WASTED EFFORT – TO MEASURE OR NOT TO MEASURE: THAT IS THE QUESTION

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ABSTRACT

Despite the odd victory here and there, the construction industry is continuing to be seen by many as a poor performer – especially considering the advances being made in other industries. It is the authors' belief that this is due (to a large extent) from a gateway waste of not measuring and/or using wrong measures for performance. By measuring and using the appropriate measures, quick wins can be achieved, as this additional knowledge helps to identify the right direction and focus areas for investing in improvement efforts.

By not measuring system performance, the industry has no idea of what is affecting current performance levels. By not understanding the factors that impact current performance, the industry will not know what improvement efforts need to be made, where these efforts need to be focused or which efforts will likely reap the best results. Hence, the waste of haphazard initiatives and improvement efforts e.g. concentrating on improving things that do not make much of a difference, implementing changes that actually have a negative impact on the process along the way, or worse, making wasteful activities more efficient.

The objective of this paper is to investigate and discuss the waste and repercussions of either not measuring or using inappropriate measures within the construction industry, through practical and common examples from boardrooms to sites. The aim is to reinforce the benefits and need for measures and more importantly, the right choice and usage of them. It suggests and highlights relevant issues to consider when choosing appropriate performance measures that can contribute to the bottom line.

KEY WORDS

Data Collection, Measures, Understanding Variation, SPC, Motivation, Targets, Systems Thinking, Gateway Process, Value and Failure Demand

INTRODUCTION

"It is not necessary to change. Survival is not mandatory." (W. Edwards Deming)

Its been 10 years since Sir John Egan published his landmark report "Rethinking Construction" (Egan, 1998), however despite clearly identifying the need for improvement and providing numerous recommendations for industry change, the

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performance improvement targets he set for industry just haven't been realised. Unfortunately and to a large extent, the industry still continues to underperform – generally due to a continued lack of design and construction process integration, a lack of focus on quality and customer value, poor contractual relationships and a general lack of understanding as to why poor performance continues, or how improvements might be achieved.

For his continuous improvement targets to be met, Egan (1998) rightly identified that companies needed to start investing in benchmarking and performance measurement – an area in which the construction industry was – and, some would say, still is – sadly lacking. It is only by doing this, that the changes needed to improve quality and productivity levels can be identified. However, for benchmarking and performance measurement to be of value, care must be taken in identifying the type of data we collect and the method by which we analyse it.

DEFINING THE PROBLEM

Construction companies are encouraged to benchmark projects using nationally identified Key Performance Indicators (KPIs) – as promoted by Constructing Excellence and the Scottish Construction Centre – to supposedly enable them to not only measure their own performance but also compare themselves against their sector of the industry. However, by capturing data for these types of KPIs, they are only measuring their performance against a range of fairly general criteria that may or may not be wholly applicable to their, or other organisations. Comparing themselves to an overall average industry performance level might not provide much real advantage and may actually send the wrong message if their performance is better than the average, by possibly reducing their incentive to try hard at process improvement… succumbing to the "if it ain't broke, don't fix it" syndrome!!!

One main issue with such KPIs is that they are based on completed project results, with too long a time lapse for any immediate impact from improvement strategies: i.e. the plan, do, check and act cycle is too big (Beatham, et. al., 2004). Another vital flaw includes the fact that they do not include details as to why certain levels of performance occurred, or reflect the overall performance of the specific organisations, as they only compare project to project. For those companies using this type of data, there is a fairly high likelihood that it could really be like comparing apples with pears. Instead, companies need to compare themselves against their own overall and specific performance, rather than against poorly defined and possibly inappropriate, external measures.

DATA COLLECTION, NOT MEASURING, MEASURING BUT NOT ANALYSING

> *"... the only way we can be sure that performance is getting better is to measure the improvement. If performance isn't measured, it can't be controlled."* (Horner & Duff, 2001)

Although it is a vital component of the performance measurement process, busy employees lose sight of the fact that data collection is necessary for process improvement is to occur. Unfortunately, there is a tendency that it just gets treated as mere data collection for management – especially if they don't see any outcomes from the work that they are doing. This is generally due to management's failure to make

the performance measurement and improvement process transparent and provide the necessary feedback to those involved in collecting the information.

