# Evaluation of the X-Efficiency Theory in the Supply Management Context

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## ABSTRACT

The paper focuses on the evaluation of the x-efficiency theory within the supply management. The applicability of the theory to four decision points in the purchasing process is evaluated. The Make or Buy decision, the sourcing strategies, the supplier strategy and the contracting process are assessed in this literature review. The study shows that the theory can contribute to the sourcing strategy, the supplier strategy and the contracting decision of purchasers by giving practical suggestions to the purchasers.

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### Keywords
X-efficiency, supply management, purchasing, theory evaluation

# 1. INTRODUCTION

Supply chain management is becoming more important nowadays, since companies are recognizing the value of effective management of the purchasing process and the relevant suppliers (Ketchen Jr & Hult, 2007, p. 573). For both small and large firms, effective supply chain management is a critical success factor that generates essential benefits (Wisner, 2011, p. XV). In order to stand out from its competitors and to develop competitive advantage, efficient supply chain management is essential for a company since lower purchasing costs, inventory carrying costs, improved quality, and better customer services are ensured through supply chain management (Wisner, 2011, p. 9). Organizations are required to integrate their purchasing function within the corporate strategy of the whole organization in order to ensure efficient supply chain management (Quintens, Pauwels, & Matthyssens, 2006, p. 882). The strategic purchasing department is important for organizations, since it ensures the supply of materials and relevant inputs for the production process of goods and services. By introducing a strategic focus to the sourcing process, firms are able to significantly reduce costs, increase productivity and improve the quality (Rendon, 2005, p. 8). Firms have to see the total supply chain management process and the effects on the company's competitive strategy in order to develop competitive advantage. It is the purchasing function's responsibility to ensure the constant supply of inputs. Therefore, it has to be decided how a purchase is made, suppliers have to be evaluated and the best one has to be selected, the purchased items have to be reviewed and the steady contact to the suppliers has to be maintained. These activities can determine an important part of the firm's turnover because strategic negotiations with suppliers can lead to significant savings (Mulder, Wesselink, & Bruijstens, 2005, p. 186). The objective of a company is to gain advantage over its competitors in order to survive in the competitive environment. Competition energizes companies to seek efficient production methods, to produce at the lowest possible costs and thereby improve their performance (Leibenstein, 1975, p. 580).

The x-efficiency theory is concerned with companies' levels of efficiency and addresses several influencing factors. According to this theory, when an input is used ineffectively, the gap between actual output and best possible output to that input defines the degree of x-inefficiency (Leibenstein & Maital, 1994, pp. 252-253). The theory captures the internal decision making processes which determine the intention of how inputs should be used and the firm's actual performance (Kubai, 2011, p. 2). Harvey Leibenstein established this theoretical concept in 1966. The X in x-efficiency is used in order to represent the unspecified and unknown influencing factors that is responsible for inefficiency (Frantz, 2007, p. 28). Motivational factors and the amount of pressure that a firm has to face are assumed to influence the x-efficiency levels. The x-efficiency theory offers a better understanding of how markets and organizational forces are affecting companies. Therefore, it helps to improve the use of resources and the level of efficiency.

In this paper, the value of the x-efficiency theory for supply management is evaluated and the applicability of the theory for the different steps in the purchasing process is assessed. Since the aim of this paper is to make a connection between the theoretical background of x-efficiency and it applicability within the supply management and the purchasing process, the following research question will be discussed. RQ: *To what extend does the x-efficiency theory contribute to purchasing and supply management?*

In order to evaluate the x-efficiency theory in the supply management context, it is also necessary to evaluate the value of the theory itself. Good theories reflect reality from a scientific viewpoint and improve managerial practice by increasing performance and supporting management (Zahra & Newey, 2009, p. 1065). Theories are useful in order to understand the complex business environment of firms and therefore, supply chain management can profit from theories as well (Chicksand, Watson, Walker, Radnor, & Johnston, 2012, p. 456). In order to evaluate the usefulness of the x-efficiency theory for the purchasing functions within organizations, its applicability in four key decision points in the purchasing process is assessed. These are the major factors with which the purchasing function has to deal: the Make or Buy decision, the sourcing strategies, the supplier strategy and the contracting process.

First, the paper will start with an examination of the theory's origins and its historical background in order to give an overview of the development of the x-efficiency theory over some period of time. Second, the underlying assumptions that are central to the theory are illustrated. The following section gives an explanation of the main variables and the core model in order to explain the basic principle of the theory. A visualized model about the main hypothesis is presented and additional variables are described that were later built upon this hypothesis. Afterwards, it is briefly examined whether the x-efficiency is a valid theory by discussing several characteristics that a theory must fulfil in order to accept the validity. For the purpose of summarizing the theoretical basis of the x-efficiency theory, the main statements are discussed in the following section. Furthermore, empirical research about the theory is summarized and presented in order to reflect the body of knowledge about the empirics of the x-efficiency theory. For this purpose, the literature selection method of this literature review is briefly explained, several empirical studies from different industries are summarized and empirical studies related to purchasing and suppliers are observed. After briefly explaining the theoretical background, the following part of this paper examines the contribution of the x-efficiency theory to the supply management of companies. Therefore, the four discussion points - Make or Buy decision, the Sourcing strategies, the Supplier strategies and the contracting decision - are discussed in relation to the theory. These findings will be visually summarized in a matrix. The last part of the paper summarizes the findings of the previous sections and comes to a conclusion in connection to the research question.

# 2. X-EFFICIENCY THEORY

## 2.1 Origins: The X-Efficiency theory emerged in 1966 by a Disagreement with the Allocative Efficiency

Due to empirical studies of firms that appeared to operate non-maximizing, Leibenstein was forced to reconsider the previously held positions of miro theory in 1966 (Dean & Perlman, 1998, p. 135). The collected data showed that both firms' costs were incompatible with minimization and the profits were not compatible with maximization. Several contemporary attempts to explain the data were made. Williamson (1965) tried to rationalize the data by stating that managers have an expense-preference function and prefer expenses that match their personal interests rather than

