2001 Skills Foresight

The skills for the future of construction

Index

1 Executive summary

In the summer of 2001, we met with groups of senior managers from the industry to discuss the future of construction. The 85 delegates who attended seven workshops were drawn from public and private sector clients, contractors, professionals, suppliers and sub-contractors. Some of the workshops consisted of delegates from just one of these groups, while others contained a mixture. This report sets out their views of the future of the construction sector and the skills and changes needed to take us to that future.

1.1 The construction industry of the future

The construction industry of the future will be shaped by seven key stimuli: client demands, the economy, government intervention, construction methods, a need to improve the welfare of employees and the supply of appropriately skilled labour.

Clients will push for greater value, better predictability, higher performance and a more effective relationship with all the 'players' in the sector. Large clients will achieve this through different methods of procurement that require partnering, two stage tenders and alliances of suppliers. Smaller clients will achieve this through more careful vetting of tenders, potential suppliers and contractors/sub-contractors.

The economy, whilst showing greater stability overall in the last 4 years, varies across regions and sectors. **Over the next three to five years, the commercial sectors will slow and public sector works will increase**. Even where growth in volume is strong, the client's focus on value and increasing costs will put pressure on margins. Shareholders expect high returns - and the construction sector will be forced to engineer cost out of the process, adopting new commercial and construction practices.

Government will intervene in several different ways. As a client and investor, government agencies will demand new procurement approaches where risk is shared and value guaranteed. Government at national, regional and local level will look to the construction sector to help generate employment, wealth and the infrastructure required to deliver the improvements in public services promised in the 2001 election. Through legislation, they will specify working conditions and seek to influence the welfare of staff. As a planning authority, they will influence the nature and volume of future development preferring re-development of inner cities to create in particular the required quantities of new housing.

Construction methods will change slowly with the biggest focus on offsite manufacturing and modular construction. Where this is being adopted, it is working well and solving some of the long-term skills difficulties of the sector. The rate of change in building methods is inhibited by the reliance on existing skills and proven methods and a reluctance of the client to accept innovative solutions.

Creating site conditions that are safe, pleasant and attractive to a socially diverse workforce is difficult but essential if the sector is to attract the right people in the volume it needs. Demographic trends will reduce the labour supply at all levels and only those industries and companies that can offer challenging careers will attract the brightest and the best new people.

Skills and labour shortages will persist, forcing companies to apply less labour intensive approaches to building and employ a flexibly skilled labour force.

1.2 The successful construction company of the future

The successful construction company of the future will:

- **Develop on-going relationships** with clients that focus on delivering best value measured across the whole life of the building.
- **Rely less on the existing claims culture** - instead sharing risk and reward with clients and suppliers
- **Maintain an ability to switch between market segments** by creating alliances with a range of different companies thus allowing it to adjust its core competences as one segment shrinks and another grows.
- Either manage teams of different specialist contractors or be able to provide services as part of a team.
- **Exploit the skills of the supply chain** by ensuring early involvement of all partners (from architects through to waste management companies), transparent and open communication and fair and equitable contracts.
- **Re-engineer its approach** to building to take out cost and the need for labour by making best use of modular construction, offsite manufacturing and mechanical handling.
- **Create a working environment** that does not exclude large segments of the workforce and that offers a safe, interesting and long-term career to both craft and professional staff.
- **Have an efficient and flexible work force**.

1.3 Can we deal with this future?

Consultation with industry suggests that the focus is on changing relations with customers rather than changing the way we build. The focus on the commercial relationships with clients appears to be absorbing most of the management time, with less progress on the way buildings are constructed.

This focus of time appears well spent. We asked senior managers from across the sector and from clients to rate its ability to deal with change. Creating partnerships emerged as the change that the sector felt most able to deal with.

Factors the sector feels confident that it can deal with

Other factors the sector as a whole is confident it can deal with are international competition and ‘green’ concerns.

Factors the sector feels it is less capable of dealing with

The sector feels that it struggles to deal with:

- Attracting and retaining people
- National economic change
- Changing client demands
- Government legislation
- Changing technology and methods

These “difficult to deal with” factors are also those that are driving change. The delegates felt less able to deal with the factors that are creating the most change.

The construction industry cannot move into the future until it fixes the present (and the past). We saw, from this consultation, significant disparities between what clients wanted, saw and did and what the contractors and supply chain wanted, saw and did. This mismatch is

both significant and material; i.e. until the sector gets to grips with it, the status quo will be maintained.

1.4 The top skills changes

For senior managers

- Long term planning based on economic and market analysis
- Identifying and establishing suitable partners and alliances
- Building up a strong network of suppliers/sub-contractors to deliver construction programmes
- Communicating a clear vision of the industry and the company to shareholders, government and potential employers
- Being aware of current and emerging legislation relating to working conditions, the environment and new forms of contract
- Changing the company culture to offer a long term and rewarding career to those joining the company.

For business developers

Everyone responsible for business development needs to extend their skills in communication, managing client expectations and the use of information technology to aid visualisation. In large firms, business developers will need skills in market analysis, understanding new ways of procurement, risk analysis and business case preparation. In small firms business developers will need better problem solving skills, new construction methods and being able to identify partners.