USING THE WRONG MEASURES

Using wrong or inappropriate measures is like using a thermometer to measure humidity – the information obtained is not only misleading, but can also influence behaviour. Measures should be fit for purpose and based on an assessment of the system and how success would be determined. Unfortunately, too many appear to be based on criteria that is perceived to be either obvious, familiar or relates to the industry as a whole, or where data collection is considered to be easy or data generation looks to be reliable.

Data collection in the construction industry is also, almost always driven by requirements for financial reporting and generally focuses on costs, profits and company turnover. Financial measures alone encourage short term thinking, where an attitude of caring for the results but not how results are achieved, becomes the priority. Costs and profits alone, do not give a complete picture of an individual's or a company's performance and can sometimes contribute to complacency. It is common for companies to reward site staff with bonuses if the profit margins are achieved or the project is delivered on time or early upon request. On the other hand, if the company has performed poorly, or a project manager's recent projects were either late or lost money – despite any efforts he may have made – is it the fault of the individual, or is it possible that the performance targets set, were a little over-optimistic? Whilst many are well aware that whether a project's quality, cost and delivery figures do well or not, does not solely lie in the capability of site staff, unfortunately there are still many who don't and this tends to be due to a lack of understanding of system variation. The same thing also applies to the growth in company turnover. Just because a company's annual turnover is continuing to increase year on year, doesn't mean that the company is actually performing better.

Examples of Wrong Measures

Some companies measure staff performance through rate of utilisation, which is defined by the amount of work done and paid for by a customer.[3] If the target utilisation rate is 75% then 25% is dedicated to the other overhead paid duties e.g. administration. But since work is commonly undervalued to get the work, employees are potentially over-working or under utilised. As Deming (1986) identified, management by objective (numerical quotas, arbitrary measures) drives behaviour – due to the fear of not meeting these measures – and can contribute to figure fixing. Known methods are to under-work (default not producing good quality work) on another project to compensate, or do as much work as possible on all projects to meet deadline and spread the charge between the different projects to make sure the target of 75% is met. This does not reflect the actual amount of work done on each project and hence, does not give accurate results. This is commonly seen in construction projects where the project managers or quantity surveyors "fiddle" the figures, by moving monies from different budgets to obtain the figures required.

[3] For example, a project is charged at £6,000. If the charge out rate is £600 per day, then one can only spend 10 days on the project.

Another classic example is the plasterboarder, who gets paid by the total area of plasterboard installed, rather than completed areas of work. The natural human behaviour will be to put up as many whole sheets as possible, to achieve bigger payments for less actual work done. Unfortunately, this often leaves the following trade unable to proceed with fee earning work, due to the smaller bits and bobs not being completed.

One large house building contractor measured customer satisfaction of their aftercare service team through resolution time. Improvement targets were set and as a result, resolution times were reduced. However, total service costs actually rose and it took them a while to get the association. Eager to meet the new targets, helpdesk personnel referred cases to field operators quicker, but without attempting as hard to resolve the issues remotely. Field operators were therefore called to make quick but costly visits, however they were happy with this, as it helped to boost their own reaction figures.

Therefore, there is a need for a range of measures to be analysed in order to offer perspectives that provide a better understanding of cause and effect relationships. A good example in the industry is how cost is strictly kept down with accounts looking very healthy but the final account – way down the line – is suddenly not so healthy anymore due to revisits and aftercare works. A more accurate picture can be monitored and quality issues detected if the cost figures were monitored together with quality figures. As an example, Figure 1 below provides details of the growth of "Customer Care" maintenance issues over a three year period, for another medium sized UK housing development company.

