

UNDERSTANDING LEAN CONSTRUCTION AND HOW IT PENETRATES THE INDUSTRY: A COMPARISON OF THE DISSEMINATION OF LEAN WITHIN THE UK AND THE NETHERLANDS

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ABSTRACT

Common et al (2000) investigated the take up of lean concepts in UK construction and found it low with a lot of confusion and limited knowledge of lean construction techniques and a great variation in perceptions.

After establishing the background of the industry in the Netherlands a limited study with the same questionnaire from the UK was used to survey a similar sample of Dutch contractors and to make comparisons. The objectives were to see whether the indicators of lean culture or principles as seen through the existence of factors based on a conceptual framework were present in the contracting industry of the Netherlands, to compare the results of the survey with the original results and to see if there were reasons for any differences that might occur.

The results indicate that the dissemination of lean concepts in the Netherlands is even lower than the UK although there is more consistency in perceptions. Within two countries with fairly common construction industry problems there is a difference in approach to lean construction.

The lack of a focussed driver for change such as the UK's Rethinking Construction report (Egan 1998) is given as one reason for the difference.

KEY WORDS

Lean construction, lean concepts, lean penetration.

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INTRODUCTION

Common et al (2000) investigated the take up of lean concepts in the UK construction industry and concluded that there was a “distinct lack of understanding and application of the fundamental techniques required for a lean culture to exist.” The work identified a conceptual framework that indicated fundamental attributes, the existence of which could be used to test the penetration of lean concepts into large construction contracting companies. As part of the data collection for the original study a small survey of academics throughout the world was undertaken. Principally this was to support the development of the conceptual framework but it also had the incidental effect of indicating that the UK might be no worse than other countries in terms of the take up of lean concepts in construction.

After the initial study was presented, one of the possible areas for future research was identified as establishing if other countries also had similar problems in transferring lean thinking into construction contracting organisations. It was therefore decided to try to duplicate the UK study in another country. The country chosen was the Netherlands. The main reasons for the choice were that the Netherlands is geographically close to the UK and both are members of the European Union. Dutch companies are also represented in the UK contracting industry with two large companies, HBG and Ballast, having Dutch parent companies. Additionally language was unlikely to be a barrier as English is commonly used in the Netherlands and two of the team speak Dutch.

The original questionnaire was to be duplicated and sent to companies in the Netherlands and analysed in the same manner as the original study to see if there were common factors relating to the penetration of lean concepts.

THE CONCEPTUAL FRAMEWORK

The original study analysed the data collected around a conceptual framework based on fundamental inputs which were seen as required for a lean construction process. The conceptual framework represented four principles which were identified as being fundamental to the development of a lean culture in construction. They were; Procurement – an enabling procurement system which allows concurrent design and construction; Planning – a more structured and certain form of planning; Management – close relationships and management of a single unfragmented process with the supply chain; Control – process control which seeks to produce the future.

LEAN CONSTRUCTION IN THE UK

The UK construction industry has been subjected for over 50 years to a number of reports which reviewed its performance and suggested improvements (Simons, 1944, Emmerson 1962, Banwell 1963, Latham 1994).

The most recent of these was the report of the Rethinking Construction task force produced in 1998 under the leadership of Sir John Egan (1998). The report contained specific, measurable challenges for UK construction and suggested a number of ways to improve the way the construction industry does its business.

The construction Task Force was set up by the Deputy Prime Minister John Prescott against the background of deep concern in both the industry and its clients that construction was underachieving, both in terms of meeting its own needs and those of its clients. Egan concluded that construction in the UK is one of the pillars of the domestic

economy. In 1998 it was to have an estimated output of some 58 Billion pounds equivalent to approximately 10% of GDP and it employed around 1.4 million people. The industry was thought too important to be allowed to be inefficient. The report said that the industry in the UK suffers from low profitability and invests too little in capital, research and development and as a whole is under-achieving. This was seen to have a direct impact on the way clients saw the industry and resulted in client dissatisfaction. Both private and public sector clients were increasingly dissatisfied with the unpredictability in terms of delivery on time, within budget and to the standards of quality expected. Working with construction was seen by many clients as expensive. The under-achievement of construction was also demonstrated by the stock market view of the industry as a poor investment. Investors generally regard construction as a business that is unpredictable, competitive on price and not quality and with too few barriers for poor performers to enter the industry (Egan 1998).