expenses in the interests of the firm (Williamson, 1965, p. 421). Therefore, agents where assumed to pursue objectives independent to the firm's preferences. In 1966, Leibenstein firstly came up with the x-efficiency theory (Leibenstein, 1966, p. 392). He stated that allocative inefficiency cannot be the reason for all inefficiencies since this type only occurs in situations where either monopoly or international trade exists (Leibenstein, 1966, p. 412). By coming up with the X-efficiency hypothesis, Leibenstein was more radical than the other attempts that aimed to explain the empirical data. In the following years, he elaborated this theoretical background and developed a larger general x-efficiency theory (Leibenstein, 1975, 1978a, 1978b). Earlier research on efficiency was mainly based on microeconomic level, as the concept of allocative efficiency was the most frequently mentioned theory until that time in(Bogetoft, Färe, & Obel, 2006, p. 451). The concept of allocative efficiency is defined as what can be gained by interaction with a perfect market (Bogetoft et al., 2006, p. 107). It means that only those types of goods and services are produced that are demanded and are therefore more desirable for the society. Leibenstein criticized that there are several other types of inefficiencies that are ignored even though these types are more significant in some cases (Leibenstein, 1966, p. 392). Not only Leibenstein, but also Mundell (1962) doubted the allocative efficiency theory. He raised the question whether some estimates of allocative inefficiencies within a monopoly would mean that the economic environment of firms does not influence the efficiency of organizations (Frantz, 2007, p. 1). Therefore, another perspective on efficiency was developed by Leibenstein, stating that imperfect competition in the market has an essential impact on the production efficiency of firms that are operating within this market (Leibenstein, 1975, p. 604). In previously accepted micro-theory it was assumed that the economic environment does not influence firms since firms are always trying to minimize costs. Leibenstein developed a framework in order to show that firms operating in a less-than-perfect competition are producing outputs less efficient than firms operating in another organizational environment that is characterized by more competition (Leibenstein, 1975, p. 580). At the beginning, Leibenstein had a lot of criticisms regarding the content of the x-efficiency theory. According to Stigler (1976), Leibenstein's arguments have to be criticized as the types of inefficiencies that are mentioned by him can simply be assimilated to the traditional allocative inefficiency (Stigler, 1976, p. 213). Additionally, some other economists showed their distance for the concept of x-efficiency and did not support the idea of "incomplete contracts, effort discretion and nonmaximizing behavior" being a cause for inefficiency (Leibenstein, 1978b, p. 203). It was rather accepted that a lack of information and errors in the production process are causes for inefficiencies, which supports the concept of allocative efficiency. As a reaction on this critique, Leibenstein wrote an article in order to support his idea and prove that the theoretical background of the theory is valid (Leibenstein, 1978b, p. 203). Some studies were represented in order to show that the x-efficiency theory is more valuable than the neoclassical theory of economics that relies on the idea that organizations always aim to maximize its efficiency in order to survive in the market (Nelson, 2008, pp. 12-13).

Nevertheless, there were not only critics but also supporter of the x-efficiency theory in the early beginnings. Comaner and Leibenstein (1969) wrote an article about the measurement of welfare loss and supposed that a shift from monopoly to competition leads to both lower prices for the customer and lower costs for organizations operating within that market. Therefore, an elimination of monopoly power can increase x-efficiency and thereby also cause welfare gain for the society (Comanor & Leibenstein, 1969, p. 307).

According to Hosseini (2003) Leibenstein has engaged in behavioral economics, which means that he reacted to deficiencies of the existing and generally accepted body of classical and neoclassical economic theory. Therefore, with the x-efficiency theory, he wanted to achieve a more realistic view on economic processes in order to show that the economic environment of firms can have an influence in inefficient production. (Hosseini, 2003, p. 393)

## 2.2 The Human Nature, Competitive environment, Unequal Market Information, Incomplete Contracts and Governmental Regulations are assumed to effect X-Efficiency

The main assumptions of the x-efficiency theory are discussed in the following. Unlike the allocative efficiency theory, the x-efficiency theory assumes that individuals do not always act rational (Frantz, 2007, pp. 3-4). The basic assumption of allocative efficiency is that it is the aim of all individuals and firms to maximize profits. Leibenstein (1966) refuted this assumption by stating that „neither individuals nor firms work as hard, nor do they search for information as effectively, as they could" (Leibenstein, 1966, p. 406). These assumptions that are made regarding the human nature are central to the x-efficiency theory.

1.) It is assumed that humans are not programmable machines but individuals that have a free will. Sometimes human beings are making rational decisions and at other times, non-rational behaviour can be observed. This can be explained by a multidimensional psychological profile that makes human behaviour unpredictable (Frantz, 2007, pp. 3-4).

2.) Another underlying assumption of the theory is the influence of the competitive environment on the efficient or inefficient production processes of firms. If a firm is operating as a monopolist, there is no need to improve performance and thereby to minimize costs. Since higher costs can simply be passed on to the customers, firms do not need to transmit pressure through the employees and managers (Leibenstein, 1975, p. 604). If environmental pressure is not strong enough, a manager is less concerned about the consequences of their decisions. Therefore, less effort is expended and this will directly lead to an increased degree of x-inefficiency of the organization (Button & Weyman-Jones, 1994, p. 91). Accordingly, perfect competition would be an environment that can encourage firms to operate x-efficiently. Nevertheless, it is assumed that in the real business world, there are imperfect markets (Frantz, 2007, p. 2). Inputs are not considered to be equally accessible for firms all over the world. This means, that management knowledge is varying and competent managers are not available for all businesses. Even if they are available, it may happen that the value of their knowledge and expertise is not recognized which means that their capacities are not being used (Leibenstein, 1966, p. 407). Due to the limited number of capable managers and entrepreneurs, company performance may be lower and therefore these companies may not be able to enter a new market. Therefore, external environmental pressure cannot be obtained and companies within the industry do not see the need to improve their performance (Button & Weyman-Jones, 1994, p. 92). The concept of pressure is central to the x-efficiency theory as it is assumed to influence human behaviour.

External pressure can be defined by the degree of market competition and internal pressure is about an individual's personality (Frantz, 2007, p. 1).

3.) Another assumption that can inhibit companies to perform efficiently is that market information is not equally available to every actor in the market. Therefore, some firms have gained an advantage over their competitors, which allows them to achieve better outputs (Leibenstein, 1966, p. 407). At the same time, financial resources are not assumed to be equally available to companies. This is influenced by the size of the organization, the country of origin and several other factors.