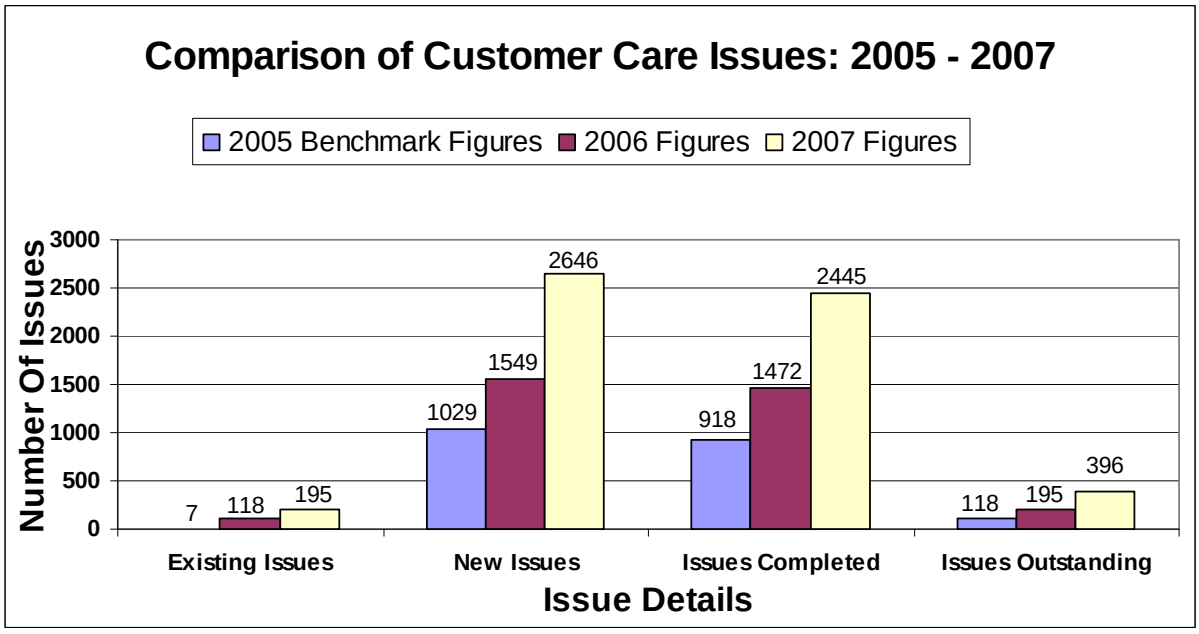

Figure 1: Three Year Comparison of Customer Care Issues for UK Housing Developer

In this example, by mainly focusing on short term cost cutting exercises and optimistic annual company turnover growth targets, the company's internal resources became stretched, product quality suffered and purchases were required to move into

properties before they had been properly completed and checked. As can be seen, this focus on the wrong measures, has led to a dramatic increase (157% increase in just 2 years) in "Customer Care" issues being raised by clients and far in excess of the company's growth over the same period. Not only is this continuing problem (a further increase of 28% over the 2007 figures, up to 30/04/2008) affecting the company's bottom line, but it is also having a negative impact on the company's strong reputation in the market place. In addition, the poorer than expected profit levels have meant that company bonuses could not be paid, which has led to increased employee dissatisfaction, resulting in increased staff turnover and a further stretching of the already overstretched staff.

Even when collecting cost data, companies generally tend to only collect data on a project by project as they are generally only interested in how any particular project is doing at that point in time. They will usually know which pots of money are within budget or not – as well as the how, where and when problems affecting budget items occurred – but they are seldom interested in the trends that may identify the root causes (the "why") or the bigger picture. The usual excuse given, is that they "more or less" already know… or at least think they do.

Table 1 below shows a collation of data relating to 8 elemental cost centres from 11 projects, constructed by another construction company. As mentioned above, projects are traditionally looked at individually and in this example, projects 3, 4, 6 and 8 were the subject of specific attention on separate occasions, as most elements were making a loss. This triggers the question of whether the company was just reacting to common cause variations. However, it was only when the 11 completed projects were compared to each other, that the picture becomes clearer for this company. Even though the company knew they were not doing too well and that they were buying some jobs to get a foot in, they were not aware that the problem was as bad as it was. Now being aware of the extent of the problem, the company quickly set about finding out the root cause of these project losses to enable improvement strategies to be implemented.

