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# Measuring Change in a Sector

CREDIT Case SE06





# Measuring change in a sector

CREDIT Case SE06

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# Preface

This report describes the results of a case study undertaken as part of the Nordic/Baltic project *CREDIT: Construction and Real Estate – Developing Indicators for Transparency*. The case study is part of the work in work package 4-6 with respect to project assessment tools, application in firms and national benchmarking systems.

CREDIT includes the most prominent research institutes within benchmarking and performance indicators in construction and real estate, namely SBI/AAU (Denmark), VTT (Finland), Lund University (Sweden) and SINTEF (Norway). Further, three associated partners have joined CREDIT. The three associated partners are the Icelandic Center for Innovation (Iceland), Tallinn University of Technology (Estonia) and Vilnius Gediminas Technical University (Lithuania).

The project has been managed by a steering committee consisting of the following persons:

- Kim Haugbølle, SBI/AAU (project owner).
- Niels Haldor Bertelsen, SBI/AAU (project coordinator).
- Päivi Hietanen, Senate Properties (chair of Finnish steering committee).
- Pekka Huovila, VTT.
- Ole Jørgen Karud, SINTEF.
- Magnus Hvam, SKANSKA.
- Bengt Hansson, Lund University.
- Kristian Widén, Lund University.

The project group wishes to thank our industrial partners and all the contributors to the case studies. In particular, the project group wishes to thank the four Nordic funding agencies that sponsored the project as part of the ERABUILD collaborative research funding scheme: The Nordic Innovation Centre (NICe), TEKES in Finland, FORMAS in Sweden and the Danish Enterprise and Construction Authority (Erhvervs- og Byggestyrelsen) in Denmark.

Danish Building Research Institute, Aalborg University  
Department of Construction and Health  
August 2010

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Research director

# Summary

This case describes an ongoing initiative in Sweden with the aim of measuring the development of the Swedish infrastructure sector. The reason this case was chosen is that it is one, of only a very few, national initiatives with a clear aim of taking an holistic approach to assess the development of one large share of the Swedish construction sector. The purpose of this case is to investigate:

- What measures are used
- The underlying assumptions for the choice of measure

The case study mainly contributes to WP6 (report 4)

## *National benchmarking (WP6) summary*

In Sweden, apart from the larger Utmärkt Samhällsbyggande a more focused program aimed at improving the competitiveness of the civil engineering part of construction, FIA (Renewal within the civil engineering sector), was launched in December 2003. FIA saw a need to monitor how the civil engineering sector develops, in order to effectively plan and implement development projects.

This survey will not directly measure the effect that FIA has on the civil engineering sector. What is measured is the direction of change for the Swedish civil engineering sector during the years that FIA is active. This knowledge could indirectly be used by FIA to initiate additional studies concerning specific subjects that could guide the civil engineering sector in a desired direction.

Two main issues are of importance in regard to the CREDIT objectives.

1. The difficulty of getting in the data – although this assessment has been initiated, approved and sponsored by the very top management of the two largest infrastructure clients and even though it is written in the procurement guidelines for both of these organisations that the survey should be carried out jointly, between the client and the supplier (consultant or contractor), it has been extremely difficult to get the survey sent in. Now, both of these two organisations have designated personnel to track down projects and make them fill it out, according to guidelines, and send it in.
2. The main performance the parties in the sector are interested to measure and to keep track of is efficiency and productivity. They are largely uninterested of measuring the performance of the product and/or how it affects the end-users. Similar tendencies have been seen in other national initiatives on housing in Sweden. This is to some extent in large contrast to the views and aim of the CREDIT project.



# 1. Introduction and objectives

This case study the method adopted in an attempt to measure change in the civil engineering sector in Sweden over time.