For professionals

- Understanding all aspects of the construction process
- Cost analysis and modelling
- Facilitation and communication
- Risk assessment for financial, technical and regulatory factors
- Identifying suppliers and specifying pre-fabrication methods
- Logistics, project management and scheduling

For site managers

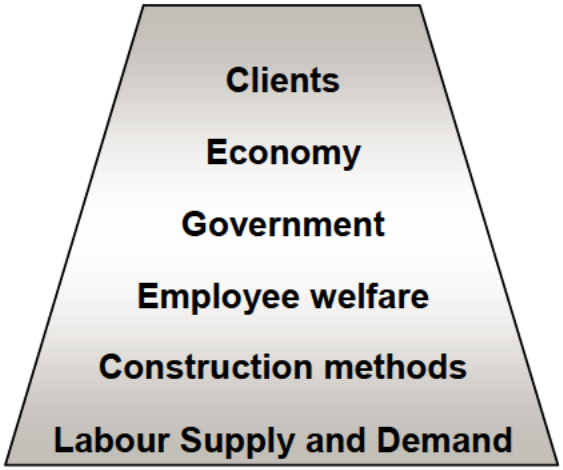
- Supply chain integration – managing a team of diverse suppliers
- Logistics and planning
- Re-engineering the construction site and process
- Waste management
- Quality control
- Training and communication
- Understanding and interpreting legislation

2 What is driving change?

Senior managers and directors from both clients and contractors report that the construction industry is changing because:

- **Clients** demand it to do so
- The **economy** creates new opportunities for buildings or increased foreign competition that threatens UK builders
- **Government,** at all levels, imposes legislation on construction markets
- New **construction methods** and technology create opportunities to do new things with the built environment
- Improvements in employment conditions and **welfare** of employees demand new approaches to management and construction
- The supply of and demand for **skilled people** changes the flow of people into the sector.

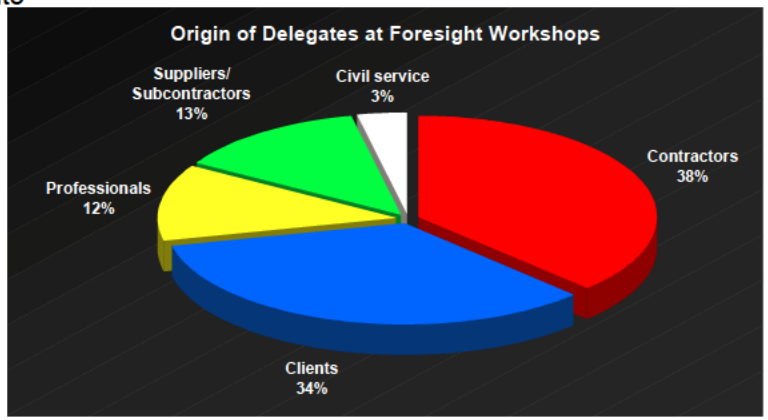
The change drivers



In this report we analyse the impact of each of these drivers on the industry, identify what will change and assess the skills needed to deal with these changes.

We draw on structured discussions with companies and organisations from the whole of the industry. In July 2001 we met with senior directors from 85 companies and discussed with them the future of the construction sector. The companies represented large and small organisations; they were drawn from clients, contractors, professionals and suppliers; they were a mixture of public and private sector, owners and directors, construction specialists and generalist managers. Government departments were represented by officials from DETR, MoD, DTI and NHS.

Whilst the sample size was small, the value of contracts let by the clients and contracts delivered by the contractors make up a significant proportion of the industry's £58bn output.



3 The good, the bad and the need for change

We asked our panels to list what was good and bad about the industry. From this we identified the things most in need of change

3.1 The good

A changing supply chain

Clients and the industry are driving change. Client pressure for better value, more predictable costs, reliable quality and fixed completion time. The response of the industry to these demands is high on most people's list of what is good about the industry. (Equally, the rate of change is high on many clients' list of what is bad).

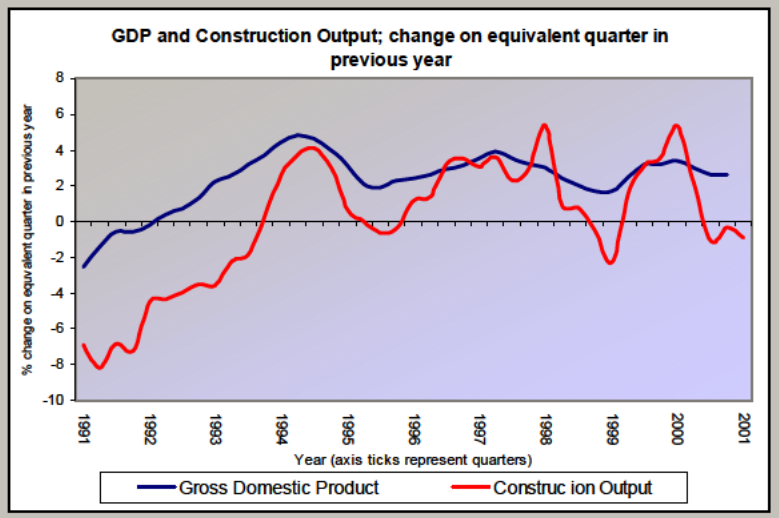
Much of the change required by clients precipitates changes in procurement techniques and more constructive relationships in the supply chain. Partnering and procurement frameworks manifest clients' focus on value and desire to minimise risk.