4.) Since the x-efficiency theory assumes human beings not to act rational in every situation, the principal-agent problem may also be seen as one of the reasons for x-inefficiency. These problems may lead to incomplete and contingent contracts, which can cause inefficiency (Gardner & Grace, 1993, p. 498). Firms often evade the negative consequences of cost overruns due to incomplete labour contracts (Button & Weyman-Jones, 1994, p. 93). Labour contracts can define the tasks that an employee has to fulfil and the time that has to be spent on the work. Nevertheless, it is assumed that these contracts fail to define the expected behaviours of employees in detail and therefore inefficiencies can occur (Frantz, 2007, p. 2). Organizations are only able to prescribe the working time, but cannot predict employees' effort level, which is critical to the firm's performance level (Taylor & Taylor, 2003, p. 76).

5.) The influence of governmental regulations is assumed to affect the x-efficiency as well. According to Button and Weyman-Jones (1994), companies that are owned or subsidized from the public sector have a high potential for increased x-inefficiency (Button & Weyman-Jones, 1994, p. 92).

## 2.3 By adding more Main Variables, the Core Model of X-Efficiency was developed over Time

X-inefficiency is about a firm's failure to fully utilize the available inputs and therefore to produce at the efficient frontier (Leibenstein & Maital, 1994, p. 252). The efficient frontier can be defined as the best possible output level under the prevailing conditions and circumstances of a firm. X-inefficiency is the gap between the attained output and maximum output that could have been attained by the organization given the existing inputs (Leibenstein & Maital, 1994, pp. 252-253). Leibenstein (1966) introduced the basic model about the x-efficiency theory (Leibenstein, 1966, p. 392). In his article he came up with the original hypothesis that there are three essential reasons that lead to a situation where x-inefficiency can persist.
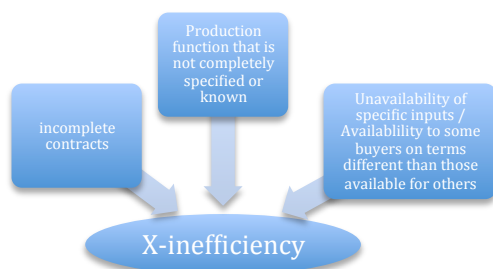


Figure 1: three basic reasons for x-inefficiency according to Leibenstein (1966)

Figure 1 shows the main hypothesis for the existence of x-inefficiency connected with variable performance for given inputs. Incomplete contracts are assumed to influence the efficiency of a firm because the effort that an employee has to expend cannot precisely be defined. According to Leibenstein (1966), the production function is never completely known, which means that the relation between inputs and outputs may be known, but the effect of changes in the input ratios cannot be precisely specified (Leibenstein, 1966, p. 407). It is possible, that specific inputs are not marketed or that they are not equally accessible for every firm that is operating within one market. Unequal access to inputs such as management knowledge, finance, raw materials etc. may affect the x-efficiency of a firm.

Ensuing books and articles by several authors (Frantz, 2007; Leibenstein, 1975, 1979; Leibenstein & Maital, 1994) have expanded on this original theoretical background (Leibenstein & Maital, 1994, p. 253). Market structure was found to be a key driver for x-inefficiency as well, since it is stated, that there is no need for monopolists to minimize costs in order to perform efficiently as there is no competition in the market (Leibenstein, 1975, p. 604). Market power came out to be a dominating factor for x-inefficiency since firms need to be under pressure in order to improve performance. Additionally, selective rationality was found to be an element of the x-efficiency theory (Leibenstein, 1979, pp. 484-485). Individuals are sometimes acting rational while their behaviour is not fully rational in other situations (Frantz, 2007, p. 2). Effort discretion is another influencing factor that reflects the variety of an individual's internal and external pressure, which affects the deviations of the individual's decisions from the firm's goals of maximizing behaviour (Frantz, 2007, p. 2). Next to that, each individual within an organization is affected by internal pressure. Peers and authorities influence an individual so that he or she acts different than with absence of that pressure (Leibenstein, 1979, p. 485). Another reason for x-inefficiency that was added later is the existence of inert areas. These are defined as upper and lower bounds within which an individual's behaviour remains the same. If the amount of external or internal pressure goes beyond those inert area bounds, routine behaviour is changed (Leibenstein, 1982, p. 92). In order to improve a company's performance, it is therefore essential to put enough pressure on the individuals to exceed their inert areas. It is an underlying assumption about human beings that it is difficult to predict and influence individuals' types of behaviour. It can have negative effects on the levels of x-efficiency of a firm. Organizational entropy is another main variable leading to x-inefficiency (Leibenstein, 1979, p. 487). An individual chooses his effort position according to what he things that is expected from his or her environment. By discovering that the expectations regarding his effort position are weaker, the individual shifts his effort points to what is preferred by the individual, but less likely to be in the interest of the firm (Leibenstein, 1979, p. 487).

In order to present all the influencing factors to x-efficiency, a new model was elaborated.
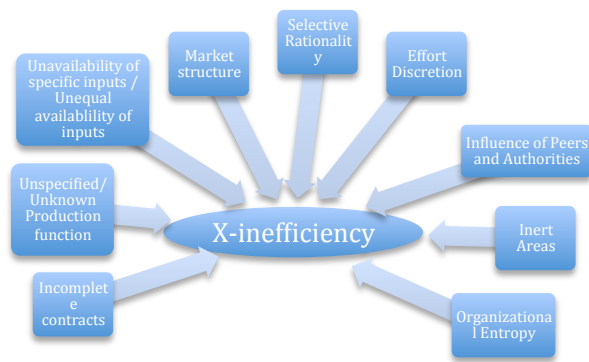
Figure 2: Extended model of the x-efficiency theory according to research from several authors (Frantz, 2007; Leibenstein, 1975, 1979; Leibenstein & Maital, 1994)

## 2.4 Theory Evaluation: The X-Efficiency Theory is a valid theoretical construct, which can be assessed by several categories