Table.1: Comparison of Project Elemental Losses – UK Construction Company

Project	Supervision	Labour	Material	Plant	S/C	Site O/h	Transport	Fees	Total
1	-22,402.00	62,801.00	2,546.00	5,832.00	-6,269.00	-20,003.00	9,390.00	3,282.00	35,177.00
2	-14,261.00	-71,310.00	-5,146.00	2,254.00	11,191.00	-18,599.00	584.00	-5,341.00	-100,628.00
3	-43,998.00	-96,296.00	-1,473.00	-5,709.00	-19,456.00	-16,356.00	-5,367.00	17,561.00	-171,094.00
4	-69,632.00	-44,557.00	38,420.00	-9,469.00	-11,221.00	-18,852.00	-11,590.00	1,375.00	-155,526.00
5	-1,473.00	-11,865.00	31,056.00	12,747.00	1,465.00	-16,120.00	3,654.00	45,308.00	64,772.00
6	-54,051.00	-54,558.00	-7,410.00	-14,100.00	-31,462.00	-11,873.00	-8,488.00	-13,822.00	-195,764.00
7	-31,521.00	-62,329.00	-34,640.00	-5,315.00	-9,130.00	3,630.00	-10,129.00	-3,367.00	-152,801.00
8	-8,289.00	-37,405.00	-45,404.00	-9,468.00	-12,515.00	-17,170.00	-12,566.00	-3,474.00	-146,291.00
9	-14,021.00	-126,853.00	-47,680.00	-24,853.00	135,600.00	-58,113.00	-6,968.00	6,180.00	-136,708.00
10	-36,774.00	17,821.00	7,803.00	20,599.00	34,976.00	20,599.00	-19,580.00	-	45,444.00
11	-61,731.00	-40,930.00	-5,001.00	-19,495.00	35,351.00	31.00	-31,457.00	26,439.00	-96,793.00
Totals	-358,153.00	-465,481.00	-66,929.00	-46,977.00	98,530.00	-152,826.00	-92,517.00	74,141.00	-1,010,212.00

HOW AND WHAT TO MEASURE?

DEFINING AND MEASURING CUSTOMER SATISFACTION

In line with Deming's 'Systems Thinking' approach to achieving the system's aim, or similarly the ultimate lean goal of achieving end user customer satisfaction, then we need to satisfy our NEXT customer first. Figure 2 below highlights that if we focus on satisfying ***every*** NEXT customer along the process, then we ultimately achieve end user satisfaction and contribute to enhanced flow and reduced waste, hence money in everyone's bank quicker - a common goal.

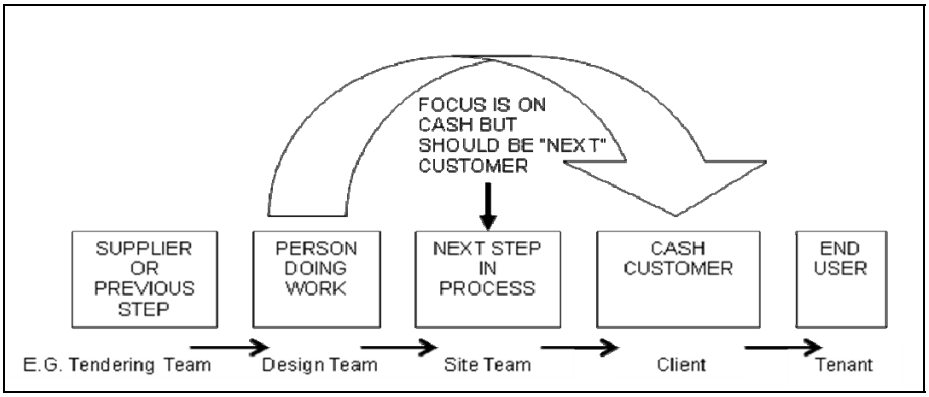

Figure 2: The "NEXT" Customer

If this is agreeable, then it would only be logical to measure what is important to the NEXT customer in the process and not just the end user satisfaction. Although it is dependent on the process, an example might be:

Stud wall > 1st Fix Electrics > Plasterboard > Tape Joint > 2nd Fix Electrics > 2nd Fix Carpentry > Painter

In this example, the painter measures the joiner, who measures the electrician who measures the tape jointer, and so on, with the results achieved, potentially triggering release of payment. If each NEXT customer's requirements (conditions of satisfaction) are stipulated and then upheld by the trade before, this would help to reduce the large amounts of interface and quality wastes currently occuring. Feedback of such information would also help the preceding company to measure their own performance in relation to meeting NEXT customer requirements. The same would apply to the macro view of client > design > build > client process. This is plausible, as one is potentially always the process before as well as being a NEXT customer.

Case Study – Next Customer Measures

There is evidence of great inefficiencies in the design and documentation process (Tilley et al, 1997; Tilley, 2005) and it is not uncommon to hear ranting comments, from site, as to how the lack of, delayed, insufficient or irrelevant design information is delaying progress and creating rework on site. These rantings, are generally from either the principal or the trade contractors – the NEXT customers of the design team.

The following case study surrounds a project consisting of both a new build component and the refurbishment of existing residential and commercial retail units.

The project, which started in March 2007 and (at time of writing) is currently due to complete in March 2009, was originally valued at approximately £7 million. This is a fairly complex project and the decision was made to introduce lean ways of working on site. The plan was to start implementing a lean philosophy as early into the project as possible, gathering the client, design and site team for collaborative planning workshops. All stakeholders seemed to be in consensus with the aims of the system i.e. deliver on time, to required quality and within budget. The planned activities achieved hovered around 55%.

Due to some major unforeseen issues in relation to the refurbishment part of the project and the ground works on the new build element, relationships were tense. It is the authors' view that if the appropriate data had been collected, collated and analysed from the outset, there would have been far less surprises for the companies involved… even those that have been in the business for "donkeys" years. To exacerbate matters, the usual issues of diminishing design fees and insufficient design time (Tilley, 2005) surfaced. This contributed to further hostile and accusing behaviour. With design issues plaguing the project, planned sessions to improve sub-contractor efficiency were postponed again and again.

In November 2007, the main contractor became impatient and approached the client directly to complain about the design team. Due to the "he said, she said" scenario that ensued, the 'Lean Practitioner' allocated to this improvement project enquired as to what proof there was to confirm the design team's inefficiencies and how much were they likely to be costing the client. To try to determine designer performance and its impact on the project, an analysis of the Requests for Information (RFIs) issued, was considered. RFI details were recorded and kept in a register showing the number of each request, to whom and when it was issued, when a response was expected back and when a response was actually received. A data analysis session was then conducted to determine the cause and cost of information flow waste. Figure 3 below shows that of the 383 RFIs issued up to that time, 63% were received later than the allocated timeframes.