Stability in the economy

A more stable economy over the last five years has seen growth in the construction market.

The graph shows the National Statistics for year on year change in GDP - a whole economy indicator - and the similar trend in construction output. The graph is plotted using quarterly data, and covers the last decade. The key characteristics noted are:

- High and stable growth in GDP over the decade, and net growth in construction output over the past six years after serious attrition in the first four years.
- The trend in construction output growth has been considerably more erratic than that in GDP, with a tendency to peak shortly after GDP, then undergo a rapid contraction.
- The output of the construction sector is clearly strongly linked to the buoyancy of the general economy



This growth in the economy creates a need for construction that creates jobs and wealth. This virtuous circle has driven the sector to become well capitalised, commercially aware and competitive.

The contribution of the industry

The industry makes a significant contribution to the UK's economic and cultural life. Our panels reported that not only does the industry create fine buildings it also offers employment to 1.4 million people; provides varied and well paid careers to professionally qualified staff; is flexible and adaptable; can work on low margins; has a strong international reputation; it recognises its weaknesses.and is making a great effort to change; and

An improving place to work

The panels recognised the poor health and safety record but commented on the efforts to improve the health, safety and welfare of its employees as a positive feature of the industry. The provision of training to improve career prospects, to improve site conditions and reduce accidents; and the variety of work were all given as positives for joining the sector.

3.2 The bad

Supply chain weakness

Despite the ambition of some to change, employers reported continued weakness in the ability of the sector to satisfy the needs of clients.

Clients complained of poor communication; lack of team working, poor coordination, lack of whole life costing, insufficient pre-site planning, un-professional management of subcontractors and a reluctance to change.

Construction companies complained of unadventurous clients with unrealistic expectations and poorly specified requirements.

Specialist contractors complained of lack of access to the team, poor teamwork, an inability to recognise the needs of suppliers and over-bureaucracy.

The claims culture, use of retentions and delayed payments is still a major source of weakness and poor relationships.

Our poll of attitudes showed wide divergence in opinions of companies from different parts of the supply chain.

Market and economic weaknesses

The continued low margins in the sector coupled with fickle loyalty, insecure workload and the client need for the lowest cost is still driving down investment in both skills and new construction methods. Even with increasing workloads, contractors do not predict strong margins.

Construction methods

Suppliers to the industry saw it as unreceptive of new ideas and stated that it was always re-inventing the wheel rather than looking for a proven modular approach. There is low investment in research and development and high waste.

Image, welfare and skills

The construction industry is not seen as exciting and dynamic and as such is not attracting new entrants at all levels.

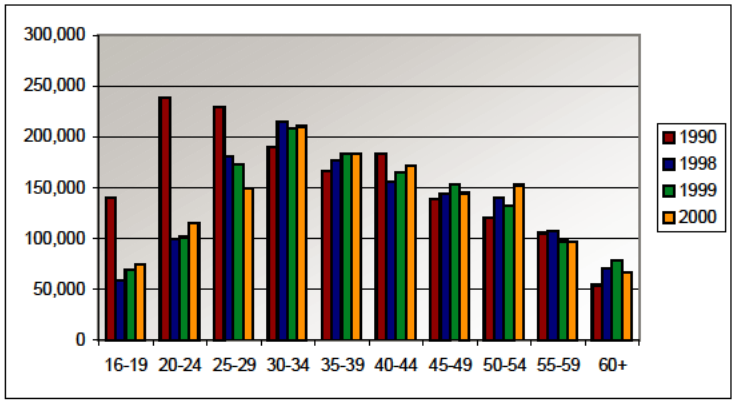


Figure 1: Age structure of the construction industry - manual workers

One effect of this is illustrated in Figure 1, taken from the CIB/DETR 'State of the Construction sector". It illustrates the 'greying' of the industry since 1990 – The number of 16-29 year olds in the industry has decreased by around 250,000 over the decade, causing a shift in the median age range from 25-29 to 35-39. This could present skills shortage difficulties in the future unless the industry's requirement for labour decreases.

Contractors feel the sector is poor at promoting itself and as a result has a low public image. Professionals were more damning in their comments, feeling that the sector is "dirty and does not look after people". There is a strong consensus that until the image of the sector improves it will not attract the brightest and the best into management roles and will not attract labour into craft roles in sufficient volume to deal with rising government spending on infrastructure.

A major part of the image problem is the reality of conditions on site and the lack of a career path. The pay structure and career opportunities for new entrants are not felt to compare with industries in Information Technology and the service sectors. The safety record of the sector was reported by all groups as a major disincentive to join the UK construction industry.

