

## **CASE STUDIES IN INNOVATION**

### **DEMONSTRATING EXCELLENCE THROUGH CLIENT ENGAGEMENT**

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### **ABSTRACT**

It has been acknowledged that the construction client has a crucial role to play both at the project and industry level. The argument however, is made that because construction represents only a small percentage of total costs of a business enterprise, traditionally the constructed facility is rarely regarded as integral to a profit making enterprise. The client is often reluctant to invest in new construction processes and technologies as the business case for doing so is not yet fully proven to them.

However, the counter argument is made that rather than being reluctant to invest in new techniques and technologies, the informed or intelligent client plays a key role in promoting innovation and idea generation in the design and construction phase, particularly where that construction would eventually house the client's core operation or would impact upon the success of future business activities (Lenard 1997).

Evidence has emerged that higher levels of innovation and productivity are achieved on projects where there is open communication between the client and the main contractor and their working relationship goes beyond traditional contractual boundaries (CII 1996b, Knott 1996) . The argument is subsequently made that there is a link between the input of the client and the relationship between the client and the main contractor.

Structural change in the support of research and innovation to all industries from the UK Government (DTI Innovation Report 2003) is also regarded as a driver for improving innovation. The UK DTI in line with other European countries has changed from providing specific sector support to a themed approach across the piece, therefore being able to support larger projects. Construction research in the UK averages £60m per annum, less than 1% of construction output. The main fund

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holders for construction research are the Department of Trade and Industry, ESPRC, ERSC. However, Business expenditure in construction research and innovation figures accord to the Office of National Statistics is typically £40M for the sector. “on the job innovation in design and engineering on problem solving is not recorded. However the UK demonstration programme suggests that since 1998 some £8 billion GBP of construction projects have recorded the business case for change and innovative business practices.

Therefore this paper discusses the role of client driven innovation, the business benefits of this process, and how the conditions are created for delivering innovation on projects in the UK construction industry. The study is based on research collected from 445 demonstration projects totalling £8 billion GBP and is based on the Constructing Excellence 2003 and 2004 reports (Constructing Excellence, 2003).

## **INTRODUCTION**

In 1998 the report “Rethinking Construction” (Construction Task Force chaired by Sir John Egan, HMSO, DETR 1998) made 72 recommendations to make the UK construction industry world class. The emphasis in the report was the performance of other industries and how these lessons could be translated into the construction sector. The way forward for the sector was five proposals that set out the conditions for Government, Clients and the Industry to interact in many differing ways. These were:

**Demonstration projects;** projects that demonstrated the business case for change and innovation in the UK construction industry

**Movement for Change;** [Innovation]; a non institutionalised group that facilitated the demonstration projects and the UK change agenda, set up in 1998 by DETR (Department of Environment Transport and Regions - dissolved in 2002, Construction transferred to Department of Trade and Industry DTI)

**Knowledge Centre;** The DETR was developing the Construction Best Practice Programme and this group fulfilled the role of providing a knowledge centre for the UK construction industry. Both The Movement for Innovation, the Housing Forum, Local Government Task Force and Construction Best Practice have merged under the umbrella of Constructing Excellence (Constructing Excellence, 2003).

