

PERSPECTIVES ON NON-VALUE ADDED ACTIVITIES: THE CASE OF PIECE-RATE IN THE SWEDISH CONSTRUCTION INDUSTRY

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ABSTRACT

One strategy to reduce the costs of building projects is to reduce non-value added activities. This paper describes the concept of non-value added activities by using three separate theoretical concepts: lean production, activity-based costing and management, and poor-quality costing. The piece-rate system is one part of many building projects that includes several non-value added activities. These piece-rate related activities are used as a case to elucidate how the three concepts can affect the amount of non-value added activities.

KEYWORDS

Non-value added activity, lean production, activity based costing and management, poor-quality costing, piece-rate, building project

INTRODUCTION

Over the past decade, an increasing number of companies have begun to identify their non-value added activities in order to be able to reduce their costs (Baker, 2002). Approaching non-value added activities by focusing on cost reductions is used in several managerial concepts, e.g. continuous improvement (Convey, 1991), target costing (Ewert & Ernst, 1999), value engineering (Cooper, 1994), business process redesign (Knorr, 1991), kaizen costing (Lee & Monden, 1996), and the value-creation model (McNair et al, 2001). Three other examples of such concepts, which will be analysed in this paper, are lean production, activity-based costing and management, and poor-quality costing. These three concepts have been chosen because they all are widely used in most kinds of industries and include the phrase non-value added activities. Yet, in other respects these concepts are quite distinct. These distinctions entail that non-value added activities are viewed and dealt with differently. There is therefore a need to clarify how these managerial concepts differ in their perspectives on non-value added activities.

The aim of this paper is to evaluate how the three concepts: lean production, activity-based costing and management, and poor-quality costing, use the phrase “non-value added activities” and how these concepts can be used to reduce non-value added activities. The paper also aims to investigate the use of piece-rate and its non-value added activities in the Swedish construction industry. The three concepts’ different perspectives on dealing with non-value added activities are tested on the piece-rate system.

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NON-VALUE ADDED ACTIVITIES

The definitions of what constitutes a value-added or non-value added activity vary considerably. Value added is in economics usually defined as the difference between the costs of purchases and the revenue from the sale of goods and services produced using those services (Koskela, 2000). This is however not a precise enough definition from a customer perspective since it can include activities that do not increase the customer value. A better definition is given by Womack and Jones (1996), who see a non-value added activity as “an activity which absorbs resources but creates no value”. A narrower definition is presented by Convey (1991): “A value-added activity is one which contributes to the customer’s perceived value of the product or service. A non-value added activity is one which, if eliminated, would not detract from the customer’s perceived value of the product or service.” Convey’s definition gives an accurate description of possible improvements and is therefore used in the analysis of the piece-rate system.

Unfortunately, as Koskela (2000) points out, classifying activities into value-added or non-value-added is problematic. People usually cannot consistently define what constitutes a value or non-value added activity. Another major difficulty with this classification is employee reaction. Employees can be annoyed if informed that they are performing non-value added activities, which higher level managers have told them to perform (Koskela, 2000). Another important aspect is that money saved by improving the efficiency of a value added activity is as valuable as the money saved by reducing a non-value added activity (Kaplan and Cooper, 1998). An alternative to the dichotomous classification into value or non-value added activities is Kaplan and Cooper’s (1998) suggestion of a classification into a four-category value-added scheme:

1. An activity required to produce the product or improve the process; the activity cannot, on a cost-justification basis, be improved, simplified, or reduced in scope at this time.
2. An activity required to produce the product or improve the process; the activity can be improved, simplified, or reduced in scope.
3. An activity not required to produce the product or improve the process; the activity can eventually be eliminated by changing a process or company procedure.
4. An activity not required to produce the product or improve the process; the activity can be eliminated in the short run by changing a process or a company procedure.

Convey’s definition of a non-value added activity would include number 4 and most of number 3 in Kaplan and Cooper’s scheme, whereas Womack and Jones’ definition would comprise all of number 3 and 4 and some of number 2. A dichotomous classification into value and non-value added activities is therefore merely a question of where to draw the line in the area between the extreme points of completely value added and completely non-value added activities. If instead of using a dichotomous classification we have more than two categories, e.g. like Kaplan and Cooper’s classification above, the problem is to know what parts that lie in the grey area of neither being clearly value nor non-value added activities (see figure 1).