The groups reported that the impact of poor image and low welfare is a lack of trades-people and professionals.

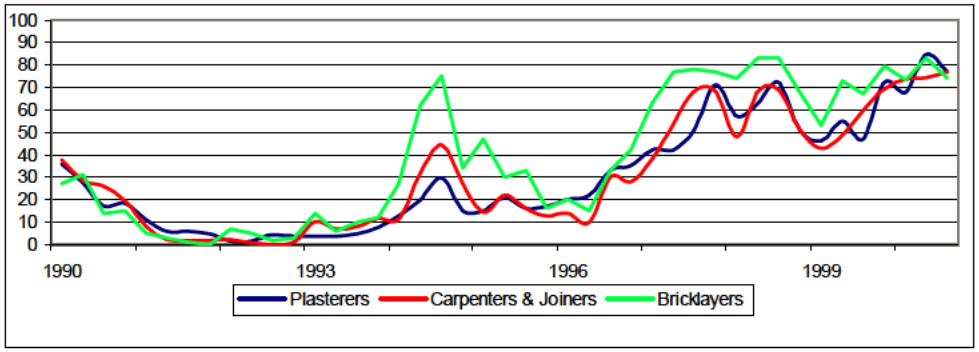


Figure 2: Percentage of companies reporting difficulty recruiting in key trades 1990-2000

Figure 2, compiled from CITB data, and cited in the CIB 'State of the Construction Sector' shows the trend for three important trades. For the early part of the decade, when the sector was in decline, there was oversupply in the trades, and considerable unemployment. As the sector returned to prosperity, labour shortages increased; the current situation has 80% of companies reporting recruitment difficulties in these trades.

3.3 The need for change

By simply counting the number of bad points (119) stated by attendees and comparing it with the number of good points (64) we can see the level of change required. ***The sector must fix the present before it is ready to move into the future***.

The areas where most change is needed are:

Supply chain integration – the whole supply chain must be involved in the delivery of best value and lowest lifetime cost of the building.

Procurement relationships – the whole supply chain must move towards relationships that allow for a more certain future, if investment in technology and people is to increase.

Construction methods – the adoption of new methods and techniques must engineer cost out of construction and engineer in reliability and better working conditions.

Image, welfare and skills – the sector must create conditions that attract and develop the right people in sufficient volume.

Our discussions reveal that there is a desire for change and an economic imperative to do so. Nobody at our meetings doubted the importance of changing the relationship with clients, and the whole supply chain; whether this is through the major players' ability to enter into public private partnerships or for a small local building firm to better serve the community. The suppliers and professionals who attended had a vision of technologies and construction methods that are unaffected by weather, safe and that do not require a gang of fit young men to assemble.

Few of the attendees would encourage their children to enter the sector yet it appeared that most had made (or were making) good careers from it.

The opportunities created by the UK government's strategic review and its focus on delivery will place heavy demands on the sector in the next 5 years.

However, the sector resists change. Our consultations suggest that the brave new worlds painted by Egan and Latham have yet to appear on the horizon of many firms. Innovative construction methods and a socially inclusive sustainable construction sector are, for many, too far in the future to even make it to the boardroom, let alone the construction site.

Resistance to change is partly caused by skills gaps and in the next section of this report we outline the skills for the future that will over come some of this resistance.

4 Making change happen

We asked our panels of clients, contractors, professionals and suppliers to consider what might change and what skills are required to make that change happen. The results are a mixture of fixing the present and solving the future problems of the sector.

4.1 Changes driven by clients

Future client needs

"Clients will seek solutions not construction services"

The meetings suggest little change in what clients want. They continue to demand more reliable buildings – on time, on budget and without defect – at the highest possible value.

Interestingly the majority of client driven changes related mainly to the problems of the present. We did not receive comments about functional improvements in buildings, multiple use buildings, climate control systems, environmentally efficient structures or extending the contractors' role to facilities management. This suggests that the construction industry must solve the problems of perceived low value and late delivery before clients will move on to demanding more innovation in building.

The client needs …..

One retail client reported judging the contractor by monitoring the impact their work had on sales per square metre, before, during and after a refurbishment. To achieve this required that the contractor and client exchanged staff. For a domestic contractor the same applies – 'is the new kitchen easier to use or not?' is the criterion for most householders.

Cost down and best value are the first concern in both public and private sectors. Secondly, delegates reported a need for increased skills at all levels. There is particular emphasis on safety, which is beginning to manifest itself in the certification of skills. Thirdly, clients will expect their contractors to have a greater understanding of their business. The client will specify what they want, not how the contractor should do it. The client may not in the future employ a team of professionals instead demanding a complete solution from the contractor.

The implications of this change

Typically, the larger clients are trying to address the issues of value by changing the way they procure major construction programmes. Much has been written about Private Finance Initiatives, Public Private Partnerships and other procurement approaches.