## 1.1 Objectives and work packages of CREDIT

Sir Winston Churchill once said, “We shape our buildings, afterwards our buildings shape us” (28<sup>th</sup> Oct 1943). This quotation underlines how strong a building can influence an occupier or a user. Providing complex public facilities for example hospitals, schools, universities and libraries that are able to meet both the internal and external stakeholders’ needs and requirements is not without complications. The aims and demands of different stakeholders within a project can sometimes create conflict with each other’s interest. Understanding the needs and requirements of these stakeholders are essential to remain competitive in today’s market. A client that pays attention to the needs of the end-users will be rewarded with a high-performance property. Simultaneously, this shift seeks to solve many ills associated with inadequate building conditions and resulting in poor building function.

Due to the amount of both public and private money being invested in delivering public and private facilities, strong actions must be adopted. Collaboration with the relevant stakeholders will help building owners in identifying the required performance indicators to create high-performance facilities. The project aims to define a model for the implementation of performance requirements, which ensure the fulfilment of the various types of users’ and stakeholders’ needs and demands. The model shall also allow for the continuous measuring of the effectiveness of the used requirements and the model as such so that it may be improved as more knowledge and experience of it is achieved.

Following the themes of the ERABUILD call closely, the aim of CREDIT is to improve transparency on value creation in real estate and construction. Thus, the objectives of CREDIT are:

- To capture end user needs and requirements in order to identify and quantify – where possible – value creation in real estate and construction.
- To develop compliance assessment and verification methods.
- To define and develop benchmarking methods and building performance indicators in real estate and construction.
- To set out recommendations for benchmarking internationally key building performance indicators.

Consequently, the deliverables of CREDIT are:

- 1. The establishment of a network of Nordic and Baltic researchers for benchmarking and performance indicators through frequent interactions in workshops across the Nordic and Baltic countries.
- 2. A State-of-the-Art report, that will identify and critically examine a number of existing tools, databases, mandatory reporting, approaches and benchmarking schemes to capture and measure end-user needs, client and public requirements on performance and value creation.
- 3. A strategic management and decision making tool to guide the definition and development of benchmarking methods and building performance indicators in different business cases.

- 4. A comprehensive performance assessment and management tool with associated key performance indicators to capture end-user requirements and to continuously measure and verify the compliance of performance throughout the lifecycle of an actual building project and linked to building information models.
- 5. Recommendations as to how sectoral and/or national indexes for performance indicators can be designed in order to allow for international benchmarking of construction and real estate.
- 6. Dissemination of the lessons learned and tools developed through news articles, press releases, workshops with actors in the real estate and construction cluster etc.

## 1.2 Background, purpose and focus of the case study

This case describes an ongoing initiative in Sweden with the aim of measuring the development of the Swedish infrastructure sector. The reason this case was chosen is that it is one, of only a very few, national initiatives with a clear aim of taking an holistic approach to assess the development of one large share of the Swedish construction sector. The purpose of this case is to investigate:

- What measures are used
- The underlying assumptions for the choice of measure

## 1.3 Research design and methods applied in the case study

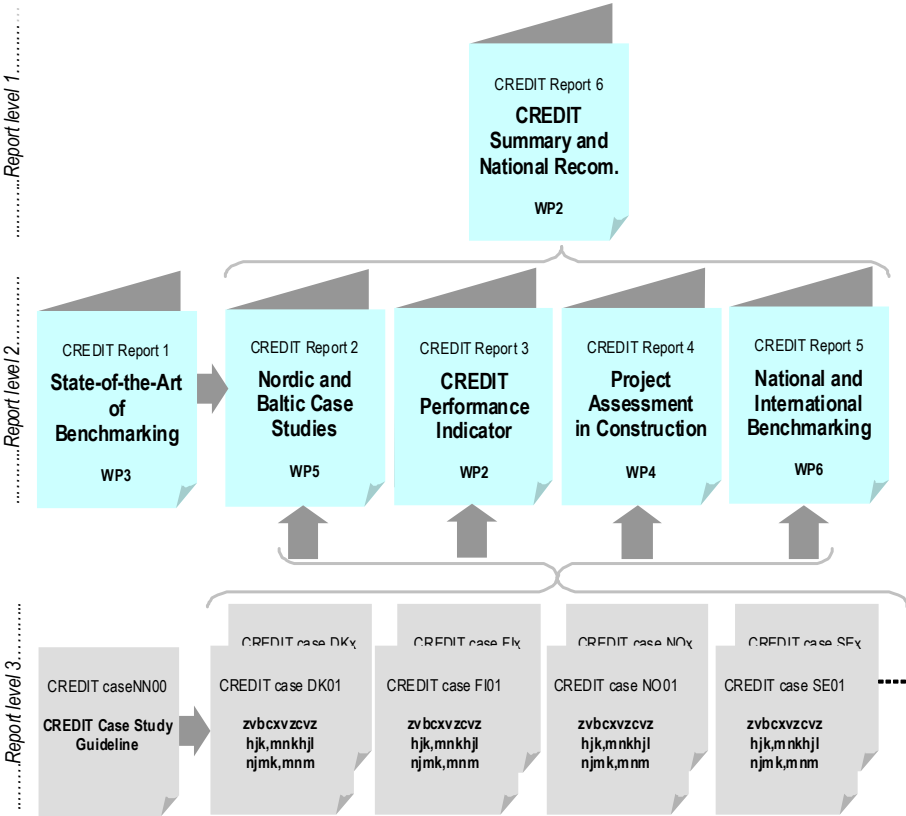
This case study is mainly carried out through document studies. The author has been involved in the development of these measures and is currently joint managing the collection and analysis of the program. It is only related to the National benchmarking level (WP6).

## 1.4 Reading instruction

Chapter 2 in this report addresses issues relevant to WP4 on assessments at project level. Chapter 3 addresses issues relevant to WP5 on the application of assessments in firms. Chapter 4 addresses issues relevant to WP6 on sectoral, national or international benchmarking systems. Chapter 5 discusses and concludes on the lessons learned with respect to the three levels of projects, firms and systems.

The work of each work package (WP) is documented in various other reports, articles etc. Below, a graphical illustration of the hierarchy and linkages between the individual reports is given.

Figure 1. Graphical illustration of the hierarchy of the CREDIT reports.



## **2. Buildings – assessments in construction or real estate processes**

This chapter is not included in the study.

### **3. Enterprises – assessments and indicators internally applied**

This chapter is not included in the study.

## 4. National benchmarking – indicators, assessment and organisation

Different initiatives to improve the construction industries competitiveness have been introduced in a number of European countries, for example Constructing Excellence (the UK), PSI Bouw (Holland) and Utmärkt Samhällsbyggande (Sweden). In Sweden, apart from the larger Utmärkt Samhällsbyggande a more focused program aimed at improving the competitiveness of the civil engineering part of construction, FIA (Renewal within the civil engineering sector), was launched in December 2003.

### 4.1 The actual benchmarking organisation and its purpose

The aim of FIA is that the year 2010 their vision should be fulfilled, the vision states:

*“The civil engineering part of construction is and is perceived as, an important and respected society provider, whom, together, in an innovative and learning process and in a cost efficient manner develops the road and rail infrastructure to fulfil the demands of society and end-customers. The industry has compared with today’s situation substantially increased their efficiency and lowered the frequency of faults.” (Free translation from Swedish)*

To achieve this five aims have been defined [4]:

- Increased efficiency delivering increased quality at lower cost with increased profit margins. (Efficiency)
- Better teamwork and increased cooperation between the parties of the industry (Cooperation)
- Better incentives for R&D and development of competencies. (R&D)
- More efficient dissemination of existing knowledge and competence (Knowledge transfer)
- Recruitment of new personnel made easier by the more positive image of the industry. (Image)

From this aims several different research and development projects has been and will be initiated by FIA to achieve these aims. FIA saw a need to monitor how the civil engineering sector develops, in order to effectively plan and implement development projects.