Vos and Schiele (2014) identified five evaluation criteria that a theory should fulfil in order to validate that it is actually a theory (Vos & Schiele, 2014). An assessment model to evaluate purchasing and supply chain management theories is provided which can be used in order to identify the validity of the x-efficiency theory. First of all, the requirements of a theory are discussed. The x-efficiency theory focuses on the individual as the underlying *unit of analysis* (Alessi, 1983, p. 64). Individuals within firms such as managers and employees are assumed not to behave rational in every situation. Theories developed on the basis of individuals as units of analysis belong to micro-micro theory (Leibenstein, 1979, p. 498). The collaboration of all individual performances determines the overall company performance and efficiency (Taylor & Taylor, 2003, p. 75). In terms of *laws*, individuals as decision-makers are seen to determine the cost of production through their choices. The outcome of the interaction of these decisions is being analysed (Button & Weyman-Jones, 1994, p. 90). The mix of different decision processes within one firm has relevant economic consequences. When looking at the *boundaries* of the theory, the most important environmental factor that has an influence on the x-efficiency theory is the structure of the market a firm is operating in. A lack of competitive pressure that can be observed in monopoly or duopoly firms results in higher than technologically minimum costs according to the x-efficiency theory (Frantz, 2007, p. 4). Research about *time* as a limiting factor to x-efficiency is mixed. On the one hand, it can be assumed that x-efficiency will increase over time, when market knowledge grows. On the other hand, cost differences due to x-inefficiencies are assumed to be time-invariant, whereas other costs that are caused by random errors can average out over time (Berger, 1993, p. 263). With regard to *value boundaries*, the x-efficiency theory takes into account firms that are operating within different competitive environments and are striving for efficient performances and therefore competitive advantages. *System states* are clear explanations of the interactions of the units under certain conditions (Vos & Schiele, 2014, p. 4). Incomplete contracts, a lack of external competitive pressure, unspecified and unknown production functions, unequal availability of inputs, selective rationality of individuals, the existence of inert areas and organizational

entropy are all reasons for x-inefficiency to persist. An improvement in some of these aspects does not lead to x-efficiency, since x-inefficiency can persist even under competition (Leibenstein, 1975, p. 580). In order to explain *why* these interactions are assumed, it is often mentioned that firms are energized to improve their efficiency when they are facing internal or external pressure. Since all of these above-mentioned reasons for x-inefficiency are lowering the amount of pressure that a firm has to face its x-efficiency goes down.

In relations to the analysis of the *empirical construction* of the theory, the *propositions* are statements about the values of the units of analysis within a system. The individuals within firms are central to the x-efficiency theory and these units are assumed not to behave rational and predictable at all times (Frantz, 2007, p. 4). Therefore, the x-efficiency theory represents a realistic view of human behaviour, which leads to valuable decisions based on this theoretical background. The *hypotheses* argue that individuals within firms facing low amounts of pressure, both internally and externally, will expend a lower effort level than individuals facing higher amounts of pressure. Based on this hypothesis, competitive advantage is dependent on the internal and environmental pressure (Frantz, 2007, p. 2). *Empirical research* regarding the x-efficiency theory has been conducted, mainly in the banking sector (Fu & Heffernan, 2007; Sathye, 2001).

## 2.5 Main Statement: The amount of pressure is influenced by internal and external factors and determines the x-efficiency of a firm

To review, the main statement of the x-efficiency theory is that x-inefficiency may persist, when firms do not have enough pressure to keep their cost levels as low as possible (Frantz, 2007, p. 2). The x-efficiency theory assumes that if firms do not make full use of their resources and profit opportunities, internal factors play an important role. In case of x-inefficiencies, a change of the volume of inputs is not necessarily required. An adjustment of management style, corporate structure and incentives will be more suitable in order to increase the overall output (Feng, Huang, & Ren, 2007, p. 2). It is assumed that individuals do not act rational at all times which means that the x-efficiency theory does not expect reasons for inefficiencies to be outside the organization, but mainly internally (Leibenstein, 1979, pp. 484-485). Therefore, internal factors of organizations are central to the theory, which are mainly the individuals that are working for the organization. Managers are also assumed to cause inefficiencies by being unable to control the internal costs and to maximize revenues. Additionally, they may manage the company in a way that deviates from the efficient frontier or the best practicing firms (Miller & Parkhe, 2002, p. 56). Due to x-inefficiency, a gap between actual and optimal output can occur, even though there was optimal allocation of production factors by the market. Therefore, the x-efficiency theory suggests organizations to increase internal pressure in order to improve both employees' effort and management effort to gain competitive advantage (Feng et al., 2007, p. 2).

A firm operating on the production possibility frontier is performing x-efficient. The production possibility frontier shows the best possible production level of a product. The difference between the actual output of a firm and the production possibility frontier, which defines the maximal output, determines the level of x-efficiency. Firms should strive

to keep the distance between those two points as small as possible, because a small distance stands for high x-efficiency (Hai-bo & He-zhong, 2009, p. 1). The main reason why firms are struggling to operate x-efficient is a lack of pressure that lowers the firms' motivation to improve the production processes. Firm management is assumed to permit a considerable amount of slack in the company's performance levels when motivation is weak. Therefore, they are not attempting to seek methods that are improving cost levels (Leibenstein, 1966, p. 408). There are several influencing factors that affect the amount of pressure that a firm has to face. Human behaviour factors are central to the x-efficiency theory, but also external factors such as market competition play an important role in this context (Hai-bo & He-zhong, 2009, p. 1). Some of the most essential influencing factors on the pressure of firms are listed below:

- *Unavailability or unequal access of factor inputs*: raw material, management knowledge etc. is not equally distributed among the competing firms in an industry (Leibenstein, 1966, p. 407).

- *Market structure*: monopoly or other forms of imperfect competition will decrease the motivation of firms to strive for improvement of the production process, because of the lack of competition within their environment (Leibenstein, 1975, p. 604). This will result in costs that exceed technological minimum costs (Frantz, 2007, p. 4).

- *Incomplete contracts*: it can never be fully defined how much effort an employee has to spend and therefore, employees' effort levels vary according to their personal interests (Leibenstein, 1966, p. 407).

- *Unspecified or unknown production function*: the effect of changes within the production processes cannot be fully estimated and therefore firms may not know their potential to increase efficiency (Leibenstein, 1966, p. 407).

- *Selective rationality*: rational behaviour of individuals cannot be expected in all situations (Leibenstein, 1979, pp. 484-485).

- *Inert areas*: a small amount of pressure does not directly lead to a change in behaviour, so individuals within firms have to be forced by their environment to change their behaviour (Frantz, 2007, p. 3)

- *Organizational entropy*: employees have a tendency to define their working processes on their own, so they are sometimes not acting in the organization's interest but rather in their personal interest (Leibenstein, 1979, p. 487).

In order to become competitive, firms have to try to focus on these factors, as they are all means to decrease the amount of pressure a firm has to face. Due to the fact that "people and organizations normally work neither as hard nor as effectively as they could" (Leibenstein, 1966, p. 431), it is essential to focus on the minimization of these factors in order to motivate management and employees to improve their efficiency. X-efficiency research helps companies and researchers to better understand how market and organizational forces have an effect on possible improvements in the use of resources. An x-efficiency analysis has several advantages over univariate performance measurements. Return on equity and return on performance are taken into account and controls for product mix and input prices are provided (DeYoung, 1997, p. 21). Additionally, the x-efficiency theory does not penalize organizations for operating in high-cost labour markets (Miller & Parkhe, 2002, p. 56).

