

# **NON VALUE-ADDING ACTIVITIES IN BUILDING PROJECTS: A PRELIMINARY CATEGORIZATION**

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## **ABSTRACT**

There is a general opinion and common agreement within the building and construction industry that the costs are too high, but a disagreement on which cost elements and what reasons are lying behind this situation. The Swedish Construction Federation states that the burden of taxation on new houses in Sweden is 65%. Other groups of actors mean that the production is inefficient or that material prices are too high. An alternative way to tackle the problem is to identify activities, which do not add value to the customer. This paper gives examples of non value-adding activities and discusses their costs and causes. A preliminary action-oriented categorization, related to when action should be taken, who should act and how to act to avoid non value-adding activities, is presented and discussed.

## **KEYWORDS**

Non value-adding activities, poor quality costs, building project, categorization.

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## INTRODUCTION

This paper aims at categorizing elements of non value-adding activities in building projects. There are two main motives for this. First, there is an ongoing debate considering the high costs for producing new buildings. Second, there is both a theoretical and practical need of broadening the discussions about quality cost in construction. Since the paper is based on a research project, which just has started, a preliminary categorization is presented and discussed.

The debate about how to reduce the costs in the construction industry has been going on for several years. In Sweden, the government has initiated three investigations in order to identify the major problems in the construction industry. 'Byggekostnadsdelegationen' (2000) focused on the high costs. 'Byggekvalitetsutredningen' (1997) focused on general quality-related problems. 'Byggekommisionen' (2002) focused on competition, quality, costs and competence. While all these investigations are motivated by incidents within the industry, they have been heavily criticized by the industry as well as by academics. One critique is that none of these investigations has taken the opportunity to investigate either the amount of non value-adding activities or the causes of these unnecessary costs. In early 2002, the Swedish Construction Federation initiated a more ambitious investigation of current problems. They invited the national association for construction workers to be a partner in the investigation, but without success. The Federation has been criticized for taking a partial opinion. However, so far the Swedish media has praised them for their openness. This commission has asked for more knowledge about quality-related costs.

While all actors within the building and construction industry agree that the costs are too high, there are disagreements on which cost elements and what reasons lie behind this situation. The Swedish Construction Federation (2001) states that the burden of taxation on new houses in Sweden is 65%. Other groups of actors point at the government's control, time aspects, complex project organisations, inefficient production, low competence, high material prices, etc. It is imperative to identify and categorize the poor quality costs and other non value-adding activities in order to create a clearer debate.

There have been numerous investigations of quality costs in construction through the last two decades, but only a few have collected data in a systematic and reliable way. The application of different definitions of quality and costs is another reason why the reporting of quality costs is confusing. The references to the investigations should be done more carefully of that reason. Some researchers (e.g. Holland, 2000; Hall and Tomkins, 2001) claim that they use a total perspective, while it could be argued that they still use a narrow definition on quality. Josephson and Samuelsson (2002) reveal some missing thoughts in practice, but also in the general scientific work. They argue that much improvement focuses on the companies' own work. However, for a contractor in a building project, other companies often produce some 80% or more of the total cost. In a long-term perspective, costs for poor quality and non value-adding activities are built in the price for the products and services delivered to the site. Most construction companies discuss how they choose suppliers for the projects, instead of discussing how they can support their suppliers to reduce the non value-adding activities. The first missing thought mentioned by Josephson and Samuelsson is that most practitioners and researchers use a short-time perspective when focusing on who pays for a specific

incident. Following on the first missing thought, the second missing thought is that most companies do not really realize that costs for non value-adding activities are included in the prices for material, sub-contractors, etc. The third missing thought is that most companies do not realize that taxes, fees, etc. to a certain extent also include costs for poor quality and other non value-adding activities. The fourth missing thought is that most companies do not realize their possibility to act on and influence all the cost categories. Those companies who want to take the lead in developing a world-class competitiveness must broaden their view of quality and quality costs to comprise all costs related to the product they deliver.

The paper describes how the view of poor quality continuously is broadened from an internal short-term perspective to including all project-related costs in a long-term perspective. It discusses how the elements of non value-adding activities could be categorized. The term non value-adding is here used to make clear that also activities created because of lack of planning or because of historical reasons are included in the definition. Some real examples are presented and discussed. Cost is here defined as the value of resources used.