The report mentioned case studies from around the world where construction was achieving improvement. Among these were examples of lean thinking being applied. Rethinking Construction (Egan 1998) says of Lean “ Lean thinking presents a powerful and coherent synthesis of the most effective techniques for eliminating waste and delivering significant sustained improvements in efficiency and quality.” Also: “ we recommend that the UK construction industry should also adopt lean thinking as a means of sustaining performance improvement”.

Since 1998 the industry has seen Government setting up bodies to assist in supporting and disseminating good practice such as the Construction Best Practice Programme and Movement for Innovation [now brought together under the Rethinking Construction umbrella]. It has also encouraged research in areas of construction improvement through Partners in Innovation and other initiatives. Among other things these efforts have included work in the area of lean construction and there have been examples of what might be termed "the lean message" around in most of the geographic areas of the UK since 1998. These can be seen in, for example, the seminars staged by CIRIA and the Construction Productivity Network.

The original study (Common et al 2000) sought to find out whether the efforts towards encouraging the use of lean concepts in construction were effective.

LEAN IN THE NETHERLANDS

Background

The construction industry in the Netherlands has historically had a fairly steady workload. The total construction output was predicted at the end of 2001 to be 0.2% up on the 2000 figure of £27.4bn (43.8bn Euro) inside the Netherlands, and is expected to show small increases of 1.5% for 2002 and again in 2003 (EIB 2002).

The construction industry has been divided into two large sectors. The B&U sector (Burgelijke en Utiliteitsbouw = housing and commercial) concentrates on housing and commercial buildings like offices and factories. This sector represents about 70% of the total turnover of the Dutch construction industry inside the Netherlands. The GWW sector (Grond-, Weg- en Waterbouw = civil) is the civil engineering sector. Generally the large construction companies dominate the GWW sector, while the B&U sector is more diverse and this is where we find large, middle and small companies. Although this split is not that distinct in the UK, the situation is not dissimilar. Prefabrication is widely used especially in housing.

Post-war reconstruction featured administrative centralisation. National government regimented and organised proceedings. Of particular concern was the improvement of the efficiency and quality of construction, particularly to enable large amounts of accommodation to be built. New construction systems were encouraged and companies seeking royalties from the government took up the challenge (NAI 2001).

In the 1950s the government developed and distributed standard details for residential construction. These measures led to increased productivity and also made it possible to monitor quality (NAI 2001).

During the 1960's, 70's and 80's the government was the main driver in the built environment, mainly concentrating on housing, large infrastructure and coast protection projects such as the Delta works which were conceived because of flooding problems in 1953 and took about 30 years to be completed (Oosterschelde project 1987).

The 1990's and the general forecast for 2000 and beyond indicates a diminishing role for government and a construction industry that will have to concentrate more and more on market (speculative) based environments instead of a government (local or central) lead demand based situation.

In the recent past there has been a noticeable shift in emphasis from central government as a client to market led construction demand although the role of the government as a coordinator and regulator still exists. The director of construction coordination policy at the ministry of VROM (responsible amongst other things for construction) summarises the aims for the industry as follows:

The establishment of a high quality built environment demands a well equipped production establishment where all construction partners like clients, financiers, architects, advisors, construction staff, suppliers form a tight cooperation team. That is not simple; after all, these separate construction partners are part of a fragmented industry where on one side there is a very advanced CAD/CAM production method and on the other side a more traditional craftsman. (Vriesman 1990) [translated]

EIB (2002) states that large company clients form the basis for large construction companies projects. This proportion of the order book has increased steadily for B&U contractors. Because of the slowdown in social housing, there is a reduction in the number of housing corporations as clients. In the GWW sector a similar trend is noticeable. Large clients are on the increase although the government still accounts for 55% of turnover. The gradual change in client base and the limited introduction of PPP and PFI type contracts, mainly to the civil sector, requires a new way of thinking and doing business.

