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Understanding the concept of productivity

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Abstract – Although the concept of productivity is a widely discussed subject by politicians, economists, managers and media, it is often vaguely defined and poorly understood. In practise, this lack of knowledge results in productivity being ignored by those who influence production processes. The purpose of this paper is to discuss the basic meaning of productivity as well as its relation to other similar terms. The findings are based on a review of the productivity literature from the last decades and on two investigations undertaken in the Swedish industry. The paper explains the ambiguous term productivity, how its defined in the Swedish industry and proposes a terminology on the subject.

1. INTRODUCTION

The concept of productivity, generally defined as *the relation between output and input*, has been available for over two centuries and applied in many different circumstances on various levels of aggregation in the economic system. It is argued that productivity is one of the basic variables governing economic production activities, perhaps the most important one [1]. However, at the same time as productivity is seen as one of the most vital factors affecting a manufacturing company's competitiveness, researchers argue that productivity is often relegated to second rank, and neglected or ignored by those who influence production processes [1,2,8,10]. A major reason for this could be that many managers do not understand what the term productivity actually means. In fact, productivity is frequently discussed by managers but rarely defined, often misunderstood and confused with similar terms, and seldom measured in an appropriate way, leading to productivity being disregarded or even to that contra productive decisions are taken. According to Koss and Lewis, remarkably many managers who every day make decisions about improving plant efficiency do not know how to answer the simple question: "What do we really mean by productivity?". It further appears to be a resistance to addressing this question [3]. Published research also shows that productivity and similar terms are not used consistently [2].

Nevertheless, if we do not fully understand what productivity is, how can we decide what productivity measures to use? How can we interpret them correctly? How can we know what action to take to improve productivity? Evidently, the confusion surrounding the subject makes it necessary to further investigate and emphasise the basic meaning of productivity. Hence, an improper definition of productivity will often result in that action is being misdirected [4].

The aim of this paper is to discuss and provide insight into the basic meaning of the concept of productivity as well as the difficult question of how productivity is related to other similar terms. The view of productivity within the Swedish industry is also investigated. A proposed terminology of terms frequently used synoumos to productivity is presented and evaluated, since it is believed that a common grammar is important in order to be able take appropriate actions to measure and improve productivity in today's complex business environment.

The findings in the paper are based on a review of the productivity literature from the past two decades and on two investigations undertaken in the Swedish industry. In the first study, 15 managers from five major manufacturing companies were interviewed about how their companies defined and measured productivity. The objective was to explore how the view of productivity differed between different companies. The second study had the same approach as the first one, but only concerned one company where 27 employees from top management to bottom line operators were interviewed. The objective was to see if the view of productivity altered within the company.

The paper is organised as follows. The second section explains the term productivity and its differences to other similar concepts. The third section proposes a new terminology. The forth section discusses how productivity is defined in the Swedish industry. The fifth section concludes the paper.

2. PRODUCTIVITY – AN AMBIGUOS TERM

Despite the confusion on the subject, several characteristic features that represent the concept of productivity have been identified within this research. Generally speaking, productivity is in industrial engineering defined as the relation of output (i.e. produced goods) to input (i.e. consumed resources) in the manufacturing transformation process. Productivity is therefore, on the one hand, closely connected to the use and availability of resources. This means in short that productivity is reduced if a comapany's resources are not properly used or if there is a lack of them. On the other hand, productivity is strongly linked to the creation of value. Thus, high productivity is achieved when activities and resources in the manufacturing transformation process add value to the produced products. Furthermore,

the opposite of productivity is represented by waste, which must be eliminated in order to improve productivity.

So far the term productivity may seem rather easy to understand, however, there are several implications which have caused much confussion. A common mistake is, for instance, to use productivity synomous to measures of production, which refers to the amount of a product or service produced. As a result of this confusion, people tend to believe that increased production, means increased productivity. This is not necessarily true. An important point to keep in mind is that productivity is a relative concept, which can not be said to increase or decrease unless a comparison is made, either of *variations* from competitors or other standards at a certain point in time, or of *changes* over time. Basically, improvements in productivity can be caused by five different relationships [5]:

- Output and input increases, but the increase in input is proportionally less than the increase in output.
- Output increases while input stays the same.
- Output increases while input is reduced.
- Output stays the same while input decreases.
- Output decreases while input decreases even more.

It is also important to understand the ambiguous nature of productivity, since there exist several types of productivity as well as different hierarchical levels which productivity can be discussed within. Almost any transformation process within a manufacturing company is fed with several types of input (e.g. labour, capital, material and energy) and emits more than one output (e.g. product A, product B). In turn we must be able to separate *partial productivity* (i.e. output related to one type of input) from *total productivity* (i.e. output related to multiple types of input). Moreover, considering all the different hiarchical levels that exist in a company it is not difficult to comprehend that, for example, the management's strategical perspective of productivity will usually differ from the more operational view of productivity among operators at an assembly line.