## **FROM QUALITY COSTS TO COSTS FOR NON VALUE-ADDING ACTIVITIES**

### **THE DEVELOPMENT OF POOR QUALITY COSTS**

For many years quality costs were divided into prevention costs, appraisal costs, internal failure costs and external failure costs, first identified by Feigenbaum (1956). Prevention costs and appraisal costs are those that management has direct control over to ensure that only customer-acceptable products and services are delivered to the customer. All the company-incurred costs that result from errors include internal and external error costs. These costs are directly related to management decisions made in the prevention and appraisal cost categories. Feigenbaum considered external failure costs as more serious than internal failure costs, because it may result in more disappointed customers. This traditional categorization has been widely used, for example in the ISO 9000 standard. Sometimes the term poor quality costs (PQC) is used because it is poor quality, not quality, that causes extra costs.

A number of researchers have tried to further develop Feigenbaums model by adding new categories. But no one has so far been widely accepted. Modarres and Ansari (1985), who added cost of quality design and cost of inefficient utilization of resources, and Sugiura (1997, referred in Giakatis *et al.*, 2001), who added adjustment cost and quality design cost, are just two such examples.

The concept of poor quality costs began to change its focus to more consider the customers needs during the 1980's. Harrington (1987) differentiated between direct PQC and indirect PQC. He used the term direct PQC for the four traditional categories. When using the term indirect poor-quality costs Harrington considered the customers different and individual requirements. He defined indirect PQC as "those costs not directly measurable in the company ledger, but part of the product life cycle PQC" and divided it into three major categories. Customer-incurred PQC appears when an output fails to meet the customer's expectations. Customer-dissatisfaction PQC is lost income because customers are not satisfied with the company's product and therefore choose a competitor's product next time.

Cost incurred due to loss of reputation differs from customer-dissatisfaction costs in that they reflect the customer's attitude to a company rather than towards an individual product. All customer-incurred PQC are non value-adding activities, while the last two categories are strictly used in a company perspective. They involve a loss for the company, but they do not cover any non value-adding activities per definition.

The concept of poor quality costs has continuously been broadened since the beginning of the 1990's, because the concept of quality has itself acquired a broader customer perspective (Sörqvist, 1998). The customer is now viewed as everyone who is affected in any way by the products and the business, e.g. shareholder, financier, state and local government, supplier, user, buyer, company management, employee, etc. The recent focus on environmental issues also adds the society as a crucial customer. It means that customer-incurred costs, environmental requirements, safety and social responsibility should be considered. Sörqvist used this wider perspective by dividing poor quality costs in traditional PQC, hidden PQC, lost income, customers' costs and socio-economic costs.

So far we have more or less used a strict company perspective. We have considered the customers expectations, but still in order to improve the individual company's business. If we broaden the view, we can find activities in the industry and in the society, which are generally accepted but should not be there and which directly or indirectly increase the costs for the customers. The systems used in the industry in a specific country may include activities that can be considered as not adding any value for the customer. For improving competitiveness, it is necessary to develop the concept of poor quality costs a further step and include costs for all non value-adding activities. This is necessary for the industry, but - as already mentioned - also for companies who want to develop a world-class competitiveness.

## **POOR QUALITY COSTS IN CONSTRUCTION**

It is evident that we lack knowledge of poor quality costs in construction. We have knowledge of the visible costs, but lack knowledge of most of the hidden costs, lost income, customer's costs and socio-economic costs. We probably lack necessary knowledge to be able to see and understand the hidden costs (Josephson, 2000). We probably also lack knowledge of the size of other non value-adding activities. We must broaden our views and question the existing and accepted activities and behaviour in projects.

Studies of poor quality costs (defect costs, rework costs, deviation costs, etc.) report figures in the range 0-25 % of the total cost in individual building or civil engineering projects (e.g. Burati *et al.*, 1992; Josephson and Hammarlund, 1999; Nylén, 1999; Love *et al.*, 1999; Barber *et al.*, 2000), depending on the scope of the study and the definitions used of poor quality and costs. However, in all these studies only a minor part of the defects and their consequences are detected. There are hidden costs not found. Lost income, customer's costs and socio-economic costs are not included either. In practical terms, we can only establish some of the visible and hidden costs. Love *et al.* (2001) and Josephson and Samuelsson (2002) have beginning to explore this area by studying indirect costs and none value-adding costs. Halevy and Naveh (2000) have taken another initiative by measuring the national cost of non-quality in Israel. Including 22 experts in the study they assessed the cost of non-quality as high as 52% of the cost of building, excluding the cost of land. However, it is not clear what is involved in that figure.