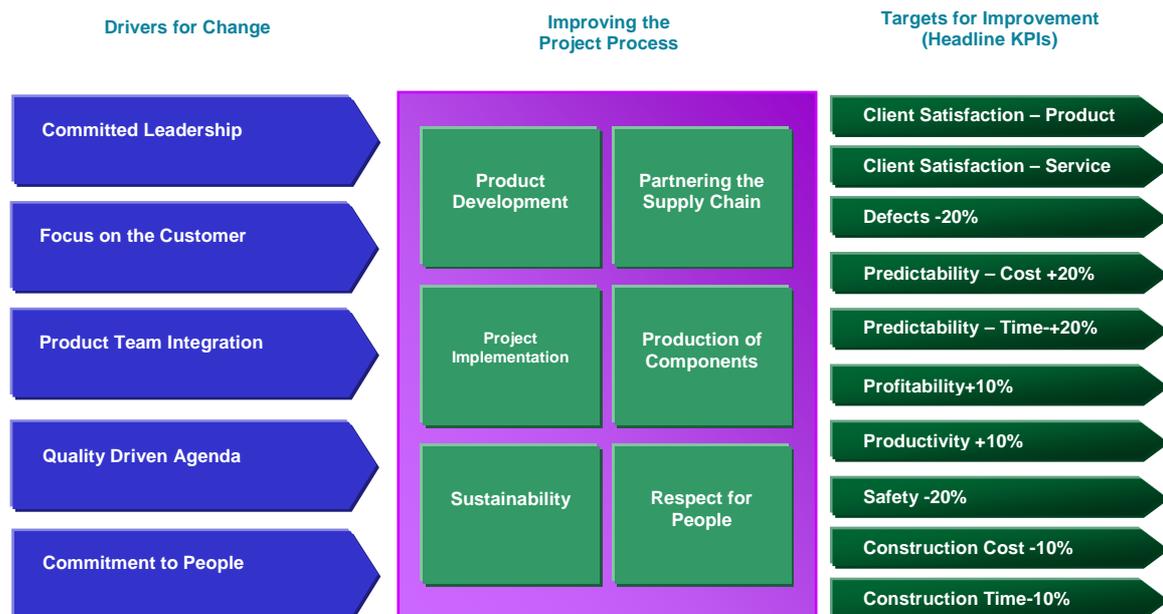
**Public Sector Clients;** As the Public sector is the largest client of the construction sector, the government delivered both the Government Clients Construction Panel, and Local Government Task Force to take leadership and promote innovation in the procurement and delivery of construction in the UK. The majority of innovative output is recorded in the demonstration project programme.

**Occasional Clients;** A programme for the occasional clients many of whom procure major projects; it was of concern to the task force that this level of activity would be excluded from the change agenda. A charter was created under the auspices of the Construction Clients Group ([http://www.clientsuccess.org/home\\_1.asp](http://www.clientsuccess.org/home_1.asp))

**Branded Products;** The Task Group felt that the industry must grasp the opportunity of improvement through specialisations and the creation of supply chains to deliver products for major clients i.e. the experience of getting well, rather than the hospital project as a driver for performance improvement.

The model for the UK construction industry is simply to create an industrial movement for change. Initially the target was for £500m, so that businesses, individuals and corporations could come together to share and learn best practice, and aggregate ideas on innovation based on evidence for bottom line improvement. All this was achieved through a Demonstration Project Programme now comprising 445 projects. The programme demonstrated innovation around the drivers for change, the key process and the targets as set out below

*Figure 1 Constructing Excellence Model for Change in the UK Construction Industry*



All UK based demonstration projects have delivered tangible improvements by implementing innovation in the above project processes, they have used cultural drivers for change with respect for people issues. All measured their improvements in relation to the above targets.

In a market where there is (at least in terms of perception) little competition, incentive to innovate or no risk of being globally challenged, it was largely the conditions placed on the sector by clients that led to such significant results. There are two distinct models, one based on cost predominately in the private sector, whereby lowest outturn cost is a key operating measure. However changes in the way the public sector was funded looking at value rather than cost and looking at whole life and the removal of the requirement of Compulsory Competitive Tendering allowed the public sector to look at tested and tangible ways of obtaining a value driven sustainable approach to design and construction. The primary measure for the public sector still remains return on capital efficiency, but with incorporation of a better understanding of value in achieving this efficiency. It is here that Constructing Excellence has helped to improve the competitiveness of the UK by:

- enhancing corporate competitiveness through business innovation
- improving service and product quality by measuring industry performance
- providing a business to business network

The May 2004 Report from the Demonstrating Excellence Programme continues to indicate that demonstration projects outperform the general construction industry in all but one of the key performance indicators. This has been a trend since the programme started in 1998. These projects have shown that they are safer, deliver better environmental performance and also are more productive and offer better services and products to clients. Generally these improvements are in line with the targets set up in the report Rethinking Construction (1998), with the result that demonstration is a vital driver for innovation, competitiveness and productivity improvement for the sector at large.

Some of the key findings are:

- **demonstration projects are more than twice as safe as the industry average**
- **demonstration projects are scoring more than twice the industry average in employee satisfaction**
- **productivity on demonstration projects is 65 % more than the industry average**
- **environmental performance is 40% more than the industry average**

The results show that the best are getting better, but most encouraging is the fact that the whole industry performance is also rising. Whilst there are many variances in projects and procurement routes, the common factor in the demonstration projects is direct client engagement and leadership and facilitation of innovation.