The literature show that the concept of productivity should be distinguished from four other similar terms: profitability, performance, efficiency and effectiveness, which will now be explained [3-8].

Profitability

Perhaps the reason why companies tend to ignore the importance of productivity is that they often link productivity and profitability as one issue. Profitability is the overriding goal for the success and growth of any business, and is generally defined as a ratio between revenue and cost (i.e. profit/assets). However, profitability as a performance measure mainly addresses shareholders as the interest group and many researchers therefore claim that using monetary ratios as productivity measures will result in several shortcomings, for instance, induce short-termism and discurage the customer perspective. Profitability can change for reasons that have little to do with productivity, such as inflation and other external conditions that may bear no relationship to the efficient use of resources. Miller argue that productivity is a more suitable measure to monitor manufacturing excellence in the long run rather than profitability, since profits are influenced by many factors in a short-term perspective [6].

The term profitability clearly has a productivity component, but it is strongly influenced by the prices a company pays for its input and receives for its output. If a company can recover more than the cost of its input from rising prices for its output, its profitability can be increased even in times when its productivity is decreasing, see figure 1. That is also a strong argument for productivity being expressed in physical units (in quantities) instead of monetary units. In conclusion, productivity can be separated from profitability by the price recovery [6].

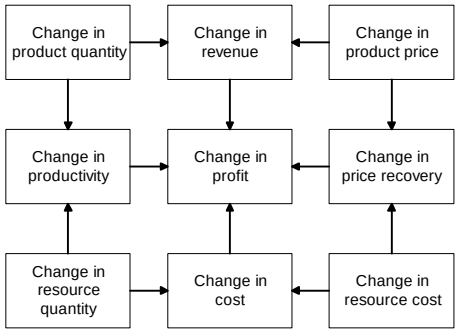

Figure 1. Productivity's relation to profitability

Performance

Many people who claim to be discussing productivity are actually looking at the more general issue of performance. While productivity is a fairly specific concept related to the ratio between output and input, performance is a term which includes almost any objective of competition and manufacturing excellence such as cost, flexibility, speed, dependability and quality. However, as illustrated in figure 2, various performance objectives can have a large effect on the productivity in an operation [7]:

- *High-quality operations* do not waste time or effort having to re-do things, nor are their internal customers inconvenienced by flawed service.
- *Fast operations* reduce the level of in-process inventory between micro operations, as well as reducing administrative overhead.
- *Dependable operations* can be relied on to deliver exactly as planned. This eliminates wasteful disruption and allows the other micro operations to operate efficiently.
- *Flexible operations* adapt to changing circumstances quickly and without disrupting the rest of the operation. Flexible micro operations can also change over between tasks quickly and without wasting time and capacity.

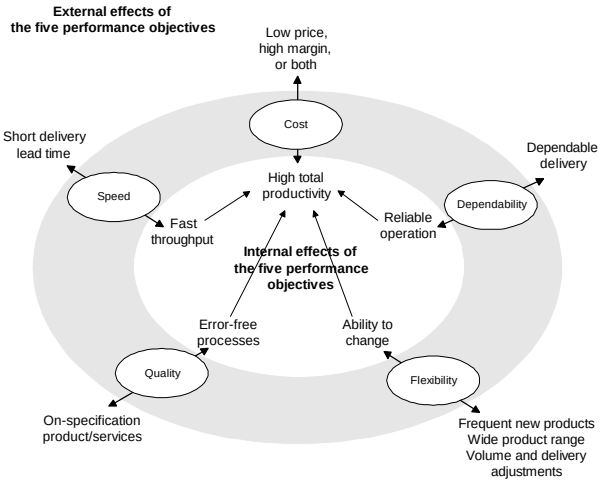

Figure 2. Productivity's relation to performance objectives [7]

Some researchers and managers see performance objectives, especially quality, as *a part* of the concept of productivity, while they instead should se them as factors affecting productivity. It is believed in this research that the confusion surrounding productivity will be even more complicated with a too broad view of productivity. If productivity measures should include all types of performance objectives, they are in grave danger of becoming so complex that their usefulness as meaningful measures of improvement become questionable.

Efficiency and effectiveness

The two terms *effectiveness* and *efficiency* render the terminology even more complicated. There is no single accepted view about these terms; however, *effectiveness* is usually described as 'doing the right things', while *efficiency* means 'doing things right' [8]. Most researchers agree that *efficiency* is strongly linked to the utilisation of resources and mainly influence the input of the productivity ratio. This means that efficiency in manufacturing can be seen as the minimum resource level that is theoretically required to run the desired operations in a given system, compared to how much resources are actually used (see figure 3). The efficiency ratio is rather simple to measure, whether it is based on time, money or other.