The government's SR2000, strategic review launched in June last year set out government plans for the period 2001-4, forecasting real spending increases in virtually all areas of government activity, including average increases of…

- Inflation + 5.4% a year in UK education
- Inflation + 20% a year in English transport
- Inflation + 4.2% a year in criminal justice (Eng/Wales)

Currently the ratio of PFI to traditional procurement methods in large government contracts is approximately 3:1 in favour of PFI. The long term trend away from traditional methods is likely to continue, and the sophistication and consistency of these methods is likely to develop. The table below presents the number and value of PFI projects current at the time of the most recent DLTR Construction Annual.

Department/Agency	Number of projects	Value of projects (£m)
Health	155	4,420
Education	73	N/A
Highways	11	1,099
Environment	29*	12,599

The cost and risk of these approaches means that they are only suitable for larger players or consortia of medium players. The industry will consolidate to accommodate this and create the larger companies capable of entering on the PFI and PPP frameworks. For companies operating in one-off contracts there still needs to be greater coincidence between the client and the contractor agendas. Client communication and expectation management are central to making this change happen.

The desired effect of these procurement styles is to change the relationship between the companies in the supply chain. It is intended to engineer a more open supply chain that shares risks and is more integrated. But what does this mean? More open means that the whole of the supply chain (from design to demolition contractor) are involved in the early stages, have equal access to information and are called on to provide expertise when it is needed. The team will be formed before the business case and not disbanded until long after the building is operational. Sharing risk means that the whole of the supply chain takes the reward if things go well and the cost if they don't. Greater integration means less demarcation where suppliers understand each other's core strengths and play to them. Companies will perform as a team rather than a bunch of increasingly unimportant subordinates. Professionals will integrate into the procurement process. Alliances of small specialist suppliers and consortia of large organisations will be created to bid as long term suppliers on framework agreements. So-called virtual teams will come together to deliver contracts and perform to supplier frameworks.

There needs to be better communication; clients need to be made more aware of the implications of their request and contractors more active in suggesting solutions and alternative methods.

There will be a blurring of the disciplines and earlier involvement of professionals in each construction contract.

The measures of success will not only be 'on time and on budget' but the amount of profit shared and the long term running cost of the building. There will be a degree of protected margins as greater certainty of forward business creeps into the industry.

The client focus on whole life costing will increase. This is not only in large public works but also small one-off contracts.

To work, partnerships require equality throughout the chain and a move away from the attitude of "we are partnering – you are taking the risk". There needs to be long term commitment, trust and communication throughout the supply chain.

Where are we now?

It is evident from discussions that this ideal is still some way away. The "honey pot" sits somewhere between the client and the prime contractor. As one moves further away from this honey pot the case for partnering weakens. Those specialist suppliers at the bottom of the supply chain generally see little openness, are rarely involved soon enough and are expected to take most of the risk at the lowest possible cost. ***Until the risk and reward is shared fairly down the supply chain then partnering is unlikely to go beyond rhetoric for the majority of companies***. Equally for the one-off buyer, partnerships and framework agreements have little or no relevance. The requirement for probity and equal opportunities required by local government sometimes sits uncomfortably with the partnership

approach to contracting. The approach of one client attending the workshops to eliminate all forms of contract may reduce the adversarial approach of construction but is a difficult concept to sell to the lawyers and accountants that run many companies. Private sector firms focusing on this year's profit margins and the need to deliver short-term value to shareholders will always be tempted by a lower cost quote; even when accepting the low quote is at the expense of long term savings or will involve some dispute over final settlement.

The skills required

The first, and most important skill is that of understanding the approach of your market to partnering and procurement. Some markets will be slow to adopt new procurement techniques and may stay with potentially adversarial "lowest cost wins" for some time.

Dealing with the issues of changing client demands and new procurement techniques requires the interpersonal and business skills associated with team building, client management and communication. A wider understanding of client needs calls for more market research and analysis skills. A broader supply chain calls for skills in team building, collaborative working and an ability to set up a multi disciplinary team.

Overall management of the supply chain and managing the delivery of the project is a key skill to make these new relationships happen. Strengthened project managers who do more than plan and report on progress are essential. Project managers will need a new broader understanding of the construction process, the ability to assemble and manage a multi-disciplinary team and the skill to engineer the maximum application of resource in the minimum possible time.

Traditional cost and accounting skills will need enhancing with value engineering. New estimating skills are needed that encompass risk management evaluation, early project appraisal costings, innovative construction solutions and whole life costs.

Design skills will become more important with design for function and design for re-use being two common demands from clients.

To achieve faster construction times, process mapping and improvement will supplement traditional project management skills.

There is a threat from management companies with no construction experience entering the void left by shortages in these skills. Many of the large accountancy based consulting firms already have the above skills and can build teams, measure value and communicate well. The point that differentiates a construction company with these skills is its ability to build. ***However, in this arena of large alliances bidding for places on framework contracts, being able to build is not enough.***

4.2 Change driven by the economy and the market

The economy of the future

The fluctuations of the economy have been less severe in the last five years than they were in the preceding twenty years and the stated aim is for longer-term steady growth. However, the optimism of long-term growth is tempered with the reality that the economy is patchy across the country; not all markets or all regions of the UK are good.