The Demonstration Programme has created the conditions in the UK whereby the construction industry, clients and government can come together to collectively improve performance through the sharing, learning of best practice and innovation.

A good gauge of industry improvement is client satisfaction and over the last five years the results show a steady increase in product and service satisfaction.

There has been a welcome increase in the number of firms reporting zero accidents.

## **RESEARCH METHODOLOGY**

The demonstration project process comprises the requirement to codify innovation through peer review. Each project has to prepare a case history and produce a set of Key Performance Indicators. The data from the demonstration project Key Performance Indicators and case histories is then compared to the broader construction industry.

The case histories investigate the following areas:

- the codification of the innovation
- the specific tangible benefits of the innovation
- the lessons learnt and recommendations for the future
- the performance of the project benchmarked against industry norms.

The data is collected and presented at peer review meetings where the knowledge is shared across the industry. The peer review meetings are cross-sectoral. The submitted innovations are scored by a peer group and in most cases by an executive board to provide a level of consistency. At this meeting we also record the peer comment and learning points for each attendee. Case studies are then derived from the data. This is how the knowledge is transferred across the sector, raising the performance of the participants.

The UK demonstration project process and Key Performance Indicator system is now being used to facilitate the sharing of knowledge across the world and compare relative progress. Constructing Excellence Key Performance Indicators are being used as the standard on which to base benchmarks internationally.

**RESULT OF CLIENT DRIVEN INNOVATION:**

The business benefit for an ongoing Demonstration Programme is clearly shown in the table below:

Demonstration Projects' performance 4 year average	Rethinking Construction Demonstration Projects (£7bn)	Construction Industry, as a whole (£70bn)
<b>Client Construction Cost</b> Demonstration project costs are <b>6.0%</b> lower than industry average	<b>Reduced client construction costs</b> from Demonstration Projects = <b>£420m</b>	<b>Reduced client costs</b> if one-third of industry take up = <b>£1.4bn</b>
<b>Safety</b> Demonstration project accident rates are <b>61%</b> lower than industry average. Estimates put accident costs across the industry at <b>8.5%</b> of turnover*	<b>Reduced costs of accidents</b> from Demonstration Projects = <b>£363m</b>	<b>Reduced costs</b> if one-third of industry take up = <b>£1.2bn</b>
<b>Profitability</b> Rethinking Construction projects achieve <b>2 per cent</b> more profit than the industry average	<b>Increased profit</b> from Demonstration Projects = <b>£140m</b>	<b>Increased profit</b> if one-third of industry take up = <b>£466m</b>

Source "Rethinking Construction Report 2003 ([www.constructingexcellence.org.uk/publications](http://www.constructingexcellence.org.uk/publications))"

**THE STUDY**

The aim of the overall study (part only is presented here) was to explore the role of the client and the contractor in promoting innovation and learning in the project and procurement process.

The projects described in the case studies reflect the clients' success. they describe how they did this by taking a team approach and by working with people they trusted and who shared their values rather than with people who offered the lowest tenders. This approach released value from the supply chain, and project costs were held without prejudicing success. Discussions were open and frank, with everyone realising that changes were to be expected and would require managing.

A set of common attributes was identified in the majority of projects. The attributes also delivered benefits in both positive and negative outcomes of a project demonstration.

These were:

**DRIVERS IN THE PROCUREMENT PROCESS**

This attribute encompassed the relationship between the client and the main contractor, subcontractors and suppliers in terms of the client's expectations of the contracted parties and the forms of contract that were in place (i.e. lump sum, design

and construct and any partnering arrangements). However in the majority of projects an overriding set of working principles was created by a statement of shared vision and values, this focussed the proactive attitude needed to make such improvements.

Typically the scope of the project allowed the team's role to explore any incentives to be put in place to encourage the supply side to make innovative contributions to the design, procurement and construction process. The incentive for the team to deliver improved performance was facilitated by two major factors, appropriate allocation of risk and often the concept of target costs and risk/reward mechanisms for project management

## **PLANNING AND COMMUNICATION**

Attributes included the significant extent to which the main contractor, suppliers and subcontractors were involved in decision making, project development and project delivery processes. A process of conflict/dispute resolution was installed on many of the projects to allow decision making to be made at the lowest level.