## 2.6 Empirical Findings

### 2.6.1 The current Body of Literature about X-Efficiency was reviewed in order to generate further knowledge on the topic

In order to summarize the most important aspects of the x-efficiency theory and to describe the theoretical background in detail, a literature review was conducted. By using the literature review methodology, the current state of research on the x-efficiency theory could have been identified and this creates a valuable basis for generating further knowledge on the topic. The existing publications about x-efficiency were the data for this literature review. The listings of the two search engines, Scopus and Google Scholar were taken as a basis for this thesis. A distinction between quantitative and qualitative studies was not made in order to ensure a broad range of academic information about the topic. The titles and abstracts of the most relevant literature were scanned for the most important key words and the publications that were frequently cited by other researchers was taken into account for this review. Therefore, the introductions, the discussions and conclusion parts of the literature were examined and for more specific information, other parts were elaborated as well. Typing "x efficiency" as a key word into Scopus, led to 61.012 hits, which is a high amount of relevant literature for the topic. The amount of literature in English language found in Scopus was 55.509 articles. In Google Scholar, 4.500.000 search results were found, by applying the language filter to English search results, the number of literature found decreased to 4.430.000. Instead of sorting the results by Date of publication, the results were sorted by relevance in order to ensure high quality for this literature review. The most valuable and relevant articles were used for this research and therefore, the final number of articles is 52. With regard to empirical findings about purchasing and the x-efficiency theory, it is not possible to find any appropriate literature. Typing "x-efficiency" as a keyword in Scopus led to 185 results and after using the subject filtering option with the keyword "supply", only ten results were found. None of these results was related to empirics in the supply chain management or purchasing activities. When using the topic filter with keywords such as "supplier", "purchasing" or "supply chain" four articles or even less were found, but none of these were empirical studies that are useful in this context. Within the search engine Google Scholar, more results were found, when typing the key words "x-efficiency supply" (4480 articles), "x-efficiency supplier" (3240 articles) or "x-efficiency purchasing" (4840 articles). The title and the abstracts of the most relevant articles were scanned, but none of these were sufficient empirical findings of the x-efficiency theory in the purchasing context.

### 2.6.2 Empirical Findings about the X-Efficiency Theory are mainly conducted in the Banking Sector and are to some extend mixed

Since the time when Leibenstein firstly mentioned the concept of x-efficiency, several case studies in different industries were made in order to test the empirical evidence of the x-efficiency theory. Even though many of these empirical studies were made in the banking sector, some other case studies could have been found as well.

Empirical research that was provided by Sathye (2001) is about x-efficiency in Australian banks (Sathye, 2001, p. 613). The

study provided evidence, that allocative inefficiencies were less relevant than x-inefficiencies. Different to the assumptions of the x-efficiency theory, the researchers found evidence that market power was found to significantly influence in a negative way. This can be explained by the outcomes of another study conducted by Edwards and Heggestad (1973) arguing that firms operating within highly concentrated markets are rather characterized by risk averse behaviour and uncertainty avoidance than by profit maximization and efficiency (Edwards & Heggestad, 1973, p. 472).

A more recent publication by Fu and Heffernan (2007) provides empirical data about the x-efficiency theory within China's banking sector (Fu & Heffernan, 2007, p. 35). Different ownership types and reforms of the banking system were assumed to affect cost x-efficiency. Therefore, data about the cost x-efficiency of ten joint stock banks and four banks owned by the state were collected over a time period of 17 years. The outcome of the research indicates that increased competition in the banks' environment and reduced moral hazard and agency problems within the banks will lead to higher x-efficiencies (Fu & Heffernan, 2007, p. 36).

Another empirical study that was made about the Tunisian banking industry revealed that the management capacity and the efficiency level of banks are closely interrelated. Additionally, economic conditions were found to influence x-efficiency levels as well as the market structure of the banks' environment (Younes & Abdessalem, 2012, p. 123). Therefore, this study provides empirical evidence for the factors influencing x-efficiency.

Primeaux (1977) compared in his study electric utility monopolists and electric utility duopolists both within the public sector in order to show that x-efficiencies are generated by competition (Primeaux, 1977, p. 107). The data showed that competition has a larger impact on the x-efficiency of smaller firms than of big organizations. Additionally, it was stated that in regulated industries with less elastic demand, there is greater potential for x-inefficiency. This leads to higher costs for organizations and thereby also higher prices for customers. Since competition leads to more elastic demands, it will also cause that organizations will work more efficient, so x-efficiency will increase (Primeaux, 1977, p. 107).

### 2.6.3 Empirics Related to Purchasing & Suppliers is still missing and needs to be further researched

As already stated above, most empirical studies about the x-efficiency theory were made in the banking sector. Therefore, empirical evidence that is related to Purchasing and Supply Chain Management is still unavailable. None of the results was related to empirics in the supply chain management or purchasing activities. Some empirical studies regarding to logistics management were found but these are not suitable for the topic of supply management. Therefore, a strong advice for further research on this topic should be conducted since empirics about the theory in sectors such as the financing sector or logistics led to interesting and valuable results. The supply management is an essential part of organizations, so the applicability of the x-efficiency theory should be tested empirically.

### 2.6.4 In the Life-Cycle Approach of Theories, the X-Efficiency Theory can be classified as progressive

In order to classify the Life-Cycle approach of the x-efficiency theory, Vos and Schiele (2014) developed a list of characteristics that are used to define the value of the theory for both researchers and practitioners (Vos & Schiele, 2014, p. 8). These characteristics can be categorized in internal virtues, external virtues and the progression of the theory's life-phase.

The *internal virtues* are the essential intrinsic properties of the x-efficiency theory. These are the characteristics that are evaluated apart from the environmental and external characteristics of the theory (Vos & Schiele, 2014, p. 6). The definition, the scope and the relationships within the x-efficiency theory make sense and give a clear logic about the message of the theory. It is possible to examine the empirical validity of the theory because the concepts and constructs are clear enough to test it in a quantitative way.