We have fairly good knowledge of the causes of the visible poor quality costs. Many causes can be related to unstable project organizations, such as new vertical relations among project members, new horizontal relations among project members, key persons joining the project organization late and key persons being changed (Josephson, 2000). These causes create more uncertainty and communication problems among the project members. We also know that good leadership during production can reduce the visible consequences of poor quality (Josephson, 2002). However, we are not aware of the root-causes of other non value-adding activities (Love *et al.*, 2001). With more knowledge about the hidden costs and their causes and by outlining the total map of non value-adding activities, the industry as well as individual companies should be able to achieve large cost reductions. To achieve this level of knowledge it is necessary to develop a categorization, which could be used to differentiate the debate.

## **CATEGORIZING NON VALUE-ADDING ACTIVITIES IN CONSTRUCTION**

### **NO GENERALLY ACCEPTED CATEGORIZATION**

Many different categorizations have been used in the studies of poor quality costs in construction. But there is so far no generally accepted system. Typical questions dealt with include (e.g. Davis, 1987; Josephson, 1994; Love and Irani, 2002)

- When did it happen? (Date or phase of project)
- When was it detected? (Date or phase of project)
- Who detected it? (Actor)
- Who caused it? (Actor)
- What type of immediate cause? (On individual level, e.g. knowledge, information, engagement, etc.)
- What type of root-cause? (E.g. organisation)
- What type of problem?
- What type of incident? (E.g. error, change, omission)
- In what element of the building? (Structure, interior design, etc.)
- In which activity?
- Who corrected it? (actor)
- When was it corrected? (Date)
- Which effect on the project? (Delay, extra cost, etc.)
- Who paid it? (Actor)

The categorizations used are dependent on the approach taken by the researcher. Most common is a company approach or a project approach (e.g. Josephson and Hammarlund,

1999). An industry approach or a national approach (e.g. Halevy and Naveh, 2000) is uncommon. Burati *et al.* (1992) classified deviations in errors, omissions and changes. Holland (2000) and Love and Irani (2002) accepted this classification and developed it further.

The relevance of some cost categories can be questioned for the purpose of this paper. The majority of the costs found by Burati *et al.* (1992) were classified as changes. However, it can be argued that the client should be allowed to make changes because of changed needs, since projects normally cover long time-spans. Another example is that a major part of the quality costs identified by Nylén (1999) had to do with unexpected extra work because of insufficient geological investigations. In a perfect process these “extra costs” could not have been avoided since they were necessary irrespective of the quality of the investigation.

### **SUGGESTED CATEGORIZATION**

Three preliminary categorizations are suggested to be used in general discussions of non value-adding activities and their costs. Since the categorizations deal with ‘when’, ‘who’ and ‘how’, all these should be combined.

First, the stage of the project indicates when the action for avoiding the unwanted activities in a specific project should be taken. Typical stages of a project are idea phase, design phase, production phase and use phase. But it does not indicate who should act to eliminate the unwanted activities.

Second, the level of organization shows how general the costs are. Consequently, it indicates who is responsible for reducing or eliminating the costs of the activities. The non value-adding activities could be on the individual level or the team level, e.g. how time is used, which means that it is a leadership problem. They could be on the project level, e.g. defects caused by communication problems, which means that several actors may be involved. If they are on the company level, it could be a strategic problem. If the problem has to do with the general system used, e.g. the bidding system and the piece wage system, it may be on the industry level or the national level.