It appears that there are some general similarities between UK and the Netherlands in the historical development of construction since the war. Although the Netherlands has had more success with system building and the timing of developments is different the trend of moving from a housing focus through government funded work to a more commercial based approach has similarities.

Lean principles in the Netherlands

As long ago as 1991 fundamentally lean concepts such as Just-in-Time, the problems of wrong planning and inefficient site methods storage and partnering are related to construction (De Bruijn and Richter 1991). Although the term Lean is not mentioned the authors also mention waste and categorise the causes of waste as a lack of involvement

(54%), lack of knowledge or experience (23%), communication (13%), stress or lack of time (5%), others (4%).

Vos (1991) in his article about technological innovation concludes that the industry needs to improve its image to attract the educated people it needs in the future and states that the industry can improve its image by introducing up to date processes that will indicate a modern forward thinking industry.

Platschorre and Wijnands (1991) comment that there is little evidence that systems are employed to make the construction process more efficient. Problems are solved on site as a reaction to a situation on a sort of ad-hoc basis. They state that the supply industry must make productivity increases and quality the first priority.

Bakens (1997) recognises a number of factors that will lead to a better construction product. He mentions items like JIT and value stream but not in a Lean context. Partnering is again mentioned and the need to be more customer focussed.

VGBouw in their report Future Scenarios (1998) States:

Changes in the construction industry happen at a faster and faster pace and influence the construction company in many ways. Research organisations, ministries and other interested groups have, from their point of view, taken stock of developments in the field of society, social-economic, technical, environmental and market forces. The challenge for the construction industry is now to filter out of this mass of information the relevant bits and use it to shape their own management policy and strategy for the future. [Translated]

The report indicates that up to 10 years ago three main trends were recognisable in construction:

- Competition was mainly concentrated on price
- Clients supplied very detailed technical specifications and left little room for innovative thinking
- There was very little evidence of long term strategic management, which meant the emphasis was on short-term project management.

This indicates similarities to the UK traditional way of working. Present day trends, amongst others, were identified as:

- The contractor will become more and more responsible for the end product.
- This means more emphasis on subcontracting and supply chains.
- Contractors are still functionally organised while integrated process control becomes more important
- All parties involved in the value-chain are coming more and more to the fore.

The mention of the value-chain touches again on a Lean concept, although Lean is not mentioned. The report also identifies some future possible developments:

- The management of construction processes will become more important.
- The construction process will become shorter, more complex and will aim for higher quality standards. IT will play an increasingly important role

- It is expected that the increased use of prefabrication will lead to a closer relationship with designers and suppliers.

Coopers and Lybrand in their report *Strategische uitdaging in de bouw industrie* (1998) (Strategic challenges in the construction industry) state that the construction industry is dominated by fierce price competition with low profit margins as a result. Minimal change is needed to let the balance swing from profit to loss. Construction companies cannot therefore build up a financial buffer to accommodate difficult periods. Because of low margins companies are forced to think in terms of increasing volume and capacity and the report indicates that this vicious circle can only be broken by a shift to a more project management based function where the company offers more integrated products. Coopers and Lybrand recognise that the quality of the Dutch construction product is high, as is the efficiency and productivity. It also concludes that the industry needs to develop towards a more demand-based model i.e. the industry needs to develop new products and new concepts of working. Construction suffers in that even the larger concerns have difficulty in differentiation from other construction companies and innovation within the industry is restricted. The report concludes that without the shaping of a clear vision with the accompanying strategic and tactical planning the industry will have a difficult time.