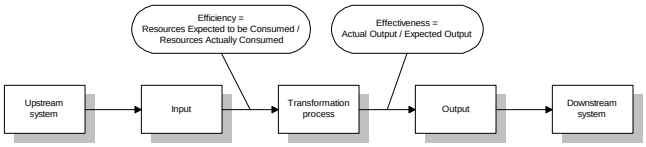

Figure 3. Efficiency and effectiveness [8]

Effectiveness, on the other hand, is a more diffuse term and in most cases very difficult to quantify. It is often linked to the creation of value for the customer and affects the output of the productivity ratio. In conclusion, a single focus on efficiency does not seem to be a fruitful way to increase productivity [9]. Unfortunately, this is often the case in industry. However, it is the combination of high values of both efficiency and effectiveness in the transformation process that leads to high productivity. Thus, is it possible for an effective system to be inefficient; it is also possible for an efficient system to be ineffective.

3. THE TRIPLE-P MODEL

Based on the earlier descriptions of the terminology sourrounding productivity, the *Triple-P model* (figure 4) has been developed to give a schematic view of how the different terms are suggested to be used [10]. The model includes five terms; productivity, profitability, performance, effectiveness and efficiency, and explains how they are related to each other. Through the Triple-P model, the main differences between these terms can easily be captured.

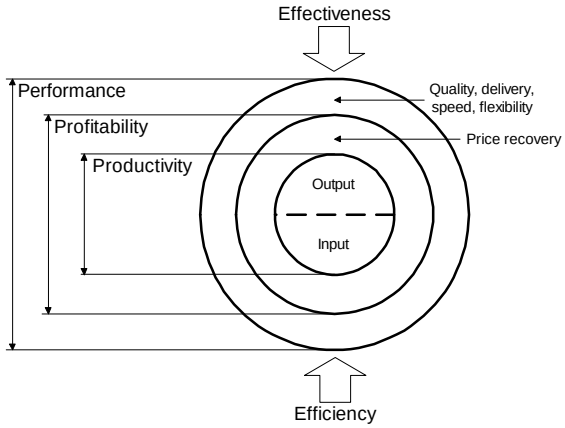

Figure 4. The Triple P-model [10]

Productivity is the central part of the Triple P-model and has a rather straightforward operational definition of productivity as a ratio of output quantity (i.e. number of correctly produced products which fulfils their specifications) divided by input quantity (i.e. all type of the resources that are consumed in the transformation process). *Profitability* is also seen as the relation between output and input, but includes influences from price-factors (i.e. price recovery). *Performance* is the umbrella term of manufacturing excellence and includes profitability as well as non-cost factors such as quality, speed, delivery and flexibility. *Effectiveness* is a term to be used when the output of the manufacturing transformation process is focused, while *efficiency* represents how well the input of the transformation process (i.e. resources) is utilised.

4. RESULT OF INVESTIGATIONS

As expected, the result of the two empirical investigations confirmed previous research and showed that there was no consensus of the view of productivity, neither between the the managers at the five companies nor among the employees at the particularly studied company. However,

the investigations did also reveal a number of other interesting issues.

In both studies, the interviewed people agreed in that is was very important to establish a clear definition of productivity within a company as well as within the industry in general. A common opinion was that a definition would simplify comminucation and help employees to understand company goals, but a definition would also help both managers and employees to take appropriate decisions to improve productivity. Nevertheless, a clear definition of productivity had not been advocated in none of the studied companies.

In the first investigation, the managers presented various views on the meaning of productivity and numerous of performance measures that the companies used. It was clear that the manager's opinions on the meaning of productivity were strongly influenced by the performance measures used at each company. Many of the managers believed that they fully understood what productivity meant, but at the same time they had difficulties in explaining the differences between productivity and similar terms, for example profitability that was mostly seen as the same thing as productivity.

At the particularly studied company in the second investigation, the lack of productivity definition had unfortunately resulted in that the employees did not fully understand the management's goals for improvement, even though the goals had been specified in numbers. Many different opinions of what characterize productivity were emphasized during the interviews, including "making money", "efficient use of labour" or just "good performance", however, the term was seldom linked to the relation between output and input. Despite it was agreed that a clear definition would be very useful, allowing people to focus and "speak the same language", the management did not show any interest in this issue. A major reason for not defining the term was the difficulties in actually agreeing on what productivity meant.

5. CONCLUSIONS

In this paper, the confusion surrounding the concept of productivity and its relation to other similar terms has been explored. Several characteristics features of productivity have been presented as well as a suggested taxonomy (i.e. the Triple-P model) that explains how productivity should be distinguished from the terms; profitability, performance, efficiency and effectiveness.

The result of the empirical investigations confirms that there is no consensus in industry of what the term productivity actually means. The absence of productivity definition within a company were also found to cause problems. However, most managers and employees at the studied companies agree that an established productivity definition would be beneficial to a company's improvement work.

Unfortunately, it seems to be practically impossible to create an exact definition of productivity that is applicable and accepted within all areas of manufacturing. Nevertheless, it vital that the *basic features* that characterize the term are understood in industry as well as in the academia. Otherwise, the existing misinterpretations on the subject will continue to cause problems and declines in productivity.

6. REFERENCES

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