection process can help a purchaser in finding and selecting new suppliers. Some steps could be differently applied by different purchasers or companies, but standardisation will help the justification of choices and reduce the errors made. These steps can also differ per product as not all the products have the same importance. In this research all the products that were included did have a high importance to the company which makes it justifiable to put much time and effort in the process of finding, benchmarking and selecting a new supplier. If a product is of less importance to the company it can be more useful to shorten the supplier selection process as it will not have a lot of consequences for the purchasing value, quality and other company processes. Therefore, this custom supplier selection flowchart will be most useful for products that are of high importance to the company.

8.1.3 Improvements can be made on estimation of the preferred customer status of potential suppliers.

The usage of the preferred customer matrix in the supplier selection process seems to be possible and could incorporate a more social perspective, which is highly needed according to Rashidi (2020)¹⁴⁵. Only using this matrix in the supplier selection process does not seem to be capturing all the dimensions which are needed for a thorough benchmark of potential suppliers. In the two cases that were analysed in this research it could be seen that some suppliers were offering better prices but were scoring lower for the preferred customer status. As this could lead to contradicting outcomes it is therefore necessary to look at the preferred customer analysis as well as the operational benchmark.

A consequence of looking at two different measurements which are capturing two different dimensions it becomes a challenge of allocating a balance between both methods. The best

¹⁴⁵ See Rashidi et al. (2020). P.17.

outcome of a supplier selection benchmark is an end score that tells which supplier is the best option. Therefore, it becomes necessary to add weights to both methods representing the importance of that method. This way both methods can be combined in a supplier selection benchmark, which will then incorporate the operational/financial dimension as well as the social dimension.

Another point of improvement that could be found during the literature research and application of the preferred customer matrix in the supplier selection process is the lack of assessment criteria. The framework is mostly developed for assessment of already existing buyer-supplier relationship which is not the case when benchmarking potential suppliers. The purchasing volume and growth potential can remain in the checklist as an estimation can be made based on the capabilities of the supplier and the current purchasing volume on the specific item(s). In this research the cultural fit was added by assessing the degree of similarity of the supplier and buyer culture based on Hofstede's cultural dimensions. In the future it can be highly interesting to see which criteria's can be added to this checklist of potential suppliers as well. A possibility could be to look at the preferred customer enablers¹⁴⁶ and see whether these enablers can be formulated in such a way that they can be assessed without knowing much about the relationship yet. Increasing this checklist will improve the reliability of a correct answer on the question if a specific supplier will be likely to award the buyer with a preferred customer status. This will be a challenge however it could lead to a thorough social assessment in the supplier selection process.

8.2 Theory implications: More research needed on preferred customer analysis in supplier evaluation and the need for research on a practical benchmark approach in the supplier selection process

In the first part of this research the comparison was made between the preferred customer matrix and the supplier performance evaluation of a high-pressure valve manufacturer. Out of those tests came that the supplier performance evaluation in this case does not indicate the preferred customer status in any way. Furthermore, did it not give a hint on whether a supplier could be identified as competitive strong or as a strategic supplier. This brings some conclusions with it which are important for the literature.

¹⁴⁶ See Routroy (2016), p. 1178-1180.

Firstly, it means that even though many benefits because of being a preferred customer are found in earlier research it is not always the case. In this research a comparison was made between different suppliers and the suppliers indicating the buyer with the preferred customers status did not score significantly higher for any of the dimensions in the supplier performance evaluation. This does not perse means that the preferred customer status does not give any benefits as it could be that over-time the suppliers that allocate the preferred customer status to HP Valves will improve much more than the regular suppliers. In the future therefore it could be that if a similar assessment was made the supplier performance evaluation could give a hint on whether a buyer is a preferred customer. Another effect that could be seen is that the suppliers that gave the buyer a preferred customer status would improve much more over time.

In the second part of this research a look was taken at the standardisation of the supplier selection process. In general, this research showed that on the different steps of supplier selection a lot of research is done. Many frameworks have been developed for supplier benchmarking, quantitative as well as qualitative. However, combining these topics in different steps has only be done in a very general way, which leaves the necessity of firms to customise these processes. One of the problems that came from the benchmark methods is that most proposed methods in the literature are quite extensive and time consuming. In reality for most firms it is not possible to execute these processes on a daily basis with the limited time and personnel they have. This encourages researchers for a more practical approach towards benchmarking methods that would be applicable on a daily base but still thoroughly assess the different possibilities.

Furthermore, an interesting topic that was applied in this research is whether a preferred customer prediction could be used during the supplier benchmarking in the supplier selection process. Based on this research it could be concluded that it is possible to assess the preferred customer status for future suppliers. However, this assessment could be extended much more in the future. Many researchers have looked at assessing the preferred customer status of current established buyer-supplier relationships but not many have looked at assessing it for buyer-supplier relationships that do not yet exist. Therefore, the conclusion in this research is that it could be included but more research needs to be done on this topic to create a thorough framework.