### 4.2 Assessment applied in the benchmarking organisation

The Division of Construction Management, Lund University was commissioned by FIA to develop the survey, manage the data gathering and to do the analysis. The survey consists of factual questions about the projects and questions where the respondents shall grade assertions about the project on a 10 graded scale from very bad to very good. The assertions and how they relate to the five goals is presented in table 1 (very strong, strong, weak or none). There was also an open question added that addressed the issue of key factors for the outcome of the project. This question gives a qualitative explanation of aspects covered in other questions. The measurements constructed from the factual questions will be adapted to the five goals laid out by FIA to evaluate how the Swedish civil engineering sector will develop in accordance to these goals.

	<b>Efficiency</b>	<b>Cooperation</b>	<b>R&amp;D</b>	<b>Knowledge transfer</b>	<b>Image</b>
1. How satisfied is the client with the product in relation to quality?	Strong	Very strong	None	Very strong	Strong
2. How satisfied is the client with the product in relation to project time?	Very strong	Very strong	None	None	None
3. How satisfied are the involved actors with the working environment?	Strong	Very strong	None	None	Very strong
4. How has the handling of external complaints been dealt with?	None	Very strong	None	None	Very strong
5. How has the communication between the project actors functioned?	Strong	Very Strong	None	Strong	None
6. How satisfied is the projects actors with the coordinated planning?	Strong	Very strong	None	Strong	None
7. How has the management of project document functioned between different actors in the project?	Weak	Very strong	None	Very strong	None
8. How has the cooperation functioned between different actors in the project?	Very strong	Very strong	None	Strong	None
9. How satisfied is the contractor with the project documents?	Strong	Strong	Strong	Very strong	None
10. How satisfied is the contractor with the coordination in the project?	Strong	Very strong	Strong	Strong	None

*Table 1. Assertions stated to the respondents and relation to the five goals of FIA.*

### 4.3 Cost and performance indicators applied in benchmarking

The main focus in this assessment is on efficiency. It has not yet been decided exactly which ones will be used. The concept of efficiency can generally be described as input versus output, how many units of something that can be produced in relation to the input of resources. For a manufacturing

industry this concept is quite clear. If the production of units increases with maintained or smaller input of resources the efficiency is increasing. However, for a civil engineering project there are many external factors (e.g. circumstances in the ground, ground levels, and existing facilities to consider) that will affect the potential amount of the finished product in relation to the input of resources. Consequently, to measure the quantity of the finished product, for example kilometre of road or railroad, is not a relevant measure in order to evaluate the efficiency of civil engineering projects.

For a civil engineering project it is better to measure the output in terms of the project value. In this survey the project value is measured both as the contract sum and as actual cost. The total length of the project is also measured, in terms of both the planned timescale and the real final length of the project. If the final outcome is different from the budgeted or planned outcome, the respondents are asked to answer why this deviation occurred. The input is measured in terms of the number of days of work conducted for one man (man days).

From these measures it will be possible to evaluate the efficiency from, for example, the following relations:

- $\text{Actual cost (SEK)} / \text{The total number of man days (days)}$
- $(\text{Actual cost (SEK)} - \text{Contract sum (SEK)}) / \text{Contract sum (SEK)}$
- $\text{The final length of the project (days)} / \text{the total number of man days (days)}$
- $(\text{The final length of the project (days)} - \text{Contracted length of the project (days)}) / \text{Contracted length of the project (days)}$

In addition to these the efficiency can be evaluated from a number of soft parameters. The explanations of why the project has increased the costs or been delayed shows if this is due to a decreased efficiency or as a result of other reasons. The form of payment (e.g. fixed price, running prices and incentives) in relation to increased costs or delays can give indications if one form of payment is more efficient than another. The amount of changes in the contract and the number errors at final inspection can give indications to the quality of the contracting documents and the quality of the performed contracting work, which indirectly will affect the efficiency of the work conducted.

