Critical view on Leibenstein's X-Efficiency Theory

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ABSTRACT

This paper is about a theoretically evaluation of the x-efficiency theory with focus on supply management. The paper comes up with different evaluations as well as a critical view on the x-efficiency theory. Furthermore possible applications within the supply management with respect to the Make or Buy decision, the sourcing strategy, the supplier strategy and the contracting are given in this paper. The paper concludes that the x-efficiency theory can be applied in many areas within company as well as in different industries but also in the supply management.

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1. INTRODUCTION

This Paper deals with the x-efficiency theory and its influence on organizations. The x-efficiency theory is a theory developed by Harvey Leibenstein (†1994). Generally spoken, x-inefficiency means the difference between the optimal efficient behavior of business in theory and the observed behavior in practice. These differences occur due to different factors.

The overall overview of this paper is that it is divided in five parts. It starts with an introduction of the paper, followed by findings and explanations about and according to the x-efficiency. The third part is about the application of the theory in supply management. The second last part is the discussion and conclusion and the paper closes with its limitations and ideas for further research.

This paper starts with a general overview what the x-efficiency theory is about. In this part the emergence of the theory is explained and the influence on organization is indicated. In addition a first impression about the importance of motivation for the theory is given. The paper continues with the assumptions and it explains why organizations are not working at their optimal level. In this paragraph several aspects are considered which can have an influence on the efficiency. The paper goes on with having a look on the main variables of the x-efficiency theory which are the employees as well as the individuals and the output. The output is a variable which is dependent on the effort and efficiency of the employees and individuals. The next segment of the paper is a confirmation that the x-efficiency theory of Leibenstein is a real theory according to Vos & Schiele (2014). After considering and explaining the main elements of the x-efficiency theory the paper continues with a closer view on it. This part makes clear that the x-efficiency is a source of adding value to an output and it points out some reasons, which can harm x-efficiency. The next section deals with empirical findings related to the theory. It starts with an overview how the literature review is done, followed by general empirical findings and goes on with findings related to the purchasing function and supplier. This part shows that the x-efficiency theory often occurs in combination with the banking sector. Each theory has its own theoretical development. Also the x-efficiency has its Life-Cycle. According to the Life-Cycle of Theories (Vos & Schiele, 2014, p. 9) Leibenstein's Theory is in the Progression-Stage. The next paragraph of this paper is about the strengths and weaknesses of the x-efficiency theory. The second part of the paper closes with a comparison to the neoclassical view. Here the main differences are pointed out and an overview of these differences is given.

The third part of the paper is about the application of the x-efficiency theory within the purchasing area and supplier. Within this part, four decision points are explicitly mentioned and the connection to the theory is given. These four decision points are the Make or Buy decision, the Sourcing Strategy, the Supplier Strategy and the Contracting decision.

This paper continues with the discussion and conclusion where all important elements and findings out of this paper are recapped and the correlation to supply management is described.

The paper closes with the limitation of this paper, followed by a short incentive for further research according to the x-efficiency theory.

2. X-EFFICIENCY THEORY

2.1 The emergence of the X-Efficiency Theory in 1966 has the reason in another view on efficiency

Harvey Leibenstein was an economist and born in 1922. In 1966 he came up with his article "ALLOCATIVE EFFICIENCY VS. 'X-EFFICIENCY'". In this article he introduced his so called "x-efficiency theory" for the first time, which is sometimes also called x-inefficiency. The main topic in his paper as the heading already indicates is the efficiency of companies, organizations and institutions. A major element of "x-efficiency" is motivation or rather the lack of motivation (Leibenstein, 1966, p. 392) as further explained later.

Several studies on allocative efficiency showed that the welfare gains which can be achieved by an increase in only allocative efficiency are usually very small. This means that as mentioned by Leibenstein (1966, p. 393f.) eliminating monopoly or an increased specialization leads not to a significant raise in welfare. A reason for this is that allocational inefficiency involves only net marginal effects, which is a result of price and quality distortions. At that point Harvey Leibenstein came up with another view of thinking. He thought about other reasons, which causes inefficiency. Leibenstein (1966, p. 399) explicitly mentioned that for allocative efficiency the whole economy was considered and for the x-efficiency just specific companies or industries, which should kept in mind at all times.

Leibenstein (1978, p. 205) proved his finding in a paper twelve years after he published his initial paper about x-efficiency. He said that in regulated monopolies there is no motivation to reduce cost up to a minimized level. This means that product prices could be lower than they really are but due to the non-minimization they are not. This way of pricing does not protect the consumer from too high prices. More competition would force them to look for cheaper resources and cheaper materials to reduce their selling price for their outputs and be more competitive, but in a monopolistic industry they are free to set the prices and in best case (for the company, not for the consumer) like in the medical industries, consumers are dependent on their products which results in price inelasticity. Price changes only lead to a small movement in demand.

There are different solutions to reduce this inefficiency, which also enhances motivation. According to the famous Hawthorne effect, studies show that an improvement in working conditions as well as small deteriorations creates a positive motivation among the workers (Leibenstein, 1966, p. 401). This means that any change in working condition could have a positive effect on workers motivation. Other theorists like Davison et al. (1958, cited according to Leibenstein, 1966, p. 401) looked for other reasons apart from motivation which can have an influence on the productivity and found that differences in incentives have an influence on the productivity per man, which also influences the unit costs of output. The more effective one man is working, the less are the labor cost per unit.

2.2 Organizations do not work at their optimal level

The x-efficiency theory has some different underlying assumptions. One of the main assumptions is that low productivity can occur because of the focus of the work of top managers. The main focus of top managers is rather focused on financial and commercial affairs than with running the factory and production efficiently (Leibenstein, 1966, p. 406). This is a kind of agency problem. Namely it is the type I agency problem, which is the possibility of conflict of interest between the shareholders and management of a firm (Hillier, Clacher, Ross, Westerfield, & Jordan, 2011, p. 19). This difference in interests might be one reason for the existence of x-inefficiency. For this assumption the units of analysis are individuals which are also covered in the next assumption.

The second assumption is that Leibenstein (Taylor & Taylor, 2003, p. 75) views individuals as the basic unit of analysis, which is for example in the neoclassical theory not the case. In the neoclassical theory the households and the firms are the unit of analysis. With this differentiation in the unit, Leibenstein wants to make clear that individuals have a great influence on organizations performance either in a negative way as well as in a positive way, and that the overall performance of an organization is dependent on the performance of the individuals working for the organization. An extended differentiation between the neoclassical theory and the x-efficiency theory is given later.

Now coming to the third assumption, which is the motivational efficiency. Within this point Tomekovic (1962, cited according to Leibenstein, 1996, p. 402) made four interesting findings.

The first one of the four is that till a certain point smaller working units are more productive than larger ones. This might be because within smaller working units everybody needs to contribute to an output and the chance to eliminate so called free rider is high.

His second finding is that working units made up of friends are more productive than those of non-friends. Friends help each other; this might also be true for productivity. If one is together with his friend they are talkative and this can be transferred to their working relationship.