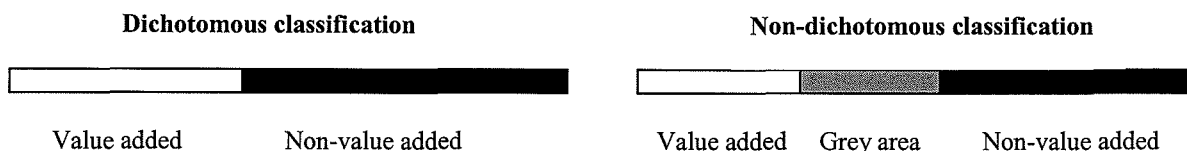


Figure 1. Two principally different ways of classifying non-value added activities

METHOD

In order to evaluate the three analyzed concepts, a literature review was carried out. The focus was to capture the essence of each concept.

To give examples of non-value added costs, the case of piece-rate in the Swedish construction industry is presented. The piece-rate is chosen as an example since several practitioners in the PhD-study of non-value adding costs considered it to be an important aspect to scrutinize. There have during the last years in Sweden been controversies between employers and employees during which the piece-rate often has been described as an unnecessary activity. Swedish Construction Federation (2003) states that the measurable additional cost for the construction industry is approximately SEK 1.5 billion per year. Another reason for presenting the piece-rate as an example is that there are only a few involved actors, which facilitates the analysis.

To gather information, interviews were done with experts of piece-rate from the Swedish Construction Federation (SCF) and the Swedish Building Workers' Trade Union (SBWU). In order to estimate the costs of managing the piece-rate, another interview was carried out with a piece-rate expert in a large Swedish construction company. The answers from all these interviews and an additional literature review resulted in a description of the piece-rate and its non-value added costs. This description was verified by representatives from four construction companies.

CONCEPTS TO REDUCE NON-VALUE ADDED ACTIVITIES

This section briefly describes the concepts of lean production, activity-based costing and management, and poor-quality costing, and relate them to non-value added activities.

LEAN PRODUCTION

Lean production stems from the Japanese automotive industry where it evolved from the 1950s based on Ford's production system in the 1920s (Shingo, 1984; Krafcik, 1988). Lean production, previously also known as the Toyota Production System (TPS) or the just-in-time system (Wu, 2003), had its international breakthrough after the release of the book, "The machine that changed the world", by Womack et al (1990). The business philosophy of lean production is to design all activities and systems to deliver products and services to the customers with minimal non-value added costs and maximal value (Knuf, 2000). Acting according to lean production thinking can be broken down into five main principles (Womack and Jones, 1996): 1) precisely specify value by specific product, 2) identify the value stream for each product, 3) make value flow without interruptions, 4) let the customer pull value from the producer and, 5) pursue perfection.

The elimination of non-value added activities is a crucial aspect for lean thinking, where “waste” is used synonymously with non-value added activity. Toyota executive, Taiichi Ohno, identified seven types of wastes: overproduction, correction, material movement, processing, inventory, waiting, and motion (Womack and Jones, 1996). Later on some other sources of waste have also been highlighted, e.g. defects and material waste (Buzby et al, 2002). Koskela (2000) identified another type of waste characteristic to construction: work done in suboptimal conditions. These conditions include congestion, rework, out-of-sequence work, multiple stops and starts, inability to do detailed planning in advance, obstruction due to stocks of materials, trying to cope without the most suitable equipment for the task, overtime, oversizing of the crew and interruptions due to lack of materials, tools or instruction.

ACTIVITY-BASED COSTING AND MANAGEMENT

The central focus of activity-based costing (ABC) is to identify, measure and manage used and unused capacity. ABC is an information system developed in the mid-1980s (Gupta & Galloway, 2003). As production systems were changing there was a need to change the costing and accounting systems in order to achieve more precise estimations of the costs of activities, products, services and customers (Cooper & Kaplan, 1988). Instead of allocating overhead costs to products, the ABC system enables indirect and support expenses to be allocated to activities and products. In using ABC, it is assumed that activities consume resources (e.g. labour, machines, equipments, material and energy) and products consume activities (Tsai, 1996). Costs are resources that are consumed. Cost drivers are factors that explain the amount of the costs for the activities (see figure 2).