This finding was part of the examination of the systems and procedures put in place to facilitate communication between the client and the contracted parties. This examination also aimed to identify how improvements were incorporated into the procurement process; more specifically, whether such improvements came from the client, or whether there was scope for suppliers and subcontractors to provide input.

## **IMPARTING KNOWLEDGE TO THE PROJECT TEAM**

Particular emphasis was placed on the role of the client, in terms of creating a learning environment, applying knowledge to the site and the implementation of best practices. The transfer of knowledge from the contracted parties to the client was also examined in terms of how such transfer is facilitated and encouraged.

## **SUMMARY**

In summary we have investigated a number of projects, and to increase the likelihood of success we have identified a number of key attributes.

These are:

- quality based selection of the team
- target cost contracts/partnering contracts
- fair allocation of risk
- shared values
- dispute and conflict resolution
- effective planning and communication in the value chain
- the right people leading the project at the right time
- quality driven approach to information and material streams
- value engineering and value management
- stakeholder participation
- key performance indicators
- review and improvement processes

### **Case Study #1**

#### **Blackpool Borough Council- St Stephens Avenue Coastal Protection Scheme**

When Blackpool Borough Council decided to adopt the principles of Rethinking Construction, they realised that they had to ensure that their construction work provided the best quality and value for money for the residents of Blackpool. Their long journey began in 1998 when they set up a working party to evaluate the Report "Rethinking Construction with the eventual conclusion that the Council should "embrace the Report's findings".

This then led the Council on an awareness raising programme that took in meetings, seminars and conferences involving the likes of Rethinking Construction, the Movement for Innovation and the Construction Best Practice Programme. In order to put the principles they had learnt into practice, the Council decided to adopt one of their projects as an M4I demonstration project and, in August 2000, the St Stephens Avenue Coastal Protection Scheme - a project for the reconstruction of time-expired concrete coastal defences - was chosen.

The Council, through Technical Services, was determined that any new systems and methods that were to be adopted would be "robust and transferable" to all future work done by all Blackpool Borough Council departments - "A Better Way" - and some of the key lessons learnt are as follows:-

#### **A new procurement strategy with selection on the basis of quality.**

The first stage for Blackpool Borough Council and Technical Services was the development of a procurement strategy that made selection on the basis of quality and not on lowest cost. In the case of the St Stephens Avenue contract, price negotiations were to take place after the selection of a successful partner. As funding for the project was coming from both the Council and DEFRA - both of which organisations have rigorous audit systems - any new way of procurement had to have clear selection criteria in order to demonstrate that best value had been achieved.

Nine contractors were initially invited to make early submissions giving details on:-

- recent work (for references)
- financial information (on the contractor)
- recent experience and capability
- health & safety
- quality management
- staff
- subcontractors and suppliers
- environmental policy

As a result of the above, three contractors were then invited to make separate, scheme specific, formal presentations that covered the following:-

- Quality
- design & construction planning
- health & safety
- resourcing & partnerships
- risk & value management
- quantification & pricing
- conditions of contract
- environmental measures
- benchmarking & performance indicators

- financial controls

The presentations were assessed by Technical Services using a matrix scoring system with Birse Construction achieving the highest score and, subsequently being recommended as the Council's "Construction Partner" for the St Stephens Avenue scheme.

Blackpool Borough Council considered that it was important to have a clearly defined contract that all potential contractors agreed to and bought in to - the main criteria being that the contract used would work on all future projects as well.

After considering various standard contracts already available, Technical Services eventually decided upon the NEC Option C X12 Partnering Agreement (June 2001) as being the most suitable as it enabled true partnering and provided incentivisation for the contractor, the supply chain and the client whilst providing a ceiling of certainty to the contract in the form of a maximum lump sum price.

Having selected the main contractor there was still a lot of hard work to do before construction work could begin on the project. Perhaps the most significant difference in the way that Blackpool Borough Council developed this method of procurement was in the open and frank discussions that took place at this early stage which enabled problems to be resolved amicably prior to commencement of the work.

Past experience had shown that such early resolution of problems ensured that "entrenched positions" were not likely to be adopted during the construction phase. Additionally, integrating the team early enabled value to be maximised through a combination of buildability, value engineering, design enhancements and risk management using the experience of the whole supply chain.

### **Contract value**

The next stage for Technical Services was to agree the value of the contract. Value for money was guaranteed by analysing previous similar contracts and extrapolating the tender costs of the competing contractors to obtain a benchmark cost for the St Stephens Avenue project.