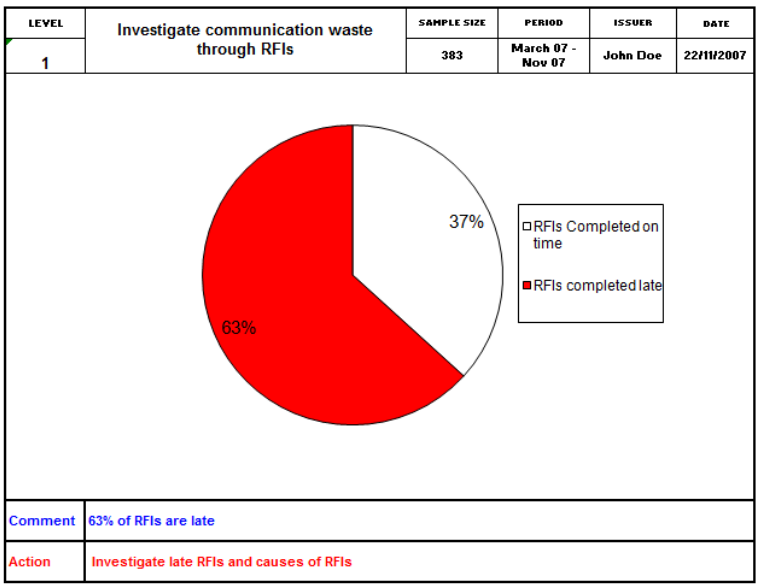

Figure 3: Percentage of RFI responses, received later than requested.

Further analysis of the data showed that out of the 63% (238) late responses, 66.4% came from the architects, 16.8% from the civil/structural engineers and 16.8% from the M&E engineers. However, what was of greater interest was the fact that when considered individually, 67.2% of architect's responses, 66.6% of M&E responses and 48.2% of civil/structural engineers' responses, were late. (see Figure 4)

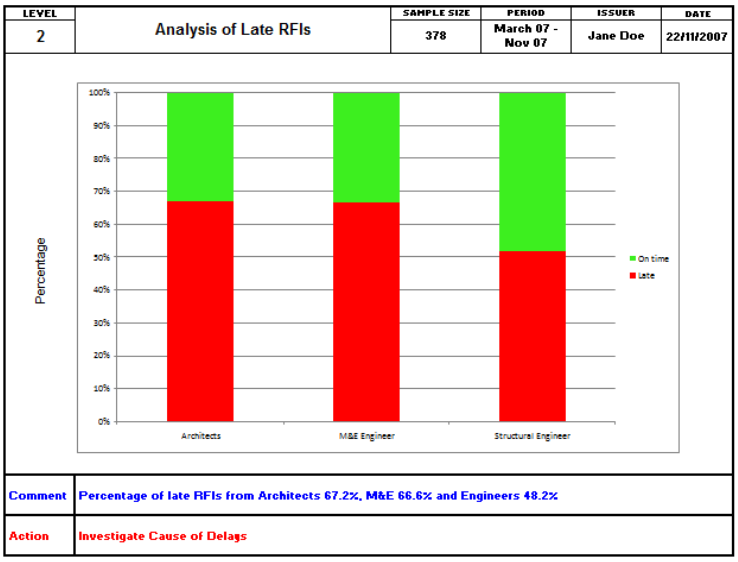

Figure 4: Analysis of late RFIs by designer type

As contractors are usually criticised for allowing insufficient time to respond to their information requests, the number of days/notice given by the main contractor for the design team to respond, was also assessed. (Anomalies were removed to prevent skewing of the data.)

- The average number of days given to the design team for response, was 10.5 days (sample size of 304 RFIs)
- The average number of days late in response, was 7.5 days/RFI
- The average number of days taken to respond to an RFI, was 18 days.

Based on previous research by Tilley et.al. (1997) and Tilley (1998), the number of days allowed for a response appeared to be quite reasonable. However, based on the number of RFIs issued up to this point in time and the average time for responses, the design team performance would be considered 'very poor' in relation to both the extent and severity of the problem. Having determined that delays to information flow was a problem, an investigation into the root cause of the original RFIs was needed. An assessment of the RFIs issued, determined that the following cause classifications would be appropriate for sorting the various RFIs:

- Lack of detail
- Design change
- Buildability
- Lack of site investigations
- Lack of pre-tender info

Based on these classifications, Figure 5 below, provides an analysis of the causes of RFIs on this project.