Tomekovic's third finding is that units that are generally supervised are more efficient than those that are closely supervised. Each individual has a different labor effort in a given labor time and most of the individuals have different working styles with different efforts. One possible reason for this can be that generally supervised units are enjoying more trust than closely supervised units. They might feeling freer and can work as they would like to without pressure from being closely supervised. This is also proved by other authors. According to Leibenstein (1978, p. 328) efforts can be defined in two different ways. On the one side there is the voluntary basis, on which employees work. Within this kind of work there is a positive utility associated, because employees do not have to work, but they do it because they want to and are therefore highly motivated. On the other side there is that kind of work, where workers are monitored. Leibenstein (1978, p. 329) found that a well-monitored structure could improve productivity if it is responsive to reports of low performance level. But at the same point he mentioned the drawback of monitoring. On the one hand there are the financial costs and on the other hand it could reduce employee enthusiasm, because they get a feeling of distrust.

Tomekovic's fourth and last point is that units that are given more information about the importance of their work are more proficient than those given less information. If employees know what they are working for and that their work has an important contribution to an output they will work more concentrated because they know that the whole working process is dependent from their job and the company ensures their income. To keep this they work more proficient when they know that their work is really important.

2.3 The Main Variable of the X-Efficiency Theory are the Human Beings and their efficiency

This part is about the hypothesis and the main variables of the x-efficiency theory. In the following these elements are explained in more detail. Furthermore it explains the emergence of Leibenstein's Theory.

Harvey Leibenstein came up with his model because of one simple reason. He thought that the neoclassical theory does not show the whole reality. He justified this thought by stating that there is always a deviation from the theoretical optimum. Out of this reason he came up with his new theory, the x-efficiency theory. As indicated earlier, Leibenstein's (1966, p. 404) hypothesis is that there is a great deal of possible variation in output for similar amounts of capital and labor and for similar techniques […] to the extent that technique is determined by similar types of equipment. This is because labor is done by human beings, which can lead to deviations from the optimum.

Therefore the one of the main variables are the employees and individuals. Leibenstein (1966, p. 407) mentioned that employees and individuals mostly do not work as hard and effectively as they could. This makes the employee and also the individuals to one of the main variables. Variables need to be measured and Taylor & Taylor (2003, p. 71 f.) pointed out that the x-efficiency theory has the potential […] to make performance indicators more understandable, practical and useful. Within the x-efficiency theory the individuals are never supposed to be fully rational. They are rational but selective rational. Sometimes they show rational behavior, but sometimes they show up non-rational behavior. This is confirmed by Harbison (1956, p. 374), who said that human beings are motivated by drives, hopes, desires, fears and frustrations. Additionally he continues that the actions of human beings and organizations are not exclusively determined by economic forces. Furthermore not all humans are assumed to maximize profits at all time. Human decisions consist out of two elements, maximization and non-maximization. Additionally they are not expected to be constantly concerned with cost minimization which can result in sub-optimal decisions. This lack of efficiency comes up because of the fact that organizations can only buy labor time but not labor effort. Labor effort is important to produce goods/services, make decisions and a lot more, because labor effort is the real effort invested in labor without idle time.

Labor, which is done by employees and individuals, is only one of the two variables; the other variable is the output. Taylor and Taylor (2003, p. 75) stated in their article that the cumulative effort levels of the employees contribute to the organization's performance. As already mentioned in the former part, the variation in the productivity per man has an influence on the total output, which makes it to a variable. This variable is

dependent on the employee efficiency, because the higher the aforementioned employee efficiency, the higher the total output.

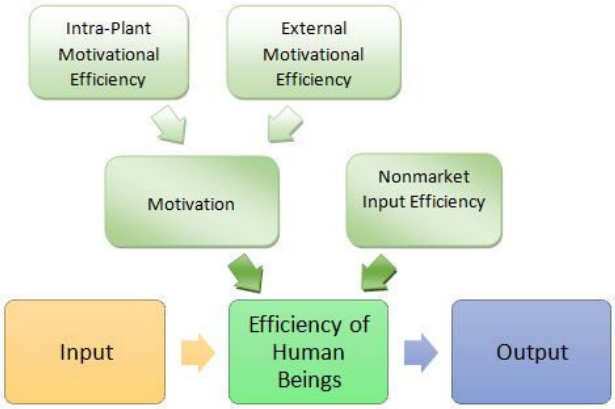

Figure 1: X-Efficiency Theory

As shown in this figure the efficiency of human beings, which is necessary to transform input into output, is the main variable in this construct. This efficiency is influenced by the motivation of human beings and the nonmarket input efficiency. Additionally the motivation is influenced by the intra-plant motivational efficiency and external motivational efficiency.

So far the term "x-efficiency theory" is used without scrutinizing why the expression "theory" is included. In the next section, the x-efficiency theory is evaluated to make it clear, whether Leibenstein's theory it is according to Vos & Schiele (2014, p. 3 ff.) a theory or not. Therefore their "determining criteria" are used and checked, to prove that all requirements are fulfilled and it is a real theory.

2.4 The X-Efficiency Theory fulfills all Theory-requirements

Harvey Leibenstein called his finding about efficiency and motivational aspects "X-Efficiency Theory". To determine whether his theory is a real theory or not the determining criteria of F.G.S. Vos and Prof. Dr. H. Schiele (2014, p. 3 ff.) are used. In this paper Vos & Schiele (2014, p. 3 ff.) set up guidelines on how to determine whether a theory is a real theory in supply chain management and purchasing or not. They pointed the main elements and characteristics out which a good theory should contain. Therefore a theory should include units (what), laws (how), boundaries (who, what, when and where), system states and should answer the question why. Within their work they developed a checklist for determining criteria. With this list it can be checked whether all of the criteria are fulfilled or not. This checklist has two parts namely the theory development and the empirical development. In this paper first the theory development and then the empirical development is checked. Beginning with the former and the first criterion, the unit. This characteristic for the x-efficiency theory is fulfilled because the theory defined the main variables. As aforementioned the employees and individuals are one main variable and the other variable is the output of the organization. The second criterions are the laws. Leibenstein's main point is that the motivation is the connection between employees and their output. The higher their motivation, the higher is the output which clarifies the interrelation of the variables (Stigler, 1976, p. 213). Thirdly the boundary limits criterion is fulfilled because the x-efficiency theory sets limits according to space, time and value. Leibenstein (1966, p. 399) mentioned that most of his evidence is concerned with specific firms or industries but not with the entire economy as a whole. He added that his theory is only tested at best on industries but not on a complete economy which is the limit in space. Furthermore the limit in time is that this is a rather new theory which was developed in 1966, and is not completely tested. There is always space for new interpretation. Additionally it has it limit in value because it cannot be determined to what extent the x-efficiency theory can influence decisions and has an influence on the output of an organization. The forth factor is the system state. According to Dubin (1978) system state should consist out of inclusiveness, it should possess determinant values and it should explain a certain degree of persistency/consistency. Within the x-efficiency theory Leibenstein makes it clear that there are different stages of motivation which can rise or decrease the output. This criterion is therefore also fulfilled. The fifth and last criterion within the theory development is going for the reason of existence of this theory. This last criterion is also fulfilled as clearly mentioned by Leibenstein (1966, p. 392). He said that there exist inefficiency to a certain degree and it can be reduced with changes in employee motivation. After reviewing all above mentioned five criteria, it can be said that all are fulfilled and the "x-efficiency theory" therefore is a real theory according to the theoretical development.