Searching the literature in the Netherlands indicates only a few authors who actually mention Lean by name. Melles (1994) writes "In fact lean production does not include really new principles of management techniques. It only combines existing principles in a new way. The primary goal of lean production is to avoid waste of time, money, equipment, etc".

There are indications of some experiments with lean concepts in the Netherlands (Botermans 1994). In 1989 experiments were carried out to use multi-skilled gangs of labourers in house building. Since the sixties all gangs were specialised. There was a lot of sub-contracting. Because every gang only concentrated on their own field of responsibility, the amount of failures was enormous. The change to multi-skilled gangs caused radical changes in organisation, but the result was encouraging. One of the consequences was that homes should not be completed by specialised work crews from components delivered to site but by all round crews working from a central yard (Melles & Wamelink 1993). Even though the experiments were profitable many construction companies did not continue with these practices.

De Ridder (1994) observes that a lot of engineering activities in construction do have aspects of simultaneous engineering. In several design and built projects, simultaneous engineering is used. The results are not always profitable. De Ridder designed new organisation structures for this kind of project. To implement these ideas a company needs a good system of management procedures. These systems are very often missing; also the relationship between the construction company and the client is not well managed (on both sides!).

The first approach to implement kaizen (permanent and stepwise improvement) in construction companies was in the early eighties. A temporary innovative action was introduced under the MANS philosophy. Two difficulties were encountered, first how to communicate the new ideas to the organisation and second it proved difficult to stimulate employees to improve permanently. "*Mans died a silent death*". (Melles & Wamelink 1993). However, the Dutch building industry this seems to have had good results with the total quality management philosophy under ISO 9000 which can be externally checked and certified (Melles 1994).

As a named concept there appears to be little real evidence that Lean Construction has been a major issue in the Netherlands but there are many examples of issues which can be recognised as lean being mentioned as "improvers", "fail costs reduction" and "drivers for change" in Dutch construction research. Research institutes and universities adopted Lean Construction as a topic for study and education only to a limited extent. Pressure to reform from the government exists in the Netherlands although it has no Latham or Egan reports of its own. However, the Netherlands government limits itself to setting to scene for the immediate future and unlike Egan or Latham does not give practical advice on how to improve the industry. Any drive towards change is instigated by the industry itself in reaction to a specific event.

THE SURVEY

The original questionnaire was at first translated into Dutch and sent to 60 medium to large companies selected from the membership list of VGBouw, a major Dutch employers organisation that represents about 120 of the nationally and internationally largest contracting companies in the Netherlands from housing, civil, and commercial sectors⁴. None of the questionnaires were returned. A second attempt, this time with the questionnaire in its original English, gave a result of 12 responses from a mix of the membership with half from medium and half from large companies. This represents a 20% rate of return (10% of the VGBouw membership list) which was not as high as the 35% achieved in the UK study but which can be considered average (Gill & Johnson 1997).

SURVEY RESULTS

The original questionnaire was designed to establish the application and development of lean within the individual company. The questionnaire also looked at whether the companies considered themselves to be a lean company and how they thought lean had been developed through the company's structure. The questionnaires were aimed at Senior Managers at Director level.

Data collected from the original questionnaires were subjected to content analysis, pattern matching and categorisation using positive, negative and neutral keywords to relate the data to the conceptual framework. This allowed establishment of the extent that each company had applied lean techniques, their applicability and the penetration of lean concepts within the companies. The questions were set to allow interrogation of answers which on the surface indicated knowledge and commitment to Lean Principles to see if these answers were backed up in practice.