The intended spend of government in the UK is high, and the construction industry is central to delivering the social improvements promised by the New Labour Government.

The growth in demand will not allow the construction industry to drive up margins. The clients' need for best value and their focus on whole life cost remain at the top of their agenda.

In a growing market, shareholders are less tolerant of perceived poor performance and the need for construction companies to grow shareholder value is paramount.

The implications of this economic outlook

To prosper in such a market requires that construction companies have a degree of flexibility; the current situation of a slowdown in commercial building and upturn in public spending proves this point.

Even in a growing economy the prudent course for any construction company is to balance the low margin long-term opportunities with more speculative and more profitable ones. Given the keen focus of investors on returns and dividends, company strategies will change from growing volumes in one market to growing profit from several.

This spreading of risks and chasing of profit militates against partnering as a *total* company approach. Partnering requires focus whilst to spread risk across different markets and types of clients suggests breadth. One solution is that contractors will join specialist alliances to bid for places on partnering frameworks whilst retaining individual interest on traditionally tendered work.

Growth across all markets could lead to wage inflation that would hit profits. So cost management and the ability to improve processes becomes a crucial skill.

The planned volume of government investment creates divergent priorities. There is a need to ensure best value, create employment and deliver massive levels of infrastructure improvements. Each of these impacts on the other; high volumes of construction can lead to inflated costs that reduces value. Higher value means lower costs that are often achieved by driving down the numbers employed. Insufficient construction activity will reduce the social impact of the government programme. If normal economic rules apply then one of these principles will need to be compromised.

It is felt by the delegates at the workshop that innovative, high value construction solutions will always sell; and therefore many drive to reduce costs.

The importance of shareholder value will force companies to look for greater certainty, manage risks better and seek greater accuracy in business planning. They will look to markets, procurement approaches and construction methods that guarantee long-term income streams. One route is longer-term contracts for building services with agreed margins as opposed to one-off design and build contracts. Construction companies may be forced by their shareholders to be more selective in client selection. If the growth in demand continues the bad or ill-informed clients may find it more difficult to find good quality contractors.

The skills required

The skills required to deal with the current economy are around forecasting and market analysis.

The major contractors will need to monitor not only the construction market, but also their clients' markets. Corporate planning will have a shorter horizon and planning skills will change from long-term economic analysis to medium term customer and market research. With a broader range of clients, a construction company will need to better evaluate and qualify tenders.

Contractors will require a broader more flexible workforce and the ability to enter new markets quickly.

To combat the threat of wage inflation companies will have to engage in new construction methods that reduce the dependence on high cost labour.

The need for shareholder management and communications skills will be heightened.

4.3 The government

For the construction sector, government is doubly important as it is not only a legislator but also a major client. There is balance to this

relationship in the UK as without a strong and effective construction sector the Government will not be able to deliver on its election promises.

The trend in governments across Europe is to increase their intervention in the way business operates. The construction sector is under legislative pressure from all levels of government: European Government, particularly in employment legislation; the UK Government, particularly in the improvement of public services; the Devolved Governments in economic re-development; and at a local level particularly in planning.

The implications of this trend

The policy priorities delegates reported by our delegates as likely to have most impact are:

- The focus on improving public services
- The replacement of annularity of budgets with three year financial planning
- The introduction of procurement frameworks and measurement of best value
- Employment legislation such as the working time directorate and health and safety
- Procurement directives and laws relating to open tendering
- Sustainability and environmental impact
- Consultation with employees and works councils

The skills change

The principle skills change required is the ability to predict understand and interpret legislation. Companies will need to be more aware of law, how to monitor it and when to act on it. It is likely that skills in and knowledge of environmental and employment legislation will be top of the list for most construction companies.

Large scale alliances underwritten by detailed contracts are likely become the norm in many large capital projects. The need to draft, interpret and work within more advanced contracts will increase the need for legal skills in the management of a construction business.

Construction managers will need better legal skills to interpret and work within these more complex legal structures.

4.4 Employee welfare

The industry must improve the working conditions and practices if it is to attract the right people in the right numbers. The groups felt that this started with health and safety and extended into basic site conditions. Clients are more aware of safety as an injury or death to a person employed by a contractor on their site is equally as unacceptable as injury or death amongst their own employees.

Health and safety is heavily publicised yet there is still more that can be done. The groups suggested not only looking at accidents and the causes of them but also re-engineering the building process and re-designing the site to remove the risks. The culture change towards a safer site involves all employees.

There was a feeling that the conflict between getting the job done quickly and getting the job done safely has not yet been resolved.

The implications of this trend

The groups felt that health, safety and welfare would continue as a key theme for construction companies and that more legislation could follow to improve safety.

The skills need

The skills change is twofold:

- Tactical skills to deal with site safety; site managers would need better skills in ensuring each operative is aware of the dangers and capable of avoiding and minimising them.
- Strategic skills to re-design safer sites; architects and professionals will need greater safety skills to ensure better safety.

The skills of site management will increasingly focus on the welfare and safety of the operatives.