Additionally there is the other part, the empirical development which shows the testability of a theory. This is the second part of the checklist. Here general propositions should be deducted from the theory and for the "x-efficiency theory" they are deducted. Leibenstein (1966, p. 393 & p. 400) used in his work two different tables to prove it. In *Appendix A (see Appendix)* he mentioned the misallocation effects which were rather small. He proved this by seven different studies. He added the source and the country where it took place. It can be seen that there are two different causes for the misallocation effects, the monopoly and tariffs. In the last column he came up with the loss in percent, which was at most one per cent but in most of the studies clearly below one per cent. This means that the losses due to misallocation effects are pretty small in the studies. In contrast to this he showed in *Appendix B (see Appendix)* the X-Efficiency effects which were at least for specific firms usually large. In this table he mentioned seven different countries with different factories or operations. Furthermore he brought in the method how the improvement was tested. In the next column he showed up the increase in labor productivity in per cent and the last two columns dealt with the impact on the firm which is measured in the unit cost reduction. In the second last column the labor savings in per cent can be seen and in the last one the capital savings limited to plant and equipment, excluding increased depreciation cost, which is shown in per cent can be seen. All in all, the table makes clear that x-efficiency has a great influence on labor productivity, labor savings and capital savings. Now coming to the next point. Also a theory should include empirical indicators which Leibenstein's theory does. He uses the labor input and the output as a measurement. Sometimes the same amount of labor input leads to a huge variation in output. As well there is a specific hypothesis derived from the propositions and the system states. As in the hypothesis part already mentioned the hypothesis of Leibenstein (1966, p. 404) is that there is a great deal of possible variation in output for similar amounts of capital and labor and for similar techniques […] to the extent that technique is determined by similar types of equipment. Lastly the theory can be falsified on basis of the other determined characteristics and is tested in reality. Leibenstein (1966, p. 395) tested his theory

in companies and specific industries and found a significant difference which was for the allocative efficiency not the case. There the difference was not significant. All in all, after checking the checklist for determining criteria all elements within the theory development as well as within the empirical development are fulfilled which means, that the x-efficiency theory of Harvey Leibenstein is accordingly to the determining criteria of Vos & Schiele (2014, p. 3 ff.) a real theory.

2.5 X-Efficiency is a source to add value to an output

After proving that Leibenstein's x-efficiency theory is a valid theory, now a closer look is taken on the main statement of the theory. The main statement according to H. Leibenstein (1966, p. 406) is that X-efficiency is a significant source of adding value to an output. An improvement in x-efficiency leads to an increased output. Leibenstein (1966, p. 406 f.) specified three elements as significant in his theory:

- Intra-plant motivational efficiency
- External motivational efficiency
- Nonmarket input efficiency

These three parts are the main elements of Leibenstein's x-efficiency theory. As can be seen, Leibenstein explicitly mentioned in two of his three elements the motivational aspect. This clearly shows the importance of motivation in his theory. His starting point for his theory is the fact that neither individuals nor firms work as hard as they could do. There is always a lack of efficiency (Leibenstein, 1966, p. 407). The neoclassical theory assumes that managers and employees act completely rational and have all information to maximize the owner's profits (Hart 1989 & Chandler, 1992, p. 29). This means that costs should be minimized and organizations work as efficient as they could. If this would be the case, no x-inefficiency would exist but in reality and practice costs are not minimized and firms are not that efficient as they can be, so that there is always a certain kind of x-inefficiency in organizations. Neither of the aforementioned, namely managers and employees, do their search for information as effectively as they could do (Leibenstein, 1966, p. 407), which means, even if there are possibilities to reduce inefficiency, this opportunity is not used due to an insufficient research of information. This could be the result of missing motivation. Leibenstein (1966, p. 392) mentioned in his paper the importance of motivation. In his point of view it is very important because motivation is associated with the degree of effort and upcoming search. There exist several reasons why the giving inputs do not result in the calculated output. In his paper he found four main reasons (Leibenstein, 1966, p. 407):

- Contracts for labor are incomplete
- Not all factors of production are marketed
- The production function is not completely specified or known
- Interdependence and uncertainty lead competing firms to cooperate tacitly with each other in some respects, and to imitate each other with respect to technique to some degree

The first two bullet points will be explained in the following, whereas the last two are self-explaining. Thus an incomplete contract for labor means that not all possible work tasks are covered in the contract and there is a scope. Therefore the firm members have to interpret their job descriptions as stated in the contracts in their own way which gives them to choose their own effort position (Leibenstein, 1978, p. 329).

Furthermore not all information are purchasable on the market. Some information about the market are existent, to which only a few individuals have access to or are only available to them. This points out that some information can be bought just in combination with hiring employees to get these inputs (Leibenstein, 1966, p. 407 f.). In some cases you have to hire an employee with specific interest knowledge about market information to get access to this information.

Nevertheless, there are more reasons for inefficiency, for example the missing competitive pressure in monopolistic economies and industries. Harvey Leibenstein (1966, p. 397) held another main statement. He said that monopoly in industries leads to a welfare loss. Furthermore he continued that one-third of the companies in the industries are monopolized sectors, but competitive pressure would only lead to a cost reduction of 3/10 of one percent. As mentioned earlier a monopolized economy is associated with inefficiency due to the lack of competitive cost reduction pressure but according to Leibenstein (Leibenstein, 1978, p. 203) also a competitive environment may not eliminate x-inefficiency. He mentioned an imagination in which he supposes that there is an X-inefficiency 20 per cent above the minimum cost. If all companies in an industry have round about the same cost which can be investigated with help of benchmarking, they might think that they are at the minimum cost level and are less motivated to continue looking for further cost reductions. That there is an opportunity like for example in Leibenstein's example (Leibenstein, 1966, p. 395 f.) of further 20 per cent reduction in costs does nobody expect on the first view. Therefore it is necessary to look for other or respectively further cost reductions within the supply management, which can be achieved through bundling or other supply management tools. Even if the organization is working below the industries average cost, they can further reduce their cost and create an advantage in pricing and efficiency compared to the competition.