The *external virtues* of the x-efficiency theory are considering the broader environment that surrounds the theory. With regard to conservatism, the x-efficiency theory was a radical approach that doubted the tenets of the neo-classical theory. Leibenstein (1966) came up with a completely new approach that is conflicting with the generally accepted neo-classical theory. External consistency is therefore limited, since some of the existing body of theories conflicts with the x-efficiency theory. Scope and unity of the theory is also rather limited as it is only applicable to the field of economics. Nevertheless, the theory can be seen as fruitful since areas of practical importance were found, but it can still be extended since most of the empirical studies are concerned with the banking sector. Especially empirical studies addressing x-efficiency within supply management should be extended.

In terms of *progression*, the x-efficiency theory was developed in 1966 and had to face lots of criticism at the beginning. Due to empirical studies that supported the theory, the x-efficiency theory is used frequently. Even though it is still conflicting with the neo-classical model, the x-efficiency theory can be evaluated as progressive.

## 2.7 Critical Assessment: The X-efficiency Theory received lots of Criticism not only because it conflicts with other Theories

Ten years after Leibenstein (1966) published his initial paper about the x-efficiency theory, Stigler (1976) wrote a paper that contained strong criticism about it. It is stated, that the kinds of inefficiencies that are described in the x-efficiency theory can simply be assimilated to the traditional allocative inefficiency. It is criticized that the misallocations of resources that were caused by monopolies were less important than failures to attain the production possibility frontier (Stigler, 1976, p. 213). The central assumption of the x-efficiency theory, that individuals never seek to maximize output, is opposed by assuming that people are always seeking to maximize utility. It is stated that increased achievement of one specific goal that leads to less achievement of another goal cannot be called increased efficiency, since it is rather a change in output (Stigler, 1976, p. 213). Additionally, Stigler (1976) criticizes that a lack of motivation is used as a universal explanation for every unperformed task that is possible, since this also includes unrewarding tasks (Stigler, 1976, p. 214). Another point of criticism examines the fact that the x-efficiency theory ignores

the problem regarding the choice of technology. The differences in technology among companies are postulated but reasons for these differences are not explained (Stigler, 1976, p. 215). Furthermore, Stigler (1976) does not accept the idea that monopolies are negatively affecting efficiencies since it cannot be assumed that monopolists are not maximizing profits and minimum costs can be reached by new market entries (Stigler, 1976, p. 215). Besides these points of criticism regarding the content of the theory, its usefulness as an economic concept was put in doubt since it is a non-maximizing theory (Stigler, 1976, p. 216).

Other publications that did not agree with the x-efficiency theory also came up in that time. Edwards and Heggestad (1973) stated that firms that are operating within competitive markets are not trying to maximize profits and efficiency, since they rather focus on uncertainty avoidance and risk adversity (Edwards & Heggestad, 1973, p. 472). This assumption clearly conflicts with the x-efficiency theory since it assumes competition to increase the amount of pressure and thereby the efficiency of organizations. Sathye (2001) also found empirical evidence for this assumption when studying the Australian banking sector with regard to x-efficiency (Sathye, 2001, p. 622). In their study about the x-efficiency in the life insurance industry, Gardner & Grace (1993) named rent-seeking activities as a limitation of x-efficiency. Rent-seeking activities describe firms that are expending resources in order to obtain private benefits at the cost of social benefits (Gardner & Grace, 1993, p. 499). Rent-seeking activities are costly actions that are undertaken by companies when they are trying to increase costs of other firms and therefore creating entry barriers. Another form of rent-seeking activity can increase a firm's output while decreasing the output of another competing firm. This is a costly activity that does not increase total welfare and therefore does not create additional industry output (Gardner & Grace, 1993, p. 499). Rent-seeking activities can be rational, when a positive payoff is expected. Nevertheless, it might be an inefficient expenditure that decreases a company's performance and thereby its profitability. Leibenstein received lots of criticism about the existence of x-efficiency not only because it is a non-maximizing theory, but also because it conflicts with the neoclassical theory of economics, which is discussed in the following section.

## 2.8 The X-Efficiency Theory is controversial to the Neoclassical Theory of Economics but is currently making a positive development

The X-efficiency theory is known to conflict with the neoclassical theory of economics (B. Howarth, Haddad, & Paton, 2000, p. 478). Within this theoretical concept, firms are assumed to be well informed, to strive to attain profit maximization and to act rational in every situation. Unfavourable market conditions, technology and governmental restrictions are the constraints to maximal output and full efficiency (DeCanio, 1993, p. 912). The x-efficiency theory and the neoclassical theory are conflicting with regard to different components of the underlying assumptions of the theories. Leibenstein (1979) identified the differences between these two theories concerning the psychology, contracts, effort, units, inert areas and agent-principal relationship in order to make the distance between the neoclassical approach and the x-efficiency theory clear (Dean & Perlman, 1998, p. 140). The x-efficiency theory assumes that human beings are characterized by selective rationality which causes „behaviour to deviate from the assumed ideal self-interested maximizing rationality of

neoclassical microeconomic theory" (Cory Jr, 2007, p. 34) whereas the neoclassical theory assumes individuals to act rational at every time. With regard to contracts, the neoclassical theory assumes that firms are working with complete contracts. Leibenstein (1966) assumes contracts to be incomplete, as they cannot prescribe every mode of behaviour of the employees (Freedman, 2002, p. 127). Even if working hours, wages and tasks are written down, a contract cannot contain rules for every possible situation that an employee can face. Unlike the x-efficiency theory, the effort that an individual or a firm is expending is given in the neoclassical model. The underlying assumption of the x-efficiency theory is that effort is variable because humans are not acting rational in all situations (Freedman, 2002, p. 169). Another difference between the theories is the fact that Leibenstein (1966) focuses on individuals as units of analysis whereas the neoclassical theory looks at firms and households (Hosseini, 2003, p. 2). The x-efficiency theory opposes that an organisation as research object is inappropriate since the ultimate decision-makers are the individuals within firms, so they have to be studied (Feng et al., 2007, p. 2). With regard to the agent-principal relationship, the neoclassical paradigm expects all individuals within a firm to have the same interests, which leads to the expectation that problems between the manager and the employee never occur. The x-efficiency model assumes interests of agent and principal to be differential which leads to conflicts within organizations (Bogetoft et al., 2006, p. 453). Unlike the neoclassical theory, the x-efficiency theory deals with the existence of inert areas, which provide an essential variable. Inert areas are defined as areas within which individuals can range their effort level (Frantz, 2007, p. 3).