4.5 New construction methods

The groups felt that three things were driving the adoption of new construction methods:

- The need for predictability of time and cost
- Shortages of skilled people
- The need to reduce whole life costs

These economic drivers for change are pushing the sector to more standardised units that are assembled off site in a manufacturing environment. This increases productivity of staff, reduces costs and shortens the time on site.

Three technologies were interesting in their omission. There was little or no mention of new or novel materials; radical construction methods or the use of information technology.

The implications of this change

The obvious answer, that the groups repeated several times, was the need for modularity in buildings. One commented

"someone out there today is designing yet another toilet block layout within an new office building– why?"

The move to framed buildings, containing standard units will grow. Mechanical handling on sites will reduce the need for manual labour and shorten the time on site.

The skills change

The skills change to accommodate these changes in the construction methods focus around the logistics aspects of site management and the quality control of off-site manufacture.

The planning of the site must take account that components and units will arrive from different points in the country. The site will need better preparation to receive modules. The scheduling of delivery will become more critical as the window of time a site is able to receive specific modules shrinks.

4.6 Labour supply and demand

All but the largest companies represented spoke of problems in recruiting enough of the right people. Demographic trends show we have an aging population with still fewer entering the construction sector. See figure 1 above.

This pressure on new people is affecting all sectors of the economy and those with the worst image will suffer the most from it. The groups all reported that they were losing people to the service and information technology sectors. Interestingly these sectors also report that finding good people is difficult.

Employers must recognise that the central driver in career choices is the candidate seeking the best possible career. "What's in it for me" is the question the construction industry must answer.

The implication of this trend

The implication of this trend is that the construction sector will have to change its image to attract new people. To change image requires not only better communication about the prospects of and careers in the sector but also changes in working practices to make the sector more attractive to a diverse workforce.

The key problem appears to be the nature of the building site. Delegates at the meeting regularly spoke of being ankle deep in mud on a wet November day. Clearly, the floods of the winter of 2000/2001 were front of mind.

The solution put forward by the groups was to engineer labour out of many of the roles and where possible moving it from the site to the factory. Adopting a manufacturing approach to construction and using modular units and introducing better mechanical handling removes labour from sites and increases productivity.

The whole issue of Human Resource Management and Career Development in the sector needs addressing in a more professional manner by all companies.

"Construction companies must be prepared to invest as much in people as they are in capital."

The construction sector needs to attract a more diverse range of people, recruiting from broader pools of labour. The careers available to people joining the industry need to be attractive and relevant. The training offered to both new entrants and experienced people needs to focus on their own and the company's development. More work is required to retain people in the sector at all levels. Companies will need to balance the tension between working time and training time - perhaps adopting more innovative solutions to training than classroom based learning. The role for distance learning methods and materials may increase.

Clients have a role to play. Future framework agreements may include evidence of training and career development as one of the qualifying criteria for companies.

Educators have a role to play and there should be closer links between education, training and employers. The education system must work for the industry and not against it.

The implications for skills

The skills change takes two different routes:

- Better communication of the reality of modern construction
- Re-engineering the construction industry to remove labour, change the skills mix and make the environment more attractive.

At the managerial level, we need to communicate that managing a construction business is rewarding and interesting; involves the application of information technology; and offers a variety of tasks.

On site, we will need to provide employees with a broader skills base so that the workforce is more flexible. New skills of production control, assembly and quality control are required to handle a more mechanised approach to construction.

In the design office, architects and designers will need a different skill set to cope with modular design.

Up-skilling and multiskilling the existing workforce is a priority over simply attracting unskilled workers. Broad vocational qualifications are a possible solution.

5 The skills changes

In this section of our report, we map out how the job roles of senior managers, business developers, professionals and site managers will change. We set out typical activities and skills required.

5.1 Senior managers

The senior manager of the future will work to increase shareholder value by seeking more profitable business from a more stable economy and use teams of suppliers to exploit a rapidly growing public sector market. Specifically they must be capable of:

- Long term planning based on economic and market analysis
- Identifying and establishing suitable partners and alliances
- Building up a strong network of suppliers to deliver construction programmes
- Communicating a clear vision of the industry and the company to shareholders, government and potential employers
- Being aware of current and emerging legislation relating to working conditions, the environment and new forms of contract
- Changing the company culture to offer a long term and rewarding career to those joining the company.

Note the senior management skills are not specific to the construction sector and the managers of the future may be recruited from outside the industry. These skills apply equally to large and smaller companies.

5.2 Business developers

The business developers of the future (in large firms) will create new business by entering framework agreements alongside alliances of other contractors, specialists, professionals and suppliers. They will manage client expectations and relations over a long period encompassing perhaps many different projects. The skills will be closer to client management than the traditional bidding skills required today. They will use information technology to predict the whole life costs, model the business case for the development and visualise the development.

In smaller firms, the business developer will advise the client on what can and should be done to realise the clients' requirement. They may deal with legislation and planning restrictions relating to the development; identify and manage other professionals and provide a total solution. The contractor will focus more on what the client wants rather than how they (the contractor) will deliver it.