2.6 X-Efficiency Theory in practice

2.6.1 Different methods to get information about the X-Efficiency Theory and to develop new knowledge

In this paper several methods have been used to find different papers and information, which are the basis of my literature research. One way of getting information are books about supply management, but basically the internet is the main source of information. Here the web of knowledge, a scientific search engine, is used as the most important source. With help of this search engine I found various articles with different keywords. The most obvious search words for topics were "Leibenstein" and "x-efficiency", because it is the x-efficiency theory of Leibenstein. Typing in "Leibenstein" into the web of knowledge lasts in 102 results whereas the search word "x-efficiency" results in 287 hits. By making a small differentiation, cutting the "x" and only looking for "efficiency", the web of knowledge shows more than 1.1

million hits. The web of knowledge was not the only search engine used. Furthermore Google scholar was used and lead to much more hits. The word "Leibenstein" got 15,600 hits, "x-efficiency" 14,800 hits and the word "efficiency" more than 4.5 million hits. Due to the high number of hits the results were sorted by relevance to get the most relevant first. Sorting by relevance is a function in Google scholar and also in the web of knowledge. The other option next to relevance would be, to sort it by date. But because of the fact, that the x-efficiency theory already exists for a long time, also older article are important for this paper and therefore it is appropriate to sort it by relevance, rather than by date. Important in the beginning of the literature research was to find articles which were directly related to Leibenstein's x-efficiency theory to get a first impression about the relevant factors. After reading the first articles another search words came up. These are for example "motivation", which has almost 180,000 hits in the Web of Knowledge. Another way to limit the articles is the specification within the search. For the section "2.6.3 The x-efficiency theory is mostly applied within the banking sector and not by the Purchasing function and Supplier" a more specific search was necessary. First the search word was again "x-efficiency". Within this search I typed different keywords into the box "Search within results for…" to specify my results. These results are described in more detail in that section. The following Table 1 is an overview of the Literature Review used in this paper, including the results for the section "2.6.3 The x-efficiency theory is mostly applied within the banking sector and not by the Purchasing function and Supplier".

Keywords	Limit to...	Initial Hits	Limit to 2005-2014	Usable & assessed papers
Leibenstein		102	9	1
Efficiency		1,280,092	809,474	9
Motivation		180,000	118,422	1
X-Efficiency		287	133	6
X-Efficiency	Purchasing	0	-	0
X-Efficiency	Supplier	1	-	1
X-Efficiency	Supply	4	-	0
X-Efficiency	Bank	74	-	1
X-Efficiency	Banking	74	-	1

Table 1: Overview of Literature review

It needs to be mentioned that this table not contains all keywords and all papers used in this theory evaluation. These are only the most important keywords and it is a description of the way how I searched for scientific articles.

2.6.2 The X-Efficiency Theory is empirical tested in different research areas

The x-efficiency theory is a topic, which already exist for a long period in time. Leibenstein wrote his paper in 1966 which is by now almost 50 years ago. Due to this large time span a lot of other authors wrote on this topic because it always has some space for interpretation and is interesting for other findings related to x-efficiency. Two of the other authors are Zelenyuk & Zheka (2006, p. 144). They identified a positive and significant relationship between foreign ownership and inefficiency. This means the higher the degree of foreign ownership, the higher the inefficiency. This can have several reasons. One can be a lack of supervision or a lack in motivation caused by the fact that the owner of the company is not directly in the company and "just" owns the company. There can also occur an agency problem between the manager and the owner because the owner is not directly in place and might have different visions of efficiencies than the owner has. Interests of the owners are to work with greatest efficiency and maximizing the added value of the firm whereas managers have different interests. Rather than adding value of the firm they want to maximize their own benefits and not that of their owners. Independent from foreign ownership or domestic ownership they state that the higher the quality of corporate governance the higher the firms performance. This can lead most probably to a substantial loss in firm's efficiency. Good corporate governance can influence this problem in a positive way because corporate governance deals among others with agency problems (Zelenyuk & Zheka, 2006, p. 144). This is another empirical finding which supports Leibenstein's theory that motivation, no matter on which managerial level is a major source of his x-efficiency. The next empirical finding is found by Stavros Peristiani (1997, p. 332 f.). He investigated the x-efficiency in the banking sector of the United States and their development after a merger. He found that there occurs a small but significant decline in pro forma x-efficiency two to four years after the mergers. This supports Leibenstein's finding that a reduction in competition (respectively a monopoly) in certain industries leads to an increase in x-inefficiency. The competition factor is also mentioned by Majumdar (1995, pp. 132, 138, 142) as he stated in a study about U.S. Telecommunications. They investigated the time span from 1973 to 1987. Till 1973 there was the time where was no effective competition in this market and with the rise of competition till 1987 they saw that the telecommunication industry have significantly improved their relative abilities to both maximize outputs and minimize costs. In an observation by Frederick Harbison (1956, p. 373) it got clear that there is a positive change in efficiency, if there is competition instead of monopoly. His example of the two petroleum refineries supported this statement. Rostas (1964, cited according to Leibenstein, 1966, p. 399-401) found in his study significant differences in output for the same amount of input in different countries. He compared companies in the U.S. and in the UK and saw differences in the nature of the management, the environment and differences in the incentives employed.

Within the research of Taylor & Taylor (2003, p. 75 ff.) they investigated universities and showed the main differences between the neoclassical theory and the x-efficiency theory. These differences will be explained later in more detail. Their main statement in relation of x-efficiency is that x-inefficiency is an intra firm inefficiency. It can arise from several factors. One of them is the environment. The environment not always gives the possibility to be as efficient as possible. Another factor is the management practices. Herewith some work can be done twice without knowing it and this is already a small inefficiency.

2.6.3 The X-Efficiency Theory is mostly applied within the banking sector and not by the Purchasing Function and Supplier

In the previous section general empirical findings were reported whereas in this part it gets more specific. Within this chapter a more narrow view is taken concerning Leibenstein's x-efficiency theory. Here the focus is laid on purchasing and suppliers with respect to Leibenstein's theory. As already indicated in the section "2.6.1 Different Methods to get information about the x-efficiency theory and to develop new knowledge" for the search word "x-efficiency" 287 results were found in the search engine Web of Knowledge. With help of the limitation-function "Search within results for…" I added a second selection with the word "Purchasing" which led to zero results. Furthermore I limited it to two other words. The first of them was to limit it to the word "supplier" which resulted in one hit. The article with the title "Information Technology Spillover and Productivity: The Role of Information Technology Intensity and Competition" is about the spillover effect of industries to other downstream industries, or to noninvesting parties (Han, Chang, & Hahn, 2011). This leads to an improvement in productivity of downstream industries. This article has no real contribution to the content of this paper but it outlines main points of the x-efficiency theory. It states that competition leads to an improvement in productivity as well as to aim for more effort towards a cost reduction. Additionally they sum up that more competitive industries are more efficient in their operations (Han, Chang, & Hahn, 2011, p. 121). All in all there is no article which contributes substantial content to findings related to suppliers.

The second limitation word with which I limited the results for "x-efficiency" was "supply" which led to only four hits. This small number of hits shows that there is not much empirical evidence about Leibenstein's theory regarding Purchasing and Supplier. This might have two possible reasons.