ABC has also led to activity-based management (ABM), which is the entire set of actions that can be taken with the activity-based cost information. ABM is neither a cost-cutting tool nor a financial system. It is rather an approach for planning ongoing activities and business processes of an organization in order to ensure it meets strategic objectives (Brimson & Antos, 1994). The advantages of ABC/ABM are in determining which products are profitable, which customers are the most valuable, if processes are value or non-value added, and where improvement efforts should be made (Gupta & Galloway, 2003).

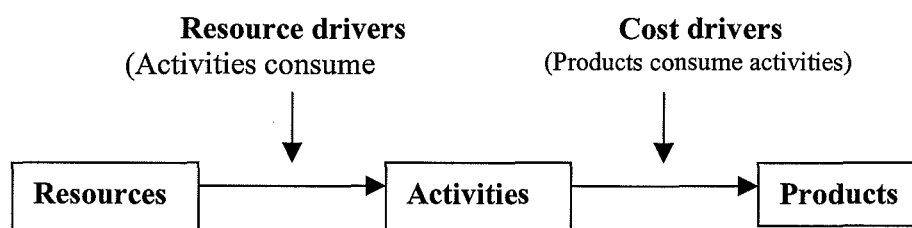


Figure 2. The connections between resources, activities and products in ABC (Modified from Kaplan & Cooper, 1998)

POOR-QUALITY COSTING

The use of poor-quality costing (PQC) has its background in the quality philosophy, which started in the 1920s when Shewhart began to use a statistical view to the production process (Shewhart, 1939; Bergman & Klefsjö, 1994). In the 1950s Shewhart's theories were further developed by Juran (1951), Deming (1988) and Ishikawa (1985). These were the founders of the concept of total quality management (TQM) and which had a major impact on the Japanese quality programmes in several industries (Hackman & Wageman, 1995; Bergman & Klefsjö, 1994). The first quality cost system was developed by Feigenbaum in the early 1950s. Feigenbaum influenced many followers of his categorization of quality costs into prevention, appraisal and failure costs (Feigenbaum, 1956; Campanella, 1990).

The literature on PQC mentions several benefits gained by measuring poor-quality costs. The most important of these benefits are to identify problem areas and improvement opportunities by providing management with monetary figures for poor-quality costs and to motivate employees by enabling them to see how lack of quality is related to costs (Dale & Plunkett, 1999; Harrington, 1987; Aoieong et al, 2002).

The focus on the quality methodologies have changed over the years from an inspection orientation, through process control, to continuous improvement, and to designing quality into the product and process (Morse et al, 1987; Koskela, 2000). After an increased customer focus in the 1980s in terms of measuring poor-quality costs, there has in the 1990s been a tendency to integrate the term non-value added costs into the quality methodology (Dale & Plunkett, 1999). One example of this is Sörqvist's (1998) definition of poor-quality costs: "Costs which do not add any value for any customer", which is very close to Convey's (1991) definition of non-value added activities that is used in this paper. Further support of the integration of non-value adding costs into the quality concept is Harrington's (1987 & 1999) change of categorizing poor-quality costs. In 1987 he did not mention non-value added costs whereas he in 1999 saw them as a part of the poor-quality costs.

COMPARISONS BETWEEN THE THREE CONCEPTS

Lean production, ABC/ABM and PQC have originally had clearly separate areas of application, but they have lately broadened their scope, which means that they now have some similarities. One such similarity, which is central for this paper, is that all the concepts to some degree focus on non-value added activities.

A difference between the concepts is their scope. In lean production the whole value stream for a product should be studied. ABC/ABM and PQC traditionally have a company perspective, i.e. their focus is on optimizing the company, not the entire value stream. There are however exceptions in the way the concepts are used. It is for example common that lean production is used as a tool only on a single company instead of for the entire value stream, and there are also examples where ABC/ABM and PQC are used to analyze broader contexts than the company (Tsai, 1996; Sörqvist, 1998).

There is also a difference between the concepts of how important it is to measure non-value added activities. Measurements are essential in ABC/ABM and PQC, while measurements are often not even mentioned in the lean production core literature, although there are examples of measuring non-value added costs in the lean literature as well (e.g.