The general development of the x-efficiency theory can be described as positive. The theory received lots of criticism in the beginning, but became more popular in the course of time. Due to a rising number of publications about empirical research on the topic of x-efficiency, many researchers and practitioners accepted the theory. Nevertheless, the x-efficiency theory is still assumed to conflict with utility-maximizing behaviour, which is a generally accepted theory in economics (Investopedia, 2014). Even though there is already empirical evidence that supports the existence of the theory, some empirical foundlings reject the theory's validity. The future development of the theory should contain lots of empirical studies in several business areas. Until now, empirics is limited since mostly the banking sector is studied and there are much more areas of interest.

## 3. X-EFFIECIENCY THEORY AND THE DECISION POINTS IN SUPPLY MANAGEMENT

## 3.1 Decision Point 1: The applicability of the X-Efficiency Theory for the Make or Buy decision is limited

First of all, one of the most important decisions previous to the purchasing process is the Make or Buy decision. The Make-or-Buy decision is the initial phase of the purchasing process since this decision determines whether an input is produced in-house or purchased externally (Walker & Weber, 1984, p. 374). There are several situations in business, where firms are better off making a product than buying it externally (Puranam, Gulati, & Bhattacharya, 2013, p. 1146). Since resources are finite and not equally available to organizations, pure in-house production would neither be possible for any firm nor would it be

beneficial (Cánez, Platts, & Probert, 2000, p. 1313). Nevertheless, it is also possible to use multiple methods of procurement by producing a product internally and buying the same input. The amount of pressure that the individuals within organizations have to face is central to the x-efficiency theory (Frantz, 2007, p. 1). Therefore, the x-efficiency theory can influence this decision point by assuming that the purchasing department will work efficiently when facing an adequate amount of pressure.

Additionally, it is assumed that companies have unequal access to factor inputs. Since it is rarely the case that material is equally distributed among organizations in a market, x-efficiency is assumed to be influenced by the access to inputs (Leibenstein, 1966, p. 407). Therefore, purchasing departments have to take the accessibility of materials in account when deciding whether to buy or to produce a product. When competing firms have enough purchasing power to get better access to factor inputs and the internal capacities and capabilities are appropriate, these inaccessible inputs should be produced in-house.

Nevertheless, even though some aspects of the x-efficiency are useful for the Make-or-Buy decision, the applicability of this theory is limited for this decision point, since it does provide clear instructions for this decision point.

## 3.2 Decision Point 2: The X-Efficiency Theory can support the Purchasing Department in the Decision of the Sourcing Strategies

The next decision point is to define the sourcing strategies. Strategic sourcing is a means for companies to attain their goals regarding to "assurance of supply, ownership cost reductions, quicker time- to-market and technological competitiveness" (Rendon, 2005, p. 9). Nowadays, it became more important for companies to take a strategic approach for selecting the right ways of procurement (Rendon, 2005, p. 9). Strategic sourcing means that the sourcing strategy and the corporate strategy are aligned. Therefore, the right sourcing strategy is defined by the corporate strategy of the organization. If a company is using single sourcing, shared benefits can be achieved since it builds a good basis for partnerships and cooperation between buyers and suppliers (Burke, Carrillo, & Vakharia, 2007, p. 96). Multiple sourcing has benefits regarding the coverage of supply, since more potential sources of technological developments are covered (Treleven & Bergman Schweikhart, 1988, p. 103). Next to that, multiple sourcing makes the buyer more powerful in negotiations. Sourcing strategies are important tasks of the purchasing department that are also influencing the company's

level of efficiency.

Button and Weyman (1994) conducted a study about X-efficiency and technical efficiency and focused on useful indicators of x-efficiency levels (Button & Weyman-Jones, 1994, p. 84). Next to competition that was named as a reason for companies to strive for x-efficiency, powerful buyers were mentioned as well. Powerful buyers are able to use coercive mechanisms such as ceasing to do business with a company that is not performing efficiently. Buyers are then able to put pressure on their suppliers in order to increase their motivation to enhance performance. Organizations can use coercive mechanisms when they have a wide choice of possible suppliers (Ratnasingam, 2000, p. 59). Therefore, it is beneficial for a firm that is in the buying position to establish a large pool of suppliers. A good strategy for the purchasing department is therefore to expand the organization's position as a powerful buyer by increasing their pool of potential suppliers to trade with (Ratnasingam, 2000, p. 59). When such a powerful position is attained, the purchasing department may be able to bargain away the additional costs that exceed the production possibility frontier. By putting pressure on the suppliers, their x-efficiency can be increased and this will lead to lower costs for the buyer. Therefore, multiple sourcing or international sourcing are the most suitable strategies. According to Burke, Carrillo and Vakharia (2007), the power that the supplier has over the buyer decreases when several sources of supply are used. Therefore, multiple sourcing also decreases the risk of a monopolistic supply base (Burke et al., 2007, p. 97). Since monopolies are assumed to decrease the amount of pressure that firms have to face and thereby the levels of x-efficiency (Frantz, 2007, p. 4), it is beneficial for the supply management to strive for multiple sourcing. For sourcing strategies, the x-efficiency theory is a useful concept in order to support the purchasing department of organizations.

## 3.3 Decision Point 3: With regard to the Supplier Strategies, the firms should take the suppliers' amount of pressure into account

After deciding on the sourcing strategy, the third decision point is the selection of the suitable suppliers. In supply chain management, the varying performances of the potential suppliers have to be evaluated against a number of criteria (Ho, Xu, & Dey, 2010, p. 16). The selection of the supplier became a more strategic approach due to the fact that purchasers do not only compare the prices of the potential suppliers. Therefore, both qualitative and quantitative criteria are essential factors that are influencing purchasing departments' supplier strategies (Ho et al., 2010, p. 22). The price, the quality of the product or

| Decision Points | | | | |
|---|---|---|---|---|
| Theory | **Make or Buy** | **Sourcing Strategies** | **Supplier Strategies** | **Contracting** |
| X-Efficiency Theory | - The purchasing department should face an adequate amount of pressure in order to be motivated to work efficiently<br><br>- Unequal access to inputs → produce in-house | - Establish a large pool of suppliers<br><br>- Become a powerful buyer<br><br>- Purchasing department should be able to put pressure on the supplier<br><br>→ Multiple sourcing or international sourcing | Take the supplier's competitive environment into account:<br><br>- Avoid suppliers operating within monopolistic markets – Avoid suppliers that are influenced by governmental regulations | - Contracts are assumed to be incomplete → purchasers should keep that in mind<br><br>- Negotiations: increase pressure to individuals to overcome inert area bounds in order to increase x-efficiency |

service, the organization's flexibility and the delivery performance have an influence on the purchasers' decision (Chen, Lin, & Huang, 2006, p. 289).