The first reason could be that the x-efficiency theory is not usable for the Purchasing and Suppliers area and the second reason, which is more likely, could be that the x-efficiency theory is mostly used in other areas.

While having a look at all the results it got obvious that a lot of the articles have a connection to the banking sector. With help of the aforementioned limiting function, the results of "x-efficiency" were limited to the word "bank" which led to 74 hits. Limiting the results to the word "banking" led to the same result. 74 hits out of the total sum of 278 hits for "x-efficiency" is a great proportion. This is an indication that x-efficiency is mostly used in the banking sector whereas for the purchasing and suppliers sector it seems not to play a big role.

All in all it can be said that the x-efficiency theory is mostly used in the banking sector because of the high number of results. This strengthens the second of the two reasons, that the x-efficiency theory is mostly used in other areas than by purchasing and supplier. But this does not mean that the first reason, that the theory is not usable for the purchasing and supplier area is true or false. Another section closer to the end of this paper shows, that Leibenstein's x-efficiency is usable in Purchasing and Supplier area as well. It can be a good tool in the decision making process in supply management. This is further explained later.

2.6.4 In the Life-Cycle Approach of Theories, the X-Efficiency Theory is in the Progression-Stage

The Life-Cycle Approach of Theories is a way to view the development of a theory over the time. To make it clearer, Vos and Schiele (2014, p. 8 ff.) came up with "The Life-Cycle of theories". It classifies a theory in the following three stages.

- Theoretical & Emperical Construction,
- Progression (Virtues)
- Possible Degeneration

Generally theories are constantly developing over the time (Davis, 2010; Kuhn, 1970; Lakatos, 1970; Vasques, 1997, cited according to Vos & Schiele, 2014, p. 8), and it cannot be said that one theory is in a certain stage and stays there forever. Therefore a theory can change its stage during its life cycle.

The Theoretical and Empirical Construction is the first stage which are also the internal virtues. The internal virtues are the instrinct properties of theories that can be evaluated apart from external characteristics (Vos & Schiele, 2014, p. 6). It contains the five characteristics mentioned by Vos & Schiele (2014, p. 4), which are already discussed in section "2.4 The x-efficiency theory fulfills all Theory-requirements". There all parts of a theory are mentioned and it got clear what the x-efficiency theory is about. Therefore it is possible to test the theory in an empirical environment.

The external virtues are different from internal virtues, because they consider the broad environment (Vos & Schiele, 2014, p.7). The scope and unity of the x-efficiency theory is limited to economic areas. When Leibenstein (1966) came up with his x-efficiency theory he clearly mentioned that his theory is not in a line with the neo-classical theory. There are differences in almost all parts of the both theories. This is why the theory is not consistent with the existing body of theories. Furthermore the x-efficiency theory, which came up in 1966, indicates that the current theories lack some virtues and it points out that the neo-classical theory is a theory, which will almost never be achieved in reality. All in all it can be said that it is a fruitful theory because new knowledge is developed. Additionally the x-efficiency theory is a useful and practical theory which is also indicated by Taylor & Taylor (2003, p. 71 f.). By now the new knowledge is rather limited to the banking sector but there are enough interesting points to develop knowledge in other areas, also in the supply management and purchasing area.

With respect to the progression, the x-efficiency theory is that it was developed in 1966 by Harvey Leibenstein and directly got critics by several authors because of Leibensteins view on the neo-classical theory. But over the time it has been proved through several empirical findings that the x-efficiency theory can lead to a reduction in inefficiency. With every new empirical test, the x-efficiency theory further develops. As indicated by Lakatos (1970) and Vasquez (1997, cited according to Vos & Schiele, 2014, p. 8) a good theory should be progressive in two ways, theoretically and empirically. One way of how to see, whether the theory is progressive is to take a look at the publication dates. With the help of a timely limitation at the web of knowledge it got clear, that a lot of articles were published within 2005 and 2014, which means the past 10 years. During these 10 years, 133 articles out of

originally 287 found, were published. This amount shows that more than 45 per cent of all articles related to "x-efficiency" were published in the last decade. One reason might be that because of the progression and development of the world wide web (Davis, 2010, p. 693) more and more articles are published. Another reason can be that this development is an indicator that the x-efficiency theory gets more and more attractive. By reading all these progression factors, it can be said that the x-efficiency is still progressive.

2.7 The X-Efficiency Theory has its strengths and weaknesses

The x-efficiency theory is a theory which differentiates itself from other theories like the neo-classical view because it takes other variables into consideration. One of the other variables is the motivation of the employees or individuals. As mentioned by Taylor & Taylor (2003, p. 78), variables should have the ability to be measured but motivation differs from individual to individual which means that each individual has a different attitude towards motivation. Due to the fact, that motivation is a part of a variable in Leibenstein's x-efficiency theory it is hard to measure the influence of motivation on the efficiency of the individuals. Of course it can be said that with a certain input a given output should be reached and if not, it is because of missing motivation, but there can also other reasons which can reduce the work effort like the incomplete labor contracts which Leibenstein mentioned (Leibenstein, 1966, p. 407). A variable should have the ability to be measured. This is for the reason to check possible differences and improvements. For this theory it cannot be said that there is a certain difference which is due to motivational factors, therefore a clear way how to calculate a ratio to make differences clear and visible is missing. Hence the exact influence which the x-efficiency has on the output of an organization cannot be determined. This is the one side of the coin. The other side is that as mentioned by Cibangu (2012, p. 97) a theory is often seen as a withdrawn from reality. The meaning of this is that the theory is just a reflection of the optimal, how it should be in a perfect way. The x-efficiency theory is different from theories within the meaning of Cibangu. The optimal outcome is represented by the neo-classical view where managers and employees act completely rational and have all the information they need (Hart & Chandler, 2008, p. 29) whereas within the x-efficiency theory the gap between the theoretical optimal outcome and the practical outcome is considered. It is closer to the reality and as mentioned by Harvey Leibenstein (1966, p. 407) x-inefficiency can never completely disappear due to the nature of the four reasons which are mentioned in section "2.5 X-Efficiency is a source to add value to an output".
Comparing a "normal" theory (according to Cibangu, 2012, p. 97) with the theory of Harvey Leibenstein one big difference needs to be underlined. These "normal" theories are more predictive because they are dealing with the optimal level, whereas the x-efficiency theory is less predictable but it is as indicated by Taylor & Taylor (2003, p. 71 f.) more practical and a useful way of evaluating performance. All in all it can be said that if the practice would be like the neoclassical theory, no x-inefficiency would exist. And because of the fact that the practice is never like that, always a certain kind of x-inefficiency appears.
In the next section the differentiation between the x-efficiency theory the neoclassical theory is further explained and distinguished.