Serpell et al, 1995; Zhao & Chua, 2003). Instead of carrying out measurements, lean production has a common method for eliminating non-value added activities. For ABC/ABM and PQC the act of eliminating non-value added activities has its basis in the measurements. Once the non-value added activities have been identified and quantified other concepts has to be used, e.g. total quality management or business process reengineering, in order to be able to eliminate these activities. Although both ABC/ABM and PQC use measurements for improving an organization they have some clear differences as well. The most important aspect in the context of this paper is that ABC/ABM compared to PQC has a larger focus on other types of costs than just those related to poor-quality and that the concept also emphasizes on the value added issues (McNair et al, 2001).

The piece-rate system in the Swedish construction industry will here be given as an example in order to elucidate how the concepts can be used.

THE PIECE-RATE SYSTEM IN THE SWEDISH CONSTRUCTION INDUSTRY

There are two main types of wage forms in the Swedish construction industry: incentive pay and time wages. The incentive pay consists of piece-rate and merit wages, while the time wages consists of hourly and monthly wages. The number of the construction workers united to the SBWU who do piecework is 13 % (www.byggnads.se/byggnads/29731.cs, 26th January, 2004).

On production of new buildings, the wage form should be incentive pay unless the local parties agree on something else. For incentive pay the process of negotiation between the company and the SBWU is managed in the following manner:

1. The employer specifies in the working site announcement what type of incentive pay they wish to have. The employer must also specify what tasks shall be done by subcontractors and therefore be excluded from the piece-rate. The estimator and the site manager estimate the amount of material and time that will be needed to accomplish the work. They also create a basis of the piece-rate that explains how long each task is expected to take. The time that is needed for most working operations is stated in existing time lists, a document that has been agreed upon on national level between the SBWU and the SCF.
2. The local negotiation should start as soon as possible and be carried out speedily. This negotiation includes tasks that are not mentioned in the time lists as well as discussions about whether the expected required time in the estimations has to be adjusted due to the structure and complexity of the construction. There is also a negotiation considering the level of payment for the hours in the fixed and variable wages. Those who take part in these negotiations are the employer, the working representative, a representative of the SBWU, and sometimes as well a representative from the SCF.
3. If the local parties cannot reach an agreement the case can be submitted to national negotiations. Parties in the negotiation are the SCF and the SBWU.
4. If the parties on the national level cannot reach an agreement, basic salary is paid.
5. If the parties have reached an agreement for piece wages, there will be a check, usually every twelfth week. The piece wage consists of a fixed part and a bonus. When determining the bonus, representatives from the company and the union check to what phase the production has reached and then compare this with what was forecasted.

Besides, the working representative collects information about the tasks that have been done in addition to those tasks that previously had been agreed upon.

If it, instead of production of a new building, is a reconstruction work, which is estimated to require less than 1200 hours, then the employer can negotiate with the employees directly through the working representative, without the participation of the SBWU. If the reconstruction is for more than 1200 hours, the SBWU is the local party that the employer has to negotiate with. The wage form for this kind of production can either be merit wages or hourly wages. When using merit wages on a project, the wages are negotiated for every project. When using merit wages or time wages on a company department it is possible to have one negotiation per year.

The piece-rate process functions as described above for construction workers who belong to the SBWU, e.g. concrete workers, carpenters, bricklayers, floor layers, plumbers and glaziers. The piece-rate process is shaped in another way for construction workers belonging to other unions than the SBWU, e.g. electricians, painters and HVAC-engineers. These workers usually have the possibility to choose if they prefer time or piece wages, i.e. the employer does not have any negotiations with these other unions.

NON-VALUE ADDED COSTS CONNECTED TO THE PIECE-RATE

In the piece-rate process and in occurrences directly related to it, there are several activities that, if they were eliminated would not impact the value of the customer; they are thus non-value added activities.