Third, it is necessary to categorize the type of costs in order to get an understanding of the underlying causes. This knowledge should guide how to act. One example is Sörqvist’s (1998) categorization of PQC in traditional PQC, hidden PQC, lost income, customers’ cost and socio-economic costs. However, he has a company approach. Traditional PQC are the obvious losses, which can be measured using poor quality cost systems. Many of these losses are sporadic problems, which disrupt operations. Hidden PQC consists of the losses remaining which directly affect the business, but which are not revealed by the financial accounting system (Sörqvist). These are often caused by chronic problems. Lost income considers the income lost by releasing products and services onto the market, which do not satisfy all the requirements of the external customer. It includes customer-dissatisfaction PQC and loss-of-reputation PQC. Customers’ cost includes costs, which affect the external customer. These could be losses due to delays or breakdowns in production. Socio-economic costs mean the losses affecting the community at large due to the poor quality of companies’ processes and products. Looking closely into the Swedish construction process, there are many accepted activities that can be considered non value-adding. Of that reason the category “other non value-adding activities” should be added to Sörqvists categories.

## TESTING SOME EXAMPLES OF NON VALUE-ADDING ACTIVITIES

The opinions about what is not adding value to the process or to the customer vary of course to a great extent dependent on which actor you talk to. Let us look at some activities and see how to categorize them according to when and how to act and who should do this in order to eliminate the non value-adding parts.

In most production-related activities a surprisingly low share of the working time is used for direct work. For plumbers only 35-40% of the working hours are direct work. 9-14% of the working hours are losses, such as waiting and unused time (Hammarlund and Rydén, 1989). The rest of the time is used for planning and preparing the direct work. Construction workers are often blamed for being late to the site and taking too long coffee breaks. On the other hand it is typical to solve problems during the coffee breaks and also to move the time for breaks depending on which activities are going on. Ineffective processes consider all project phases and depend on how well the activities are planned, but is also a consequence of errors occurred. It is a management problem and can be categorized as a hidden problem.

The system with piece wages for construction workers is traditionally used in Sweden. In most projects, representatives for the employees' trade union do extensive measures on site, followed by long discussions between employers and employees to decide what the piece wages should be based on in the specific project. According to the trade magazine 'Byggindustrin' the costs for measuring the workmanships works corresponds to 1.5% of their salaries. This system, which is old and deep rooted in the culture, considers the production phase. The construction companies are struggling with the system in specific projects. It is heavily discussed within the industry and should be solved by the Swedish Construction Federation and the trade union for the workers. The system does not exist due to poor quality. Theoretically, the activity could easily be eliminated and should be classified as other non value-adding activities.

The bidding system does not itself add value for the customer. With this view most bidding activities, with several parallel calculations, in the project supply-chain are poor quality costs and should be removed. In addition, costs for the customer to administer the biddings are unnecessary. Currently, the competition is tough in the Swedish construction industry. There is generally experienced that most contractors have a success rate of approximately 10%. The bidding system is considered a way to find as low price as possible. However, in a long-term perspective it can be argued that the costs for calculation of non-successful bids are included in the actual bid. The bidding system is mainly used in design and construction. Several organisations can independently of each other change their procurement methods to reduce the costs for bidding. Since it is not due to quality problems and since the activity theoretically could be eliminated easily it should be classified as other non value-adding activities.

In most major building projects, the client hires several specialized consultants to administer the project. In partner relations, building on trust between the client and the contractor, many of these consultants become unnecessary. One example is Hotel Gothia Tower in Gothenburg, built 1999-2001. The client and the contractor co-operated as partners. In this case the client had one consultant, while the partners estimated that it would be 4-5 consultants with a traditional contract form. Some work, typically made by the consultants,

was taken over by the contractor, but most work was eliminated. This example considers the procurement. The client decides which procurement to use, but the partner can also act in order to increase trust. The system may exist because of previous quality problems and should of that reason be classified as hidden. But it may also be classified as other non value-adding activity.

The Swedish construction industry is regarded as one of the safest in the world (Flanagan *et al.*, 2001) regarding the physical health, bad working conditions, accidents and also fatalities. Still, there are major problems to deal with since these factors cause relatively high costs influencing the projects. The debate currently focuses on the mental health. Several investigations indicate that up to 1/3 of the workforce is feeling ill because of stressful working conditions and too much overtime. This is a general problem considering all actors in all phases. It is related to a number of factors, for example poor quality, planning, and the existing culture. Of that reason it is related to the traditional PQC as well as the hidden PQC.