The UK results indicated a number of contradictions which supported the conclusion that there appeared to be significantly less lean culture than was being professed in the UK. As an example, the fact that companies which indicated they were using lean principles indicated traditional contracting and critical path planning as being the basis of

⁴ When the the business and regional units of the 120 largest contracting companies are taken into account, VG Bouw represents about 300 companies, representing a collective turnover of about 13 billion Euros (about 30% of the 44 billion Euro total national turnover of the building industry) inside the Netherlands. Recently VG Bouw merged with the Dutch SME organisation for the housing and commercial sector into a joint organisation called BouwNed, representing about 4000 Dutch contracting companies with a total turnover of more than 18 billion Euros (nearly 45% of the total national turnover).

working in the industry, lead to the conclusion that a number of lean principles were misunderstood since these two working practices are responsible for a good deal of waste found in the industry and ignore the advantages of supply chain management. The responses of the majority of questioned companies in the Netherlands also indicate clearly that there is a lack of knowledge of lean principles.

Specifically the answers to the questionnaire were related to the conceptual framework and analysed against the four fundamental principles that need to exist for lean to be developed. The results in these areas are given here.

Procurement

The need to move on from process exchange models to those based on concurrent engineering principles is essential to improving construction within a lean ethos. The evidence from the survey indicates that traditional contracting and open tendering are the most common basis for procuring construction in the large majority of cases in the Netherlands. Very few other methods are indicated. Design and Build, which is considered a reasonable vehicle for enabling concurrent design and construction, has a limited share of contracts. Traditional contracting is considered to indicate a conservative approach to the way of doing business and points towards a reluctance of doing things differently. Open tendering does not support the close relationships needed to assist in developing improved flow in the supply chain and tends towards fragmentation of the construction process. Responses also indicated that the design element of the process is generally contracted out which fits with traditional tendering where relationships with designers tend to be fraught with difficulty. Improving relationships, particularly with designers, is important for implementation of lean principles in construction. The UK response produced similar results even though non-traditional procurement was more widely used.

Planning

Critical path planning is the preferred method for contractors in the Netherlands. All the respondents indicated this as their main method with no acknowledgement of the leaner planning techniques given in the list [Last Planner, All Activities Critical, Lookahead Planning]. Critical path methods are considered to be ineffective in dealing with the type of complex dynamic projects with high levels of uncertainty that are found in construction. In addition, they are inherently hierarchical and “schedule pushed” which introduces waste into the process through the production of the wasted effort involved in producing programmes with low achievement rates. The headline results in this area were close to those of the UK survey.

Management

The close relationships and lack of fragmentation within the supply chain that are needed for lean concepts to be applied were not evident within the survey. There was little evidence across the questions of issues which would support increasing communication and participation through the process. In one specific question, which was aimed at identifying the most important issues for generating value for the customer, supply chain management was amongst the least identified along with value streaming and benchmarking. The most frequently indicated issues were traditional ones such as quality assurance and site and production management. Respondents were also asked to indicate

which of particular principles their companies had any involvement with. These issues were mainly those with some element of lean connection and supply chain management was not mentioned by any of the respondents. The procurement issues mentioned above are another indicator that improving the fragmentation of the supply chain is not a priority within the Dutch contracting industry. A pattern was seen across the categories of the UK professing to use certain tools and techniques which could not be supported in detailed analysis of the responses. This was not seen in the Netherlands but the overall assessment that the lean issues were not really evident was the same.

Control

To enable an assessment to be made that lean concepts of control exist within the industry there would need to be evidence of interest in, or application of, some of the techniques that are available for improving the flow of production while accounting for variability and maintaining the focus on goal achievement. These would be techniques such as Last Planner or Lookahead Planning (Ballard 1994, 2000). The survey contained a number of instances where respondents could indicate their interest or use of these techniques but no respondents did so. Although the UK professed more knowledge of Lookahead Planning and Last Planner this was not supported by detailed analysis of the responses and the overall results were similar.