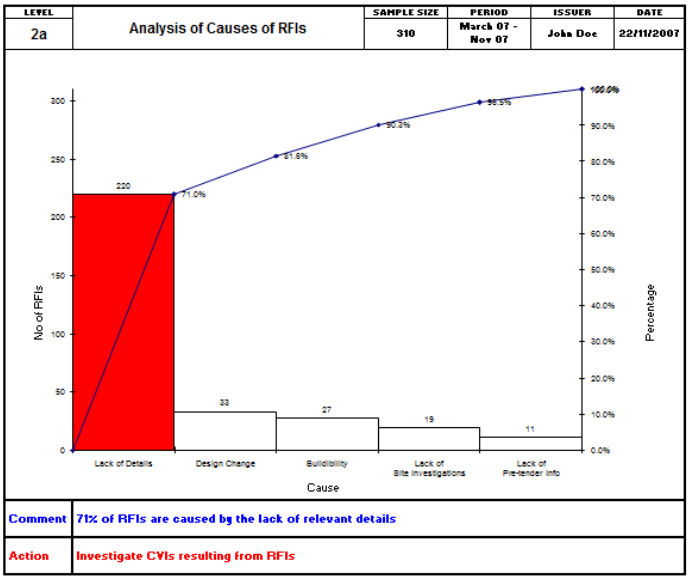

Figure 5: Analysis of Cause of RFIs

As can be seen, 71% of RFIs were due to a lack of detail in the original documents. To assess the issues further, the team decided to investigate the Confirmation of Verbal Instructions (CVI), as they were the results of RFIs. At the time this analysis was carried out, there were a total of 178 CVIs. Figure 6 below, shows that approximately 71% of the CVIs were due to the lack of a proper site investigation. Note that the classifications were reduced as it was team consensus to drill down to the root cause.

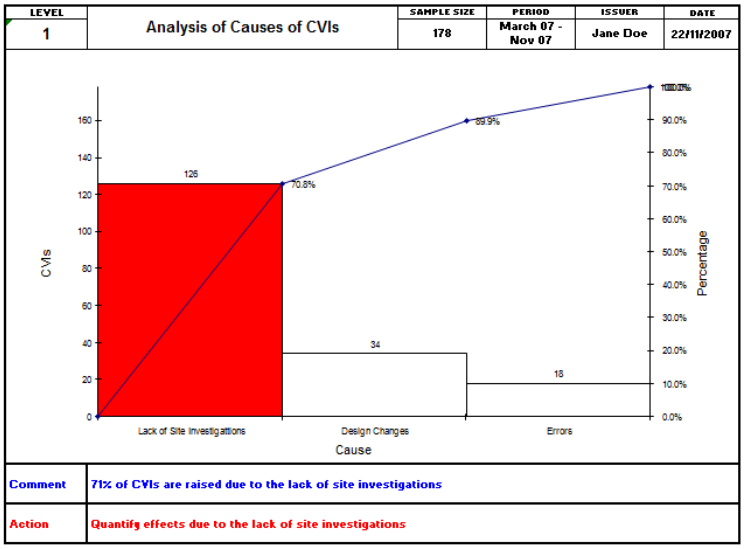

Fig.4: Analysis of Causes of CVIs considering root causes

Table 2 below, provides a summary of the costs relating to these CVIs and clearly shows that the lack of site investigation was responsible for an increase in project direct cost, of approximately £560K.

Table 1: Summary of costs against CVIs

Causes of Variations	**Cost (£1,000)**	**Percentage**
Lack of Site Investigations	£560	71%
Design Change	£110	19%
Errors	£95	10%
TOTAL	**£765**	**100%**

At time of writing (April, 2008) there are 395 RFIs, 283 CVIs – currently valued at approximately £2M and the project is currently approximately 6 months behind programme. However, for the objectives of this paper, the case study and the data in itself is not of significance. What is of significance, are the benefits for a main contractor who possesses such data and information. Such data, if collated and analysed from all projects, enables the main contractor to determine trends, thereby helping to make confident business decisions and enable the education of clients in terms of potential cost savings. In this case, spend a little up front for proper site investigations. Although in this instance, it was the main contractor that was mainly interested in using the data to back up the claims and negotiations at the end of the project, the same information could also be used by the design firms for assessing their own performance.