2.8 X-Efficiency Theory has similarities as well as differences to other theories and is more practical than the Neoclassical View

Taylor & Taylor (2003) compared in their article "Performance Indicators in Academia. An X-Efficiency Approach?" Leibensteins X-Efficiency theory with the Neoclassical Economics. The neoclassical view assumes that there is a maximum utilization of resources and individuals which should result in profit maximization of the owner (Hart & Chandler, 2008, p. 29), but this is in reality not the case. This gap between the theoretical utilization/outcome and the practical utilization/outcome is the x-inefficiency and this is why Taylor & Taylor (2003, p. 71 f.) say, that the x-efficiency theory is the more practical and useful way of evaluating performance and looking for improvements. It is not only theoretical but also on a practical basis and do not assume all resources and individuals to work at a maximum level and with maximum utilization. As they said x-efficiency is the deviation from the optimum. The optimum is represented by the neoclassical view of economy. Frantz (1988, cited according to Taylor & Taylor, 2003, p. 73) said that the neoclassical theory has several limitations. One limitation according to him is that it expects that organizations work at their production frontier with maximum output for their given input. This means that organizations are cost minimizers. Another limitation is that each firm has its own production frontier which differs from company to company. Some firms have greater knowledge and can minimize costs and some have not and cannot minimize costs. The biggest difference between neoclassical economics and Leibenstein's x-efficiency theory is that the latter does not ignore the internal operations of institutions and organizations. In Leibenstein's view the individuals are the basic unit of analysis. The overall organizational performance is determined by the culmination of individual performance from all employees (Taylor & Taylor, 2003, p. 75). While comparing the x-efficiency theory with the neoclassical theory there are the following components investigated. The units of analysis are compared as well as the psychology, contracts and efforts. Furthermore the inert areas and the agent-principal are compared.

There are differences in all components as can be seen in the following table 2:

Components	X-Efficiency Theory	Neoclassical Theory
Unit of analysis	Individuals	Households and firms
Psychology	Selective rationality	Household - Maximization of utility Firm - Maximization of profit or minimization of costs
Contracts	Incomplete	Complete
Effort	Discretionary variable	Assumed given
Inert areas	Important variable	None
Agent-principal	Different interests	Identity of interests

Table 2: X-Efficiency Theory and Neoclassical Theory: A Comparison (Leibenstein, X-Inefficiency Xists: Reply to an Xorcist, 1978, p. 329)

Within the neoclassical theory the unit of analysis is rather general with households and firms whereas for the x-efficiency theory individuals are analyzed. Individuals are selective rational as aforementioned in contrast to households which want a maximization of utility and firms which want a maximization of profit or a minimization of costs. The contracts in a neoclassical view are complete but for the x-efficiency theory they are not complete. For the latter the effort is a discretionary variable, the inert area is an important variable and between agents and principals different interest occur. For the neoclassical theory it is different. The effort is assumed as given, there does not exist any inert areas and agents and principals have an identity of interests. As this comparison makes clear there are great differences between the neoclassical theory, which focuses on the perfect and optimal outcome without any influences and the x-efficiency theory, which also considers individuals and sees the gap between theoretical and practical outcome and calls this x-inefficiency.

As pointed out the x-efficiency theory considers the different interests of agent and principal which sometimes lead to an agency problem. In general the principal wants the agent to do the work in the best interest of the principal, which is most of the time profit-maximization, whereas the agent is more concerned with making the best decisions for him, which might not be the best for the principal. Different points can influence the decisions of the agent like personal interest, non-rational decisions or decisions, because the agent has not always access to all necessary information to make the best decision. The fact, that the principal and the agent have not the same interest, have different focuses, or making decisions, which is not favorable by the principal, is a negative influence on efficiency and hence inefficiency occurs. The x-efficiency theory wants to minimize inefficiency and therefore the agency theory can also be a useful tool within the x-efficiency theory.

This example shows that the x-efficiency theory on the one hand is an own theory, but on the other hand other theories like the agency theory can also be part/the reason for an x-inefficiency.

3. THE X-EFFICIENCY THEORY CAN BE APPLIED IN DIFFERENT AREAS WITHIN SUPPLY MANAGEMENT

In the aforementioned section "2.6.3 The X-Efficiency is mostly applied within the banking sector and not by the Purchasing Function and Supplier" the question whether the x-efficiency theory is usable for the purchasing function and supplier or not came up. Within this section the connection between the x-efficiency theory and four different decision points will be discussed. These four decision points are:

- Make or Buy
- Sourcing Strategy
- Supplier Strategy
- Contracting

In the following it will be shown that each of these four decision points can have a contribution to minimize x-inefficiency. It will not be determined to what extend it can reduce x-inefficiency but it will point out that there is the possibility that it can reduce it. With each of these decision points it can be seen that Leibenstein's theory can also be a useful tool for the purchasing function and in supply management, because all of the decision points are related to the procurement and contracting. The first decision point is the decision between make or buy.

3.1 Decision Point 1: The motivational factor plays a role in the Make or Buy decision

The make or buy decision is a decision where it will be determined to produce products or services on their own or to outsource it. On the first view there is no clear connection between the make or buy decision and the x-efficiency theory but if it is seen from another perspective there is a connection. Within the make or buy decision it needs to be decided to produce themselves or not. For this part the motivational factor plays a role. There are two different scenarios. The first one is that products or components are produced in-house. Here the input needs to be transformed into output by human beings. Human beings need to be motivated in a way, that they work as efficient as possible. Therefore the company itself is responsible for the employee motivation. In the other scenario the opposite is the case. The products or components are outsourced to other manufacturers and companies. The buying company just needs to order the products, whereas the producing company has to ensure the efficiency of the human beings working in the company. Therefore a make or buy decision is not just a decision to produce in-house or not, but also a shift of the responsibility of the motivation and efficiency to a supplier.

Of course there are also other reasons like the capabilities or the transaction cost. These are important factors and are major players for the make or buy decision. Companies want to maximize their profit and therefore they try to keep their expenditures as low as possible. Because of this crucial fact the transaction cost need to be outweighed whether a buy decision or a make decision is more appropriate. Furthermore if a company has no capabilities to produce on their own they have to outsource the production, whereas in contrast to this if the capabilities are available and it is cheaper to produce on their own, an in-house production is likely. One advantage of in-house production is the workforce can keep their work which can create a positive atmosphere among workers. This can lead to a higher motivation which can result in higher efficiency.

As can be seen, many factors are important for the make or buy decision and each of them can have an influence on the decision.