When applying the x-efficiency theory to the supplier selection decision, it may be suitable to take the competitive environment of the supplier into account. According to a study of Button and Weyman-Jones (1994), organizations that are influenced by governmental regulations are assumed to have a higher potential for x- inefficiency (Button & Weyman-Jones, 1994, p. 92). The government may provide a basis for shelter by giving superior access to information to firms that are publicly owned organizations and suppliers that are subsidized from the public sector. This makes it possible for potential suppliers to compensate their inefficient performance (Button & Weyman-Jones, 1994, p. 92).

At the same time, organizations that are acing a less-than-perfect competition environment or even monopolists are also assumed to operate x-inefficient (Leibenstein, 1975, p. 580). Therefore, a practical implication for the purchasing department is to take the supplier's competitive environment into account in order to ensure that the supplier's performance is acceptable. When searching for suppliers, the purchasing department should avoid organizations that are operating within these environments, if this is possible.

## 3.4 Decision Point 4: Increased Pressure leads to higher X-Efficiencies in the Contracting Phase

The last decision point that will be evaluated in this research is the contracting process. Contracts are creating obligations between the suppliers and the buyers but cannot guarantee successful collaboration between these two parties (Blomqvist, Hurmelinna, & Seppänen, 2005, p. 497). The contracting process within the supply management can be useful in order to increase mutual understanding and to build up trust (Blomqvist et al., 2005, p. 497). Contracting is therefore an essential part in supplier management and can influence the performance of supply chain management. Because of new approaches to purchasing, contractual relations became more complex and therefore may cause conflicts between buyer and supplier (Saad, Jones, & James, 2002, p. 175). With regard to contracting, the x-efficiency theory assumes labour contracts to be incomplete and therefore to influence the levels of efficiency in a negative way (Frantz, 2007, p. 2). The assumptions that Leibenstein (1966) made regarding labour contracts can be adapted to contracting decisions in the supply management. Therefore, contracts are able to define the outcomes that are expected from the supplying firm but neither the detailed behaviours of the individuals that are working for the supplier nor the effort levels can be prescribed. Since these behaviours and effort levels are essential influencing factors of the supplier's performance and thereby its efficiency, it is crucial for the purchasing department to influence these factors in a positive way.

Next to that, negotiations are also part of this last decision point. The employees of the purchasing department should have good negotiation skills, as these are necessary in order to coordinate and direct both internal and external individuals that are dealing with the company (Giunipero & Pearcy, 2000, p. 12). The x-efficiency theory deals with individuals' behaviours, their varying effort levels and their selective rationality (Frantz, 2007; Leibenstein, 1979, pp. 3-4; 487). Purchasers should be aware of the fact that individuals do not act rational at all times and

therefore are not assumed to maximise profits all the time (Taylor & Taylor, 2003, p. 75). In negotiations, this knowledge may be of importance. Next to that, the theory assumes inert areas to influence the actions and effort levels of employees (Leibenstein, 1982, p. 92). This means, that purchasers should influence the individuals that are working for the supplier to a certain amount so that this external pressure goes beyond the inert area bounds. Consequently, the supplier will change its effort levels and strive to increase x-efficiency. This will lead to increased supplier performance and thereby to decreased costs for the buying firm. Consequently, the x-efficiency theory can be evaluated as useful in the contracting context.

## 4. DISCUSSION & CONCLUSION

The aim of this paper was to evaluate the usefulness and applicability of the x-efficiency theory in the context of supply management. In order to test the theory's contribution to purchasing and supply management, a brief literature review was conducted. In the first section, the general topic was introduced by explaining the aim of this research. This was followed by a brief discussion of the different aspects that are important for the x-efficiency theory. The history was discussed, the main concept including the assumptions and main statements was reviewed, the empirical studies that were conducted up to this point of time are discussed and the theory's validity is examined. In this part, it could have been seen that the x-efficiency received lots of criticism and empirical evidence about the theory is still mixed. The current empirics do not take the supply management and the purchasing process into account. In the next section of the paper, the different steps of the purchasing process are evaluated and the usefulness of the x-efficiency theory is assessed. It can be stated that the x-efficiency theory is less useful for the Make or Buy decision, as the practical suggestions that are indicated regarding this decision point are limited. The useful implications for this point are on the one hand, that companies should put purchasers under a certain amount of pressure in order to motivate them to work efficiently. At the other hand, the theory assumes competing firms to have unequal access to materials, which can have an influence on the Make or Buy decision, as this will suggest firms to produce items in-house. With regard to the next decision point, the x-efficiency theory can have an influence on the sourcing strategy that purchasers should choose. It is assumed that it is beneficial for the supply management to build up a powerful position as a buyer in order to put pressure on the supplier. Therefore the theory suggests purchasers to aim at a multiple sourcing strategy. This will lead to a decreased risk of creating a monopolistic supply base. Next to that, the buyer can put a higher amount of pressure on the supplying firm. Furthermore, the supplier selection strategies can be influenced be the theory in terms of choosing a supplier that is operating within an environment that does not hinder x-efficiency. A practical suggestion for purchasers is to select suppliers that are not owned or influenced by the government because these organizations have higher potentials for x-inefficiency. Additionally, monopolists or duopolists should also be avoided as well, since these companies do not have enough motivation to improve their efficiencies and their overall performance due to a lack of competition. Therefore, buying materials form these kinds of suppliers will be a disadvantage. The Contracting phase is the last decision point in this framework. The x-efficiency theory assumes contracts to be incomplete since the effort levels of individuals cannot be clearly defined and therefore purchasers should try to decrease the risk of undesired behaviour by the supplier in the contracting phase. When it

comes to the negotiation of the contract conditions, purchasers should put pressure on the individuals that are working for the supplying firm in order to achieve a change of behaviour. This will lead to improvements in x-efficiency.

The limitation of this study is the methodology that was used since the review is based on the existing theoretical and empirical literature. Therefore, it adds theoretical considerations to the current body of knowledge but empirical research is still missing. The implications for further research are therefore to test the validity of the x-efficiency theory through empirical methods. Empirics about the x-efficiency theory within banking sectors are already huge, but other sectors should be studied as well. A strong recommendation for further research in the supply management should be made since it is an important area of interest that should be taken into account in this context. The supply management and purchasing fields are essential areas for empirical studies, since there is potential to find evidence that the x-efficiency theory is beneficial for these business areas.

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