#### 4.4 Relation to enterprises, building project and real estate

The main question in the survey relating to the issues of cooperation between the different actors in the project process (e.g. Client, main contractor, sub-contractors, designers), are if any forms of systematic cooperation has been adopted beyond conventional practice? Depending on what form of cooperation that have been adopted it can be graded on scale from 0-5, where 0 is conventional practice and 5 is a long term strategic cooperation between for example client and contractor.

In addition the following questions relates to cooperation.

- Have soft parameters been evaluated in the tendering process?
- Was price the deciding factor in choice of contractor?



- Have new production methods or products been that have not been used before by client or main contractor?
- What kind of contract (e.g. standard approach, design and build) has been adopted in the project?
- What kind of reimbursement form has been adopted in the project?

These questions are by themselves of limited interest. However, the correlation between these and other questions can give insights of how different levels and forms of cooperation will affect for example the different aspect of efficiency as stated above.

The main question that relates to R&D is if any new production methods or products have been used that have not been used before by client or main contractor. The following questions can also indirectly be related to the topic of research and development:

- Have any forms of systematic cooperation been adopted beyond conventional practice?
- Have alternative solutions for the production been given from the contractor in the tendering process?

In the survey there are no direct factual questions relating to knowledge transfer. In the questionnaire design the formulation of one clear question that could not be misinterpreted was almost impossible. However, nearly all other questions in the questionnaire can indirectly be related to this topic, which gives ample opportunity to indirectly evaluate the consequence of an existing, or non-existing, transfer of knowledge. The main questions that relates to this topic are the following:

- Have any forms of systematic cooperation been adopted beyond conventional practice?
- Have common goal been established between the actors in the project?
- Amount of changes in the contracted works during construction on site.
- Amount of errors at final inspection.

#### **4.5 Visions and innovations for future improvements**

There has been an interest in the development of indicators on productivity. The issue has not been solved yet, as it has been found to be rather difficult to find comparable measure across the infrastructure sector. It is now leaning towards the use of a number of indicators, indirectly measuring productivity and those measures used together as indication on the trend of productivity in the sector.

## 5. Discussions and conclusions

This survey will not directly measure the effect that FIA has on the civil engineering sector. What is measured is the direction of change for the Swedish civil engineering sector during the years that FIA is active. This knowledge could indirectly be used by FIA to initiate additional studies concerning specific subjects that could guide the civil engineering sector in a desired direction.

One important aspect to note is that although the surveys are done on projects there are no aims what so ever on measuring and comparing different projects with each other. All data will be de-identified and only aggregated data will be used in the analyses. The only reason to use project as the unit of measure is because it is the unit that are the most reliable when it comes to hard data.

The assessment is still in its infancy. The base line has been determined and projects in the continuous assessment are beginning to come in. No actual results have been achieved yet. The first results are likely to come out in the beginning of 2010.

### 5.1 Buildings - lessons learned and recommendations

This section is not included in the study.

### 5.2 Enterprises - lessons learned and recommendations

This section is not included in the study.

### 5.3 National benchmarking - lessons learned and recommendations

Two main issues are of importance in regard to the CREDIT objectives.

- 1 The difficulty of getting in the data – although this assessment has been initiated, approved and sponsored by the very top management of the two largest infrastructure clients and even though it is written in the procurement guidelines for both of these organisations that the survey should be carried out jointly, between the client and the supplier (consultant or contractor), it has been extremely difficult to get the survey sent in. Now, both of these two organisations have designated personnel to track down projects and make them fill it out, according to guidelines, and send it in.
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This case describes an ongoing initiative in Sweden with the aim of measuring the development of the Swedish infrastructure sector. The purpose of this case is to investigate:

- What measures are used
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The case study mainly contributes to WP6 (report 4)

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Two main issues are of importance in regard to the CREDIT objectives:

- The difficulty of getting in the data.
- The main performance the parties in the sector are interested to measure and to keep track of is efficiency and productivity.

1<sup>st</sup> edition, 2010

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