The skills required are:

Large firms	Small firms
Market analysis	Problem solving
Understanding new ways of procuring	Application analysis
Risk analysis	Identifying partners to create entries to larger opportunities
Business case preparation	Construction methods
Communication	
Information technology applications	
Expectation management	

The business development skills split according to the market and size of firm. Small firms operating in the "one-off" market need to get better at working with clients although the biggest change will be in large firms

5.3 Professionals

The professional of the future will have a greater role to play in making the business case, costing the development, measuring best value and applying novel construction methods that reduce the need for labour and shorten the time on site.

They must be capable of:

- Understanding all aspects of the construction process
- Cost analysis and modelling
- Facilitation and communication
- Risk assessment from both financial, technical and legislative point of view
- Identifying suppliers and specifying pre-fabricated units and methods
- Logistics, project management and scheduling

The professional will become more integrated in the team capable of supporting the development from concept through to operation.

5.4 Site managers

The site managers of the future will have a closer relationship with the professionals and business developers. Working as a team these groups will develop approaches to construction that minimise time on site, levels of labour and exploit novel construction methods. Specifically they will be skilled in:

- Supply chain integration – managing a team of diverse suppliers
- Logistics and planning
- Re-engineering the construction site and process
- Waste management
- Quality control
- Training and communication
- Understanding and interpreting legislation

6 The skills map

In this section of our report, we set out the skills required to deal with each individual change identified by the groups attending the workshop. The skills cover contractors, suppliers as well as the professional designers.

Change Driver	Changes demanded by this group	Skill for senior managers	Skills for business developers	Skills for professionals	Skills for site managers
Clients	A move to partnerships, two stage tendering and framework agreements	Team building Risk evaluation Risk management Longer term planning	Market analysis Client communication Understanding of new ways of procurement Analysing and presenting business cases in different markets Dispute resolution Problem solving	Team working Developing alliances	Process mapping to improve the construction process
	An integrated supply chain with greater participation at all stages from all involved	Defining novel contract relationships with other companies	Communicating potential of new supply chain to clients	Broad understanding of all aspects of construction Facilitation skills Open book accounting	Logistics Project management Procurement Facilitation skills
	Alliances of different types of company to provide a total design, build, operate service	Identifying and establishing other companies to work with		Design Whole life costing	
	Blurring of responsibilities along the supply chain	Communication	Communication Broader understanding of construction and clients' business beyond filling out tender applications	Communication Broader understanding of disciplines outside of design, costing and estimating Building personal networks	Communication Broader understanding of disciplines outside of construction
	New measures of success beyond traditional project cost quality and timeliness	Communicating value	Performance evaluation	Performance evaluation Value engineering	

Change Driver	Changes demanded by this group	Skill for senior managers	Skills for business developers	Skills for professionals	Skills for site managers
	Simplified contracts and less litigation	Enhanced legal skills	Enhanced legal skills particularly around contract management		
The Economy	Long term increase in government infrastructure projects	Creating an adaptive workforce Lobbying and government relations		Creating design partnerships and alliances	
	Less severe peaks and troughs	Economic forecasting and analysis	Predicting future workloads Client analysis		
	Increased focus on value and whole life costs	Analytical skills	Analytical skills	Open book costing Whole life costing	Supply chain integration
	Increased demands for profits from shareholders	Market understanding Communication of vision Clarity of direction Spreading of risk	Evaluating potential profit of a market and client		Re-engineering construction methods to reduce labour Skills to improve productivity Waste management
Government	Focus on infrastructure projects to improve public services	Creating a flexible company capable of moving in different markets	Understanding of PFI and PPP		
	Focus on best value and delivery of results		New ‘estimating’ and costing skills	Costing Evaluation	
	Replacement of annual budgets with longer term planning	Longer term planning	Working for and within longer term relationships		
	Greater employment legislation	Greater legal skills			Awareness of employment legislation and its limitations on site work

Change Driver	Changes demanded by this group	Skill for senior managers	Skills for business developers	Skills for professionals	Skills for site managers
	Focus on environmental issues	Greater legal skills	Better awareness of 'green' issues and improved marketing of environmental initiatives to promote project value.	Environmental risk and impact assessment Understanding changing building regulations	
	Consultation with workforce	Communication	Communication		Communication
	Greater influence of other governments (CEC; devolved parliaments etc)	Language skills Greater legal skills	Language skills		
Employee welfare	Improved health and safety record	Legal awareness Safety training	Planning safety into projects	Design for safety Specifying safer construction methods	Re-engineering the site to improve safety Assessment and certification of skills
	Improved employee welfare conditions	Culture change	Communicating/contracting requirements with suppliers	Better specifying site and construction conditions	Interpersonal skills Team building Empathy
New construction methods	Modular design and manufacture	Communicating potential for new construction methods to staff	Seeking new solutions	Logistics and scheduling	Off site quality control Procurement Logistics and scheduling
	Cost reduction	Company strategy and structuring	Innovation	Specification of units Modular design Computer aided design	Information Technology Construction management
	Mechanical handling		Integration of design and construction methods/procedures	Designing for 'constructability'	Production engineering Site layout
	