After a period of negotiation, a guaranteed maximum price was agreed upon by Technical Services and Birse and, as part of this procedure, a "gainshare" agreement was also struck whereby any costs above the guaranteed maximum price would be met by Birse and that any savings made below the maximum would be shared by Blackpool Borough Council and Birse on a percentage formula. After agreeing the value of the contract a Value Engineering workshop was held involving project staff from Blackpool Borough Council and Birse, where the whole scheme was reviewed. After an assessment of cost, time, practicality and whole-life issues, several items were considered and built into the project.

### **Measurement and Key Performance Indicators**

Measurement and benchmarking were a key part of the St Stephens Avenue scheme – not only were they a method for driving continuous improvement throughout the supply chain, but also satisfactory KPI achievement was used as a measure for the amount of any earned saving share-out between the client and the main contractor.

### **The lessons learnt (so far)**

Now that the St Stephens Avenue Coastal Protection Scheme has reached the construction stage, it is worthwhile considering the lessons learnt so far. The change by the Council to this new style of working has not been a short one. It needed considerable planning and the involvement of all relevant stakeholders within the Council. A clear auditable procurement policy was necessary to show that best value was obtained without recourse to lowest cost.

The NEC Option C XI2 Partnering Agreement (June 2001) provides for partnering and gainshare through-out the supply chain. It is wrong to think that the selection of the contractor is the end of the hard work. The selection of the contractor was followed by a period of tough but open negotiations before the commencement of work. This enabled problems and issues to be aired at a point when changes were far easier to implement. It also meant that the quality of the construction could be maintained at an appropriate standard, with cost efficiencies also being maintained. A process of value engineering is an integral part of the procedure so that all members of the supply chain benefit.

Benchmarking is an important tool that can be used for continuous improvement and as a performance indicator upon which gainshare can be made dependent. Finally it is worthwhile adding that the project teams have found working in this way a more rewarding experience which they feel will continue to benefit all parties in the future.

## **Case Studies#2**

### **Project Aquarius**

Project Aquarius is a series of civil engineering infrastructure projects carried out by Water Service Northern Ireland. The projects entail pipeline laying, water treatment works and various reservoirs and infrastructure modifications. The driver for the project is the European Waste Water Directive, along with the need for strategic upgrading of the water, waste treatment and distribution in the province.

The client in this case is a central government department who has been a traditionally conservative procurer. We use the term conservative due to the recent past of the province whereby project procurement needed to assure adequate equality, and whereby rules and regulation tended to preclude much innovative client practice. However as a result of a secondment to the UKs, the Government Clients Construction Panel (GCCP). The GCCP is a panel of central government clients who met and devised a series of policies and guidance notes on new methods of public sector procurement. It was noted by the client of the project that aspects of traditional procurement practices could be changed to encourage innovation and collaboration whilst retaining the need to ensure equality. (Due to the troubles in NI, equality in the selection of personnel had to comply with local byelaws, section 76)

### **The Tendering Process**

To facilitate innovation, the client started with standard target cost contracts based on the NEC option C form of contract. After several contracts the client needed to ensure that transaction costs were kept to a minimum and that the time to “dig” from tender was also shortened to meet with the client’s many programmes of work. Typically the process to get to tender stage took many years so a procedure to speed up the delivery of projects was needed. This approach was facilitated by a framework agreement. The framework is essentially an umbrella agreement and protocol document that allows a series of construction projects to be delivered without

unnecessary bureaucracy. The frame-work is a quality based procurement and selection tool, its primary purpose is to short list supply chains for project delivery. The tendering basis was 85% quality 15% cost. The client uses the quality based selection methodology after deciding, in each case the necessary requirements and objectives of the project. The supplier is then given the opportunity to bid in a process which is designed to align competencies and values in the prospective supply chain. Project execution, in this scenario is based on an ongoing continuous improvement programme ensuring best value for money is derived, and that financial probity is adhered to without the need for subsequent tendering processes.

### **Client Innovation**

Through the process of selection the client identified a number of key traits required from the supply chain. The client investigated key statements from the suppliers and scored them on their ability to innovate in terms of business and technical matters.

Most significant of the many improvement techniques is the use of **value management & value engineering**. This activity was delivered in a series of workshops. Also some areas of integration & synergistic partnerships were resultant as part of this process.