3.2 Decision Point 2: The Sourcing Strategy has an influence on X-Efficiency

The second decision point is the sourcing strategy. The aforementioned Make or Buy decision is also a part of the sourcing strategy but it is only a part. The sourcing strategy is much broader than just the Make or Buy decision because it is a part of the supply chain management and the aim of the sourcing strategy is to give the long term direction of sourcing and to help the company to achieve overall goals (Monczka, Handfield, Giunipero, Patterson, & Waters, 2010, p. 54). Within the sourcing strategy there are different connections to the x-

efficiency theory. One point to reduce inefficiency within this topic is to run the sourcing process smoothly. An example how it could be done is the reduction of double work. This means that no work should be done double because of a lack of information. The purchasing department should closely work together with other departments to get all information they need to make optimal decisions.
Furthermore the sourcing strategy has different aims (Monczka, Handfield, Giunipero, Patterson, & Waters, 2010, p. 65):

- Cost reduction
- Introducing new technology to operations
- Introducing new products
- Reducing the supply base
- Improving product quality

In all of these aims a reduction in x-inefficiency can be done. Examples for the first two are that costs can be reduced through bundling, and bundling means a reduction in work effort. For the aim new technology to operations can result in a faster and more efficient production which is an optimization of the work flow.
Another point how sourcing strategy can lead to a reduction of x-inefficiency is to take a look at the competitive environment of the supplier. Important is to know whether the supplier works in a competitive or in a monopolistic industry. In monopolistic industries the incentive for price reductions is lower than in competitive industries. One way to overcome this problem is to choose supplier in competitive industries, which is not always possible. Another way is to build new competitions in monopolistic markets to force the players to reduce their prices.
Furthermore a sourcing strategy in competitive environment can be to source products from different suppliers. This raises the supplier's motivation to sell for best prices or to sell under better conditions, for example reduced delivery times, otherwise the buyer can switch to their competitors. A reduction in delivery times is positive for the buying company. He can order faster and react faster to urgent customer orders. Faster production processes also raises the efficiency of a company and therefore sourcing from different suppliers is a good way to motivate the supplier to further develop and improve their products and services and to give the best prices to stay competitive.

3.3 Decision Point 3: Different supplier need to be treated in different ways to gain an advantage

Supply management is all about supplier. Therefore the supplier strategy is an important factor, choosing the right supplier, paying a fair price for the products and a lot more are part of this strategy. As mentioned by Leibenstein (1978, p. 205) in part "2.1 The emergence of the X-Efficiency Theory in 1966 has the reason on another view on efficiency", supplier in a monopolistic industry do not have that incentives to reduce their prices than companies in a competition have. Furthermore the pressure in price negotiations within a monopolistic industry is low whereas in a competitive industry pressure can be applied to gain lower prices. Additionally lower prices are not the only advantage which can be achieved in competition. Faster delivery times or better payment conditions are only a few examples which are easier to achieve in competition than with monopolistic suppliers. It is important to find ways how to profit from monopolistic suppliers as well as from suppliers in competitive industries. Normally monopolistic suppliers can set the market price and have not much incentive to reduce prices. Therefore the buying party has to find ways how to overcome this problem. One way can be to work together with the supplier. Here the Kraljic Matrix is a helpful tool. The Kraljic Matrix classifies all products in four quadrants. If one has a monopolistic supplier the supply risk is high because there is only one supplier. Thus the Strategic and Bottleneck quadrant are important. Because of the fact that the importance of purchase is low for bottleneck items, the strategic items are the most important ones. Focusing on the strategic quadrant, the development of long-term supply relationships is one possibility to reduce the risk (Kraljic, 1983, p. 112). The supplier can be seen as a strategic partner. If both parties work together, for example if they have a common development or share information, both parties can profit from faster research and development, and so both can reduce their inefficiency.

This means in all situations, either for supplier in competition as well as for supplier in monopolistic industries there are ways to reduce inefficiency but the supplier needs to be treated with different strategies.

3.4 Decision Point 4: Contracting is an important success factor if it is done in the right way

Contracting is the last out of the four decision points, which does not mean that this decision point is at least important. Contracting is a very important point. There are different areas where contracts occur, for example labor contracts or contracts of purchase. Of course there are many other types of contracts. For this paper, the most important contracts are these in purchasing and supply management.
Nevertheless also labor contracts, as mentioned in the part "2.5 X-Efficiency is a source to add value to an output" are part of the x-efficiency theory. Leibenstein (1966, p. 407) said that one reason for the existence of x-inefficiency is that contracts for labor are incomplete. Often there is too much space for different interpretations and therefore sometimes it is not clear, who has exactly to do which tasks. As a result inefficiency can occur because of the fact, that employees can choose their own level of effort (Leibenstein 1987) and that is why labor contracts should be as complete as possible.
The other types of contract which are mentioned above are the contracts of purchase. According to Law and Smullen (2008, cited according to Monczka, Handfield, Giunipero, Patterson, & Waters, 2010, p. 329) is a contract a legally binding document. Thus a contract should contain all important elements to avoid get into trouble. As pointed out by Louis M. Brown (1950, cited according to Monczka, Handfield, Giunipero, Patterson, & Waters, 2010, p. 329) "it usually costs less to avoid getting in trouble than to pay for getting out of trouble". This means that it is extremely important to cover everything in contracts to be sure that everything goes the right way. This is the formal part of a contract. Mostly a contract is an agreement between at least two parties. In the former section it is stated, that the purchasing

party has low bargaining power in negotiations with a monopolistic supplier. This means that the buyer is dependent on the supplier, whereas in contrast to this in competitive industries the supplier wants to keep their buyer and has to fight against their competitors to keep them. Therefore in these two scenarios there are two different bargaining positions. The first one is that the supplier has an advantaged bargaining power and the other one that the buyer holds the power. This situation in competitive industries can be used by companies to reduce their x-inefficiency. Not only the prices reduce x-inefficiency, also the advanced bargaining situation has an influence. Due to the bargaining pressure of the buyer, the suppliers are forced to deliver in time if at all possible. This is again an improvement in the sourcing and production process, because the pressure to deliver in time is higher.

The next point is how a sourcing company can profit from contracts with monopolistic suppliers. One form is a long-term agreement. If products are sourced by only one supplier or over a long period of time, the supplier should have more knowledge over time and more experience how to run the production faster and more efficient. Thus a fixed annually price reduction could be possible and reasonable due to the learning curve of the supplier. Furthermore long-term agreements are positive for the supplier, because they can better plan their production forecast, and have also a positive effect for the buying party, because they know which quality to expect. Therefore long-term agreements are helpful in monopolistic sourcing industries and both parties can profit from it. Furthermore both can reduce their x-inefficiency because of the reasons mentioned in this section. These are not the only reasons, there are many other ways how to reduce x-inefficiency.

All in all, all of the four aforementioned decision points have an influence on the x-efficiency. Each of them can contribute in a certain way and in the specific areas to reduce x-inefficiency. As a result it can be seen that x-efficiency indeed occurs within the purchasing and supplier area and it can be reduced with the right actions. Thus it helps the company to achieve their overall goals.

4. DISCUSSION & CONCLUSION

In this paper, several different factors of the x-efficiency theory were discussed. One of the main factors is that it is proved that the X-Efficiency Theory is according to the determining criteria of Vos & Schiele (2014, p. 4 f.) a real theory. They continued that theories are developing over time and came up with a three stage model, the Life-Cycle of Theories. Within this Life-Cycle, the x-efficiency theory is at the moment in the second stage, which is the progression stage. This does not mean that it stays there forever, because it can move to another stage over the time.