8.3 Limitations and future development: A small sample in a case study. Future research can focus on the effectiveness of different supplier identification methods and a practical approach to benchmarking of potential suppliers.

Like every research this research also has some limitations to it. To start with this research was executed as a case study at a high-pressure valve manufacturer. The fact that in this research no connection was found between the supplier performance evaluation and the preferred customer matrix does not mean that this will be the case in every company. This could also be dependent on the methods of supplier evaluation used. One more important aspect that needs to be considered is the fact that only supplier evaluation of 2017 was available besides the delivery rate which was extracted from more recent data. The preferred customer checklist was filled in by purchasers of HP Valves in 2020 which leaves a small-time gap between the data collections. This fact could lead to a slight difference in results in comparison to when data was from the same year.

The last limitation of this research has to do with the preferred customer checklist which is developed to fill in the preferred customer matrix from a buyer's perspective. This means that the matrix in this research resembles how the buyer thinks that the supplier thinks about the buyer. As a result, from this it could be that a preferred customer status is awarded to HP Valves based on this research while in reality the supplier thinks completely different about HP Valves. Therefore, a similar research in which the preferred customer matrix is applied from a suppliers perspective could lead to different results.

As a result, from this research some proposals on future research can be made. As mentioned in the previous paragraph it would give useful insights to perform this same research with a preferred customer checklist from a supplier's perspective. Also derived from the previous paragraphs it could be useful for research to perform this research with more recent data in the future and in different companies from different business areas.

The second part of this research concerned the supplier selection process. After analysing this process and testing this with two cases it was proven that there are many different possibilities of supplier identification. At a first sight this seems to be speaking for itself however no research has yet looked at which methods are most useful and most applicable daily. In the future research this could be a topic to investigate even more as it will enable purchasers to search for suppliers in the most effective way. Furthermore, during the cases it could be seen that the checklist for the prediction of the preferred customer status awarded

by new suppliers it not yet thoroughly developed which could also have a large theoretical as well as practical use. The last recommendation of future research is from a practical point of view. In the literature many different methods of supplier benchmarking are described however most of these methods are not applicable daily as there is only limited time available. The business therefore would need a method which is less time consuming but still a thorough assessment of a potential supplier.

Regarding the inclusion of the preferred customer matrix many future developments can be made. To start with, future research could look at enhancing the number of criteria's that can be checked for the prediction of the preferred customer status of new suppliers. In this research the culture criteria was added based on Hofstede's dimension but the number of criteria's can be extended much more. Furthermore, future research could look at how reliable the method of assessing future suppliers with the preferred customer matrix is. The question that could be answered then is how many suppliers that have the potential of awarding a manufacturer with the preferred customer status give this status to the manufacturer.

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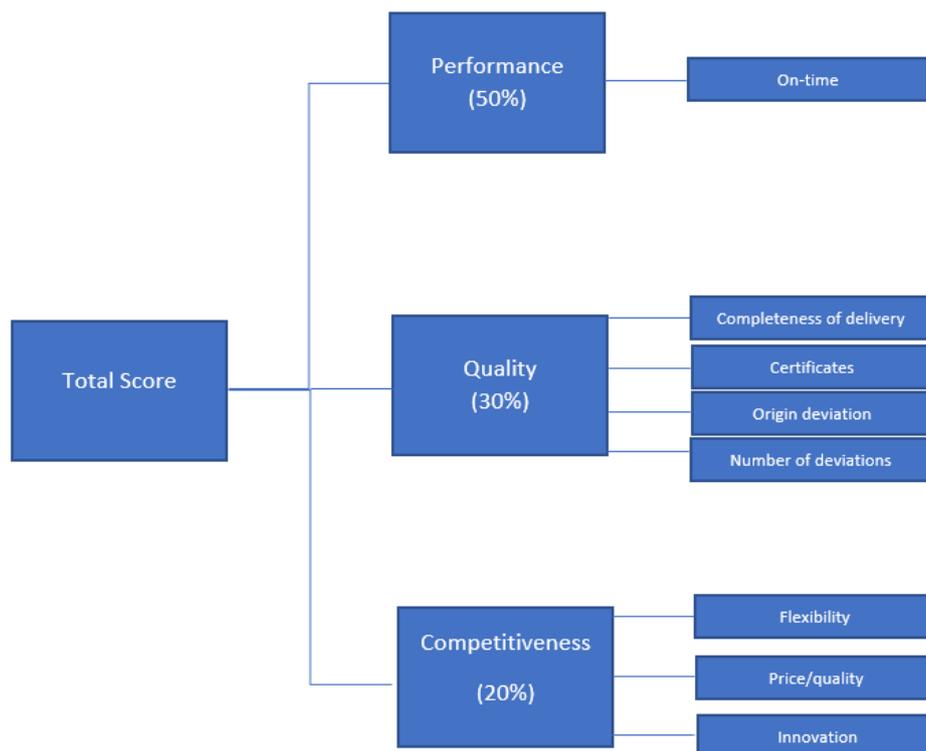
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Appendix