The last year the Swedish media has paid attention to thefts on construction sites. Some unpublished calculations indicate that the cost for preventing thefts, including insurance, security arrangements and education, and restore the production corresponds to more than one percent of the total project cost. Actions could be taken on project and company level, but also on national level since it is partly a social and cultural problem. It is due to poor quality and could be categorized as traditional PQC and hidden PQC.

The Swedish Construction Federation (2001) conducted an unpublished investigation, which shows that 65% of the total costs for new produced houses are taxes! The taxes on each stage through the whole project are accumulated. The taxes cover many crucial activities including the judicial system, total defence, health service, medical service and social care, economic security with illness and handicap, etc. These examples include major costs, which in a politically economic perspective partly can be considered as 'unnecessary', because if all people would follow the law, etc. some of these costs would disappear. Necessary questions are: How do individual companies' businesses affect the taxes? What are the taxes on building-related activities based on in reality? The taxes could be categorized in different ways depending on which aspect is focused on. The taxes consider all project phases. Actions should mainly be taken on the national level. The costs include traditional PQC, hidden PQC and other non value-adding activities.

## **DISCUSSION**

There are several methodological and measurement-related aspects to consider when identifying, quantifying and categorizing costs of poor quality and other non value-adding activities. Such aspects considering poor quality costs are discussed in Gluch and Josephson (1999). Some examples considering other non-value activities are given here.

Most non value-adding activities increase the knowledge in an organization. For example, a firm preparing a bid gains new knowledge irrespective of whether they win or lose the job. Even though organizational learning in construction projects often is argued to be defective (Josephson, 1994; Love and Li, 2000; Huemer and Östergren, 2000) the individuals involved will learn. The value of this knowledge is hard to estimate.

The bidding system can be considered as an example of another measurement problem. It is argued above that it includes activities adding no value. On the other hand, the competition

means that the prices may be lower. Costs for safety and health problems are problematic to calculate. For example, what are the real costs for work-related mental problems and what are the real costs for deaths?

It is obvious that the costs for non value-adding activities may be counted twice. It is often complicated to identify a single root-cause for an incident. Looking from the other side, two or more incidents may lead to the same consequence. This means that it is not correct to analyze individual activities and just accumulate them. A typical example is that the cost for a specific unnecessary activity includes taxes and the taxes are dependent on how well the social system is functioning.

The designers' works are often discussed. Architects make several alternative sketches to test and find good solutions fulfilling known and unknown needs. It can be argued that this type of 'trial-and-error-procedure' includes activities adding no value. However, most practitioners and researchers define this way of working as necessary.

Another problem considers what the cost for poor quality and other non value-adding activities should be related to. Of course, it depends on which focus is used. What is relevant here is that if a customer perspective is used, then the cost base for relation should include the customers' own costs.

## **CONCLUSIONS**

There are obvious motives and clear needs to map the totality of non value-adding activities and associated costs in building projects. First, the users do not accept the high cost for producing buildings. Second, we lack knowledge of poor quality costs and other non value-adding activities. Third, the trend of broadened perspectives on quality makes new studies necessary. Fourth, facts are necessary to stimulate the current debate on building costs and also to make the debate clearer and more action-oriented.

In practice, there is no doubt about that most companies are aware of all known losses, which are directly related to the business. One problem is that many costs, e.g. the hidden PQC, are not known by a single company, and for that reason are not considered in internal improvement programs. Another problem is that many of the losses, which are indirectly related to the business, are accepted as part of the existing system and for that reason are not considered. A third problem is that the company only focuses on improving its own activities, while the customer considers all his or her dollars spent being transferred through the specific company. In reality, all categories of non value-adding activities more or less influence individual companies' businesses in a negative way. This is particularly relevant for larger firms, because their activities influence the existing industrial rules and systems to a greater extent.

To become a world-class company the focus must be broadened to include all dollars transferred through the company. All these dollars also include taxes. In order to reduce the costs for poor quality and other non value-adding activities these costs must be categorized in a systematic and relevant way. This paper argues that three crucial categorizations considering when, who and how should be used. These questions are action-oriented and relate to when actions should be taken, who should act and how to act.

The study presented here is currently starting up. The data collection will be a combination of methods, including analysis of available investigations, group discussions

with experts and close follow ups of a number of construction projects. The analyses will be based on specific building projects to make the results clearer and easier to accept by involved companies and by the industry. Several companies and trade organizations are of that reason involved in the study.

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