It got clear that the most important factor within the x-efficiency theory is the motivational aspect. There are some factors with probably work against inefficiency like smaller working units or generally supervised working units. Furthermore if the working unit is more information given they work more efficient and if the working units are made up of friends it has also a positive effect on efficiency. X-efficiency is a significant source of adding value to an output but it cannot be determined to what extend the x-efficiency theory has an influence on the output of an organization. Nevertheless there is the fact that x-inefficiency can never be eliminated because of different aspects. One of them is that it is hard to get all information to work as efficient as possible and to make the best decision. To make the best decision with all the information and the most efficient outcome is assumed by the neoclassical theory. This paper pointed out the main differences between the x-efficiency theory of Harvey Leibenstein and the neoclassical view. It says that the neoclassical view does not show the whole reality because there is always a deviation from the theoretical optimum. One reason for this that the work is done by human beings which work not always with the same level of effort due to several factors and the output of a company is dependent on the efficiency of the employees. Without any deviation from the neoclassical view in practice there would no x-inefficiency exist. Therefore the x-efficiency theory is seen as the more practical and useful way of evaluating performance (Taylor & Taylor, 2013, p. 71 f.). The x-efficiency theory is closer to reality. It considers factors like the environmental influence on output which will not lead to the optimal outcome. These factors are not covered in the neoclassical view. It can be said that an organization will never work as the neoclassical view it assumes because it does not ignore internal operations of organizations and therefore the x-inefficiency can be reduced, but it will never completely disappear due to the nature of several reasons. Of course the neoclassical view is more predictable because it assumes all information given and no deviation from the optimum but that is just a theoretical prediction, which is hard to achieve in reality.

By talking about reality, the x-efficiency theory is empirical tested for several times with interesting findings. One found a positive and significant relationship between foreign ownership and inefficiency, others stated that the higher the quality of corporate governance the higher the firms performance. Moreover there is a positive change in efficiency when suppliers are in competition instead of monopoly. Also it is pointed out that the environment does not always give the possibility to be as efficient as possible.

The aim of the x-efficiency theory is to reduce inefficiency of organizations and institutions. As aforementioned motivation is one of the main aspects to reduce inefficiency. Inefficiency can occur in all kinds of an organization. This paper shows that it is mostly applied in the banking sector, but it has also it potential to reduce inefficiency in the purchasing and supplier area. In four different areas in supply management the potential of x-efficiency has been checked in this paper and it gives basic approaches in which parts inefficiency can be reduced and how this can be done. Supply management has a great influence on organizations performance because it helps to achieve the overall goals of the company. Therefore inefficiency should also be reduced in this part of the company. One way is to try to run the sourcing and production processes smoothly with as less as possible idle times. Therefore good predictions of other departments and a good information flow are crucial. Another approach is the supplier strategy, in which the supplier and their competitive environment should be investigated. A supplier within a monopolistic industry has more bargaining power than a supplier in a competitive environment. This should be kept in mind in negotiations. The aim of negotiations is to come to an agreement which should be written down in a contract. Contracting is important, because in contracts all important points are in black and white and signed by both/all parties. It is legally binding and should be as complete as possible to avoid negative surprises. Labor contracts need to be complete to determine the level of effort of employees and contracts of

purchase need to be complete to make sure that the agreement leads to the desired outcome.

All in all it can be said that the x-efficiency theory is a good way to evaluate the real performance of a company. It can occur within many other theories or in combination with other theories. It can help to reduce inefficiency with changes in motivation, which is also part of a drawback of the theory, because motivation is a variable but it is hard to measure the influence of motivation on efficiency.

5. LIMITATIONS AND FURTHER RESEARCH

This paper is limited to a literature research and this literature research has the focus on supply management. Therefore other areas in which the x-efficiency theory might be interesting are not part of this paper. Noticeable is that the x-efficiency theory is a theory which is not often considered by now which can also be seen in the relative low number of hits in several search engines.

An opportunity for further research is within the supply management. This area is not so much tested by now and hence the aspects mentioned in this paper can be used for further investigations. Moreover further research especially within the purchasing and production area can be done. As mentioned in this paper there are a lot of points, which can be further developed and evaluated. Also other areas give possibilities to reduce x-inefficiency, because x-inefficiency can occur almost in every business and industry.

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Appendix:

Appendix A:

Study	Source	Country	Cause	Loss
A. C. Harberger	*A.E.R.* 1954	U.S.A. 1929	Monopoly	.07 per cent
D. Schwartzman	*J.P.E.* 1960	U.S.A. 1954	Monopoly	.01 per cent
T. Scitovsky	(1)	Common Market 1952	Tariffs	.05 per cent
J. Wemelsfelder	*E.J.* 1960	Germany 1958	Tariffs	.18 per cent
L. H. Janssen	(2)	Italy 1960	Tariffs	max. .1 per cent
H. G. Johnson	*Manchester School* 1958	U. K. 1970	Tariffs	max. 1.0 per cent
A. Singh	(3)	Montevideo Treaty Countries	Tariffs	max. .0075 per cent

Sources:
(1) [29].
(2) [16].
(3) Unpublished calculation made by A. Singh based on data found in A. A. Faraq, *Economic Integration: A Theoretical, Empirical Study*, University of Michigan, Ph.D. Thesis, 1963.

Appendix B:

Factory or Operation	Method*	Increase in Labor Productivity %	Impact on the Firm (Unit Cost Reduction)	
			Labor Savings %	Capital† Savings %
India				
Seven textile mills	n.a.	5-to-250	5–71	5–71
Engineering firms				
All operations	F, B	102	50	50
One operation	F	385	79	79
One operation	F	500	83	83
Burma				
Molding railroad brake shoes	A, F, B	100	50	50
Smithy	A	40	29	29
Chair assembly	A, B	100	50	50
Match manufacture	A, F	24	19	—
Indonesia				
Knitting	A, B	15	13	—
Radio assembly	A, F	40	29	29
Printing	A, F	30	23	—
Enamel ware	F	30	23	—
Malaya				
Furniture	A, D	10	9	9
Engineering workshop	A, D	10	9	9
Pottery	A, B	20	17	17
Thailand				
Locomotive maintenance	A, F	44	31	31
Saucepan polishing	E, D	50	33	—
Saucepan assembly	B, F	42	30	—
Cigarettes	A, B	5	5	—
Pakistan				
Textile plants	C, H, G			
Weaving		50	33	33
Weaving		10	9	9
Bleaching		59	37	37
Weaving		141	29	29
Israel				
Locomotive repair	F, B, G	30	23	23
Diamond cutting and polishing	C, B, G	45	31	—
Refrigerator assembly	F, B, G	75	43	43
Orange picking	F	91	47	—

* A = plant layout reorganized
B = machine utilization and flow
C = simple technical alterations
D = materials handling
E = waste control
F = work method
G = payment by results
H = workers training and supervision

† Limited to plant and equipment, excluding increased depreciation costs.
Source: P. Kilby [19, p. 305].