Stake-holder buy-in at the time of the individual project value engineering exercise is crucial to ensure perceptions and expectations are clearly obvious and considered. However, the improvement processes plateau after several iterations of the project process.

The client needed a new focus for the delivery of the projects which improved performance of a sustainable basis.

The uses of the tools from the other sectors were transferred into the client organisation and principle contractor. The primary tools were:

1. creating the conditions for innovation
2. tools for developing systematic innovation
3. tools for development of the supply chain.

#### **1. Creating the conditions for innovation**

“Project Aquarius” is a brand that builds together the values of the team. This allows most teams to be able to focus on the delivery of the projects. Appropriate risk allocation in most instances now lies with the client who in most circumstances, is best placed to manage risk.

A values workshop for each project was held and looks at key policy deployment issues. This delivered targets for financial benefits, productivity and heads of agreement.

An empowered team able to deliver innovation within the parameters set out within the scope and Heads of Agreement.

A contractual frame work providing for the setting of a fixed scope and cost to ensure quality and predictability. Overheads and profits are dealt with under the auspices of this frame work. Costs and scopes are then engineered to deliver full functionality at the best costs using a must, should, could and would selection process. The client

leads the stake-holders in these exercises and all agree as to the way forward thereby facilitating an environment of innovation.

A series of interdependent delivery teams were set up to focus and co-ordinate costs, information and interfaces in order to help the delivery of innovation and cross functional working.

The team applied new tools from other industries by the client as a result of Constructing Excellence's innovation and business development clusters;

These were:

- workplace organisation (Masaaki Imai, Gemba Kaizan 1997)
- value stream analysis (Seeing the whole, Dan Jones and Jim Womack)
- triz – theory of inventive problem solving (G Altschuller, and suddenly the inventor appeared 1996)
- production control (Last Planner, Lean Construction Institute, Glen Ballard, Greg Howe) (Critical Chain Scheduling, Dr Eli Goldratt)

Tackling people issues such as team effectiveness, process improvements and the way the teams are organised. The client codified this into a route map for success.

Aligning vision and values across the value chain and policy deployment, getting the message across in terms of targets and improvement teams were foundation stones of creating the conditions for innovation. Policy deployment gave the compelling need to deliver change in process thinking.

## **2. Tools for developing Systematic Innovation**

The client implemented training in the use of value stream analysis, in particular the Toyota based tool of process activity mapping.

The client mapped the time value is added [value add] in relation to the total time spent by objects flowing through a process. Records show that use of this tool has helped others make sustainable improvement decisions for over several decades.

By continually measuring the value add in objects, information and people flowing through processes, a factual base line about performance is established and from this continuous improvement targets could be achieved. Typically doubling of production could be achieved from the result of this process.

The client measured value add in the concrete, rebar process, the notion is that both processes were thought to be quite productive, however using process activity mapping they found that efficacy was as low as 4%. By improving the layout and innovating in the tying of rebar they managed to make a 75% increase in the pours that could be achieved in a day.

The tool used, quantifies and visualises waste in process in a graphical format thereby allowing easier diagnosis of where areas for improvement lie.

Supplementary tools were used such as Workplace Organisation Techniques such as 5S to ensure standards were maintained and improved.

Production control was the next area where big losses were identified. Up to 50% of time is typically added as safety in general construction timeline. The use of Critical Chain Scheduling and Buffer Management, aided in the control of interfaces and communication and reduction in the programme through waste minimisation.

Currently the programme is 10% ahead of time with zero losses for quality and 20% under budget, saving several millions of pounds.

### **3. Tools for development of the supply chain.**

The team, once grounded in the concepts and the use of the above mentioned tools, looked at supplier development as an opportunity for further savings on the project.

The contractual arrangement for the supplier [Steelwork fabricator] was in essence a mirror of the target cost arrangement. The problems facing the site were predictability issues regarding delivery and satisfactory cost management. Cost issues internally were due to increased costs due to overtime, this was factored into the price to the main contractor.

The team carried out a process activity map and work place organisation survey and delivered a £30,000 saving to the contract and increased the capacity of the factory so that overtime was reduced to zero.

Delivery was improved due to much more predictable process based on understanding work flow through the factory.