Lean Concepts

The survey sets out to give a number of opportunities to interrogate responses to indicate the level of knowledge and awareness of lean concepts within the industry. The results of the survey of Netherlands construction indicate very low results in this area. Most of the real lean issues are not acknowledged at all while certain issues that are associated with lean but can also be considered as “stand alone” are acknowledged although they are not ranked highly. TQM and Quality assurance are in the public eye in the Netherlands at the moment as there are a number of high profile initiatives being publicised. These initiatives look at customer satisfaction and quality, not in the context of lean but more as an individual subject. There are indications that Just in Time appears to be wrongly looked upon as pushing the supply stream rather than pulling it although some respondents acknowledge that they are using it. One large contractor has looked at items like reducing on-site times and is also looking at partnering.

Answers about the issue of customer value also indicated a traditional approach in that it was felt that value could be best added at the production level through quality assurance and direct control of production.

Respondents were asked specifically what their current position was relative to the application of lean. The highest level of response was the 40% who indicated that their companies were thinking about lean application. The final question asked if respondents felt that lean principles could be applied to construction and most thought that either they could not or they could only be applied in a limited way.

CONCLUSION

The evidence from the survey indicates that the penetration of lean concepts within the contracting industry in the Netherlands is low. In comparison with the original work it appears to be even lower than in the UK. Lean, as a concept appears to be largely unknown although some issues associated with it have some low penetration of the

industry. Some companies indicate that a few principles could be applied but there is no indication that they have gone beyond thinking of introducing them. Most of them have no intention of introducing them and some believe that they cannot be applied to construction. However, there is also evidence to suggest that they do not understand what lean is really about because the industry as a whole has not applied itself to lean and has chosen other paths to improvement. Although the level of understanding of lean concepts in the UK was low and there was a great variation in perceptions that in the Netherlands appears lower.

The range of opinion however, varies less in the Netherlands than the UK and is therefore more consistent. The evidence suggests that there is more awareness of lean in the UK even if the depth of penetration is low. There are only few examples in the Netherlands of the dissemination of best practice examples such as those produced by the UK Movement for Innovation or Construction Best Practice Programme. In the Netherlands these large, government instigated initiatives are not common practice. Knowledge of best practices are being transferred to the industry by the employers organisations and so-called “collective research programming institutes” of the different sectors, which are financed and lead by the different sectors also. A trivial, but important reason for best practices not to disseminate very well into the Dutch construction industry is that they are put in English terms, which often causes misinterpretation or even reluctance against them beforehand. In addition, the collaboration and knowledge exchange between the industry and the academic and research institutes is not very structured. For instance, dissemination of knowledge of best practices, including Lean Construction through combined academic and business conferences or workshops is not common practice. However, recently there have been novel initiatives combining government, universities, collective industry organisations and companies into national “knowledge development and implementation programmes”, e.g. focussed on the improvement of building processes, similar to British initiatives related to Rethinking Construction that has proven to be successfully contributing to the dissemination and implementation of best practices to the UK industry (M4I, CBPP, Knowledge Exchange etc.)

The issues which have caused the UK construction industry to be concerned about its achievements appear similar to the Netherlands and there is plenty of evidence that industry and research bodies have identified things such as waste and process improvement as needing attention. Yet, in the main, they have not chosen to consider the lean approach to improvement. What appears to be different is the lack of a strong driver for change such as the Egan Report. The Netherlands survey indicated that, despite the companies having a reasonable overseas work profile, only one company [which has a UK subsidiary] had knowledge of Egan and Latham and there does not seem to be an equivalent in the Netherlands. However, it can also be argued that the survey suggests that, at that time, the UK industry was beginning to become more knowledgeable about Lean “language” but not about its real meaning and that this is not seen in the Netherlands because there is no strong central driver of change. Perhaps further research of the last 2 years could indicate whether the penetration of lean principles into the UK has improved due to the continued pressure from the bodies developing the “Egan” message and that for the same to happen in the Netherlands a similar driver would be needed.

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