CONCLUSIONS

Wrong measures are often used in the industry and this leads to wrong "behaviour". Wrong behaviour drives us further away from value, i.e. what the customer wants… or sometimes more importantly, needs. Measures drive behaviour. People will ensure that they do the things that they are measured on and even skew measures to fit the target. In order to drive behaviour towards value, the industry needs to understand systems thinking and variation. We need a modus operandi to aid us in making decisions on whether resolving a problem is economically viable or beneficial at all to act upon. According to Deming (1986), 90% of the problems come from inefficient systems and processes and only 10% is due to people.

However, management at all levels – e.g. from board members to trade foremen – generally spend most of their time trying to improve the 10% (e.g. via motivation, teamwork, skills and capabilities) with little overall effect, when the same effort put into improving even a small percentage of the system (the 90%), could reap better and more immediate results and by default, help to improve the 10% attributed to people.

Most main contractors feel that the choice and type of clients are not within the company's control. This is mainly because without firm facts and figures, the industry is crossing its fingers and randomly hoping that they will encounter more "good" clients, or that a "bad" client can be managed better this time. Hope and gut feelings

based on experience are not valid strategies. A company may have 10 very profitable projects but 1 very bad project can sink the company. With facts and figures, main contractors can for example:

- Better steer their businesses by turning down a client or a type of project due to having a confident understanding of the implications and cost of risks involved.
- Be able to advise and steer clients in the right direction with facts and figures instead of relying on "the number of years of experience the company has".
- Decide if the company is into earning profits from variations or actual construction work.

With respect to the last issue, actually earning profits from variations is rarely the case (Tilley and Gallagher, 1999). However, with data, companies can bring what was previously in their sphere of concern into their sphere of influence (Covey 1989).

When measuring end user customer satisfaction, most companies use general customer feedback e.g. post contract reviews, which are very subjective and when used to compare project to project is equivalent to comparing apples and pears. This type of customer feedback is usually dependent on "mood", the relationships between key players and also who it is within the customer company, is giving the feedback – as personal agendas, individual expectations, knowledge of the project, etc., can influence the outcome of the feedback (Kärnä et al. 2004)

In line with lean's definition of value and waste (Womack & Jones 1996) when it comes to producing a product, lean services have their definition adaptation for services namely, value demand and failure demand (Seddon, 1992). Value demand is equivalent to lean's definition of value i.e. requests generating what the customer wants, while failure demand are requests generated as a reminder or due to not having done it right first time.

The construction industry deals with both products and services. In terms of product, we need to measure our performance in quality, cost, delivery and health and safety. In "NEXT" and end user customer satisfaction, there is a need to measure percentage value and failure demand. Understanding the type and cause of value and failure demand can give more reliable focus areas for improvement than subjective customer feedback based on "feeling". Value and failure demand can potentially let us know our customers better than they know themselves. It is management's duty to set strategic goals and help staff create fit for purpose "NEXT" customer measures.

In a survey of 100 contractors and architects, waiting for information was the second reason for delays and disruptions, coming after sequencing problems. (Horner & Duff 2001). Whatever the reason for the delays in information, most architects and some clients although knowing that this will cause losses in productivity on site, few are willing to act upon it. If the NEXT customers were to be identified right from the start and appropriate measures put in place (potentially triggering payment), the chances of delivering a project on time, on budget and to the customers requirement will be greater.

FURTHER RESEARCH

The next steps is to research how feasible and practical it is to measure and pay according to NEXT customer satisfaction (develop a NEXT customer type contract). The first author is embarking on a project to introduce systems thinking to a national construction company, investigating inter-departmental ways of assessing NEXT customer relations and measures. This may sound too challenging an idea to embark upon or implement immediately but all it takes is a few strategically positioned lean souls to challenge fixed ideas. We need to start investigating this opportunity one step at a time as recommended in continual improvement, NOT kaikaku, a huge leap, which gets mistaken for continual improvement.

To measure for the sake of measuring or measuring using recognized measures because every one does that, that is indeed the question. Considering current industry performance and current economic situation, do we have time to spend on wasted effort? Sink or swim, a dilemma? But as Deming proclaimed - Survival is optional!

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