### **Commentary**

Much of the paper addresses the way relationships have changed and how the suppliers are satisfying clients demands for change. This final commentary addresses the future and the need for technological innovation, indeed this was a feature of the longer term improvements in case history #2

Many construction contractors agree that there is a significant need for improvement, particularly in the areas of efficiency, flexibility and management practices. Certainly, over the past ten years, the construction industry has been forced to address a variety of issues as they have acquired greater industrial, organisational, legal and commercial importance. The construction market in general is becoming more competitive as firms are required to exhibit a level of organisational, technical and commercial sophistication not previously envisaged. Construction facilities are becoming increasingly complex, demanding greater technological sophistication to build them. The ongoing change requires extensive supply reorganisation and (Office of the Deputy Prime Minister, MMC, Modern Methods of Construction) MC just to deliver the required volume of dwellings and infrastructure requirements for the UK. To get a scale on this viz. 30,000 new homes per annum in London alone up to 2016. Clients are demanding 'more construction for their money' in a number of spheres, from the purely financial to the environmental. These factors necessitate change and place a new emphasis on the need to increase the industry's capacity for innovation. This can only be done if the client demands improvement, measurement and improvement in the value add component of process performance.

However, while improvements have been made in some areas, there is a general concern that if systematic change is not being achieved that the aforementioned small gains will be lost once industry activity continues to increase. The next wave of industrial development will necessarily incorporate the adoption and utilisation of

innovative technological processes and developments, and see the emergence of highly responsive organisations capable of exploiting transient and niche markets. This polarised environment (Rethinking Construction 7<sup>th</sup> Target “improve turnover and profits by 10% on the preface of industry reorganisation) demands a responsive and dynamic construction industry with the diversity to cope with and initiate change, that is capable of employing a range of approaches to the procurement and delivery of construction. This will necessitate a much stronger emphasis on innovation than ever before.

The question as to why the construction sector (demand) has not taken up such technologies needs to be addressed. Quite simply it may be down to lack of competition in the UK marketplace. For a construction organisation to commit itself to the use of advanced technology over an established practice it must be seen to benefit the construction process in at least four areas, ie the project objectives, expected benefits, risk and liability (insurances), and cost. The project objectives and technical requirements set basic criteria for acceptance of the final product and selection of a method to produce it. The expected benefits include competitive advantage in winning the job and performance advantage in decreasing costs and schedules, with resulting improvements to profitability. Further, the new technology must be proven to out-perform existing technology.

Unfortunately, new technology rarely satisfies such exacting criteria immediately. Often, it has to be tailored to meet specific needs or environmental conditions, and staff must be educated as to its use (processes which may take considerable time and resources). These factors, combined with the absence of reliable templates against which to cost new technology, have meant that the construction industry has been slow to invest in this area and as a result, has not reaped the benefits such technology has furnished in other industry sectors. However the West's drive for innovation through technology needs to be accepted cautiously, simply the business model for the sector needs to be reviewed and passed before technology takes hold.

There are several structural problems that exist within the construction industry due to lack of competition. The construction industry's inability to measure and improve “value add” when compared to world-class organisations. If this simple process was driven by clients the improvement potential would last for upwards of 40 years, viz Toyota cars and most likely reduce the perceived skills deficit to oversupply in less than 3 years.

If the industry is to adopt a more innovative stance, then it is imperative that it explores the use of advanced technology and incorporates the need for such exploration into the planning process. Construction plans and budgets must recognize the start-up costs of new technologies. This includes the cost of hardware, parts, technical support and training for the new operation and the possible lower production and productivity of the new method during the start-up period. In other words we need to set projects up as a business and balance the capital investment to labour ratio.

## **Innovation**

Through the programme of demonstrations, Constructing Excellence is proving that construction projects procured and carried out through integrated techniques achieve:

- better quality
- fewer accidents

- increased productivity
- a staff turnover that is three times better than the industry
- A more qualified and highly satisfied work force.
- Completion in less time than the rest of the industry that is still dominated by those using traditional techniques.

In spite of this evidence many construction clients continue to favour the traditional method of segregated teams. This is an inefficient way of working, typically less than 1%.

Although profitability on demonstrations has remained consistent, there still remains a challenge to the industry to turn competitive advantage into improved profitability. However it is clear from the figures that many organizations are investing in the long-term and also many are involved in the early stages of frame-work agreements, which requires upfront investment.

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