Appendix 1: Supplier performance evaluation HP Valves



Appendix 2: Preferred customer checklist

Preferred customer quick-checklist (1/3)						
Strategic supplier		1	2	3	4	5
End customer relevance	1 = Supplier only relates to the customer via the end-cost of the product					5= Component of this supplier is responsible for the purchase by the end-customer
Possession of quality certificates	1= Not in the possession of quality certificates					5= Always in possession of necessary certificates (ISO9001, ISO14001, NDE, QP, CE)
Supplier delivers products for pressure-holding parts	1 = Delivers components which have no relation to pressure holding parts					5 = Direct pressure holding components
Degree of specialization	1= Supplier serves different markets					5= Supplier only makes highly specialized parts and only delivers to direct competitors
Integration in product development process	1=Simple parts no supplier integration needed					5= Complex parts, early supplier integration needed
Strategic supplier if sum > 16						

Preferred customer quick-checklist (2/3)						
Competitive strength		1	2	3	4	5
Competitive market position of supplier	1 = weak					5= Top 3 worldwide, supplier has unique selling points

Technological competitive position of supplier	1= Supplier serves different markets						5= Top 3 worldwide, unique selling points
Service position 2 nd tier supplier	1=Components of 2 nd tier suppliers are not always the best						5= Supplier has better 2 nd tier suppliers than its competitors
Worldwide strong supplier > 10							

Preferred customer quick-checklist (3/3)							
Preferred customer		1	2	3	4	5	
Relationship with supplier	1 = difficult relationship, subordinate treatment						5= Long-term relationship, on different levels we are treated as best customer
Communication of supplier	1 = no communication at all						5= Communication about late deliveries and a good after-sale service
Price behaviour supplier	1= Price influence is difficult, supplier is not thinking about cost-saving measures						5= Supplier is willing to give discounts and think about cost-saving measures
Innovation behaviour supplier	1= No suggestions of improvement points						5= Supplier comes with innovative ideas on products/services or processes
Purchase volume per year	1= <0.1 million						5= > 1 million
Share in turnover of the supplier	1= <1%						5= >50%

	Preferred customer status > 18
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Appendix 3: Estimation potential preferred customer checklist

Preferred customer quick-checklist (1/3)						
Strategic supplier		1	2	3	4	5
End customer relevance	1 = Supplier only relates to the customer via the end-cost of the product					5= Component of this supplier is responsible for the purchase by the end-costumer
Supplier delivers products for pressure-holding parts	1 = Delivers components which have no relation to pressure holding parts					5 = Direct pressure holding components
Degree of specialization	1= Supplier serves different markets					5= Supplier only makes highly specialized parts and only delivers to direct competitors
Integration in product development process	1=Simple parts no supplier integration needed					5= Complex parts, early supplier integration needed
Strategic supplier if sum > 12						

Preferred customer quick-checklist (2/3)						
Competitive strength		1	2	3	4	5
Competitive market position of supplier	1 = weak					5= Top 3 worldwide, supplier has unique selling points
Technological competitive position of supplier	1= Supplier serves different markets					5= Top 3 worldwide, unique selling points
Worldwide strong supplier > 6						

Preferred customer quick-checklist (3/3)							
Preferred customer			1	2	3	4	5
Cultural fit	1= Completely different score Hofstede's dimensions						5= Highly similar score Hofstede's dimension
Purchase volume per year	1= <0.1 million						5= > 1 million
Share in turnover of the supplier	1= <1%						5= >50%
Preferred customer status > 9							

Appendix 4: Abbreviations preferred customer matrix

Asco Numatics Benelux	ANB
ASCO-controls BV (Nederland)	ASCO
AUMA Benelux BV	AUM
Dongkang Metal	DM
Dichtomatik	D
Drehmo GmbH	DGH
Rotork UK ltd	RUK
Frewo Metaal	FM
Gurtek Metal San	GMS
Dong eun Forging Co., Ltd	DEF
HJ Valve Co. Ltd.	HJ
INOX MECC s.r.l	INOX
KB Schmiedetechnik GmbH	KB
Key Valve Technologies	KVT
L.E Jones Company	L
Marini Cipriano	MC
Rotork B.V	RBV
Straub Armaturen Service GmbH	SAS
Trislot NV	TNV
Valley Spring Co. Ltd.	VS
Winsert incorporated	W
ISEF S.r.l	ISEF
IAV Drehteile	IAV