MANAGING THE PIECE-RATE AT THE CONSTRUCTION COMPANY

In order to estimate the cost of managing the piece-rate, an interview was done with a piece-rate expert in a large Swedish construction company. These estimations show that in a typical building project that spans 10,000 hours and has piece-rate there are 120 non-value adding man-hours connected to the piece-rate in the company. These man-hours include the time for compiling the basis of the piece-rate (40 hours), discussions with the parties concerned (24 h), negotiations (24 h), and checks (32 h). With a salary of SEK 370 per hour for white-collar workers, this leads to a non-value added cost of SEK 4.44 per hour (approximately 0.5 euro). If the amount of the wages is 15 percent of the total construction cost then this would mean that the amount of non-value adding costs related to piece-rate would be approximately 0.24 % of the total construction cost. In a smaller building project, this percentage would be larger since the mentioned non-value adding time would not decrease proportionally with the construction time. The cost of managing the administration and the checks in the Swedish construction company Peab is according to their own calculations seven SEK per hour (approximately 0.75 euro) (Hindersson, 2002). The SCF (2003) estimates that the administrative additional cost for the piece-rate is 6 % of the piece wages, of which three quarters are activities done by the employer. These administrative additional costs do not include the time for checking how far the production has reached, which are estimated to be cost equivalent to another 2 % of the piece wages.

MONITORING FEES

The 120 hours mentioned above are, however, only the non-value adding time for the employees of the construction company. There are also non-value adding costs for the work done by the SBWU that is related to piece-rate. The process of checking how far the production has reached, and which of these tasks are done in addition to the original plan, can take up considerable time. About 0.5 % of the construction workers' wages go directly to financing this monitoring of the output that is done by the SBWU. In order to monitor that the wages are correct, the workers also pay a wage-monitoring fee to the SBWU, which is 1.5 % of their wages. In a normal building project, exemplified above, these fees would add up to 0.17 % of the total construction cost.

FEE TO FEDERATIONS

The construction companies which are members of the SCF (i.e. most large and medium sized construction companies) pay a fee to the federation that amounts to 0.65 % of the wages for all employees in the company. A part of these fees finance non-value added activities related to the piece-rate, for example, negotiations that the SCF takes part in and campaigns for decreasing the use of piece-rate. The SBWU has similar campaigns as well, but their effort is instead to increase the use of piece-rate. This means that apart from the 0.41 % (0.24 % + 0.17 %) of the construction cost for the monitoring fees and costs in the construction company, there are additional costs in the federation and the union. Besides these measurable costs there are several other non-value added costs as well that are more difficult to measure, which will be described below.

WORKING-TO-RULE

Negotiations that do not lead to an agreement result in only basic salary being paid to the workers. This salary is much lower than what the workers are usually paid. Both the SCF and the SBWU say that such decreases in salary often results in working-to-rule, i.e. the workers intentionally do not work to their full capacity. Working-to-rule is illegal, but very difficult to prove. The whole building project can easily be delayed if a small group with key positions works-to-rule, and the delay of a building project has several non-value added costs as a consequence. It is however unusual that the negotiations do not result in an agreement. Even in occasions where there is working-to-rule, it is difficult to estimate the non-value added costs involved.

OTHER POSSIBLE NON-VALUE ADDED ACTIVITIES

There are other non-value added activities that could be caused by the piece-rate. The frequent wage negotiations and checks, which are connected to the piece-rate, often make mischief between workers and management. This mischief affects the ability to co-operate and leads to a bad working environment, especially for the management at the site. This could lead to a number of negative consequences such as poor quality and increased absenteeism.

Since the piece-rate system only rewards pace it is possible that it will lead to non-value added costs due to poor quality of the final construction and higher material consumption

(Paarsch & Shearer, 2000). The focus that piece-rate has on pace can also lead to stress and increased risk for injuries for the construction workers. This also leads to increased absence as well as increased costs for the extra time that is required for those who take over the tasks of the absentees. Absenteeism does not only affect the construction companies, but also the whole society because of sickness benefits, etc.

ADVANTAGES OF HAVING PIECE-RATE

Several studies have shown that piece-rate leads to increased productivity (e.g. Paarsch & Shearer, 1998; Koretz, 1997). These studies are however not from the construction industry and the working operations in these studies are mainly repetitive and standardized, i.e. the type of operations that are best suited for piece-rate (Chen & Vedin, 2002). In these studies there has also been individual incentives, which have larger effects on the productivity than group incentives, which are used in construction (Paarsch & Shearer, 2000). Planning is another aspect that can be improved by piece-rate since the construction workers often become more engaged in ensuring that they are never without work tasks and therefore to a larger extent are willing to help the management to avoid managerially imposed constraints (Kreiner, 1989). There are signs that the increased insight and influence of the construction workers that the piece-rate often entails, could result in a better working environment (Loftus, 1997).

There are companies which think that it is profitable to pay their employees high wages. Higher wages may lead to increased worker effort and less shirking, a higher-quality job applicant pool, lower quit rates and reduced costly labor turnover, and an increased labor loyalty (Chen & Vedin, 2002). Those who have piece-rate in general have higher wages and it is therefore possible that some of these mentioned positive effects could be realized by the use of piece-rate. Those who have incentive pay, on average earn SEK 146 per hour, while those with time wages on average earn SEK 124 per hour (the SBWU's wage statistics for the fourth quarter of 2003, www.byggnads.se/byggnads/30788,30785.cs, 2nd June, 2004). A higher wage cannot be considered to be a non-value added cost. A higher wage means, however, that the time workers spend on non-value added activities results in larger non-value added costs.

ANALYSIS OF THE PIECE-RATE COSTS USING THE THREE CONCEPTS

This section will analyze the differences in the three concepts regarding a reduction of non-value added costs caused by the piece-rate. The analysis will not consider that the concepts can use different definitions of non-value added activities.

The non-value added costs of managing the piece-rate, monitoring fees, working to rule, and fees to federations are such that it would not matter if any of the three concepts were used. Neither lean production, ABC/ABM nor PQC would directly affect any of these costs. The methods used in ABC/ABM and PQC could, however, highlight these non-value added costs by pointing out their existence and estimating their economic impact. It would thereby be possible to eliminate these non-value added costs by using other methods, for example trying to avoid the use of piece-rate. The measurements carried out in ABC and PQC could on the other hand be considered as partially non-value added activities since they do not directly create customer value.

When it comes to the quality of production and material consumption all the three concepts are to some extent able to reach improvements (e.g. Ittner et al, 2002; Zayko et al, 1997; Dale & Plunkett, 1999). The question here, however, is whether the concept can affect the increased poor quality and material consumption possibly caused by the piece-rate. ABC/ABM and PQC can be used to identify if there are quality problems caused by the piece-rate and then take actions to prevent these manifested causes of the piece-rate to re-occur. A higher working pace does not directly imply that there will be an increase of problems with quality and material consumption. Lean production has some related methods to improve these aspects that are similar to those recommended in PQC literature, e.g. statistical control, quality control conducted directly by the workers, continuous improvements, and quality circles. What is unique for lean thinking in this respect is that the just-in-time-principle and the low inventory levels can expose previously hidden quality sources (Söderquist & Motwani, 1999). Low inventory levels can, however, not be used as a method to improve quality, but only as an indicator of the existence of these problems.

The non-value added costs caused by the increase of injuries, stress and absent workers due to the piece-rate are probably such that they only to a little extent are affected by the use of any of the three concepts. The working environment is to a much greater extent influenced by other factors, such as how the work is planned, company culture, how managers act, and how engaged the workers are to participate in health and safety campaigns (Lingard & Holmes, 2001; Gyi et al, 1999).

CONCLUSIONS

There is much that indicates that the piece-rate system brings about several non-value added costs. The measurable or probable costs that have been presented in this paper are, for example, the supplementary time for negotiations and checks, working to rule, weakened employee loyalty, worse quality and increased material consumption. When we only measured the costs for the monitoring fees and the management of the piece-rate in the construction company, we found that these costs equals 0.41 % of the construction cost in a normal building project. There are on the other hand probable advantages for using piece-rate as well, principally an increased productivity. The piece-rate should be used when the advantages at least compensate for the non-value added costs. This is, however, probably not always the case when the piece-rate is used today. The piece-rate is likely used for other reasons than just to increase the customer value, e.g. to raise the workers' wages and increase the power of the SBWU.

The analysis of how the concepts of lean production, activity-based costing and management, and poor-quality costing affect the non-value added costs caused by using the piece-rate in the Swedish construction industry shows that these concepts only would have a marginal impact. The exception is the increased poor quality and material consumption, which all the three concepts to some extent could influence. The three concepts could however be more useful for reducing non-value added costs caused by other aspects than the piece-rate, for example non-value added failure costs and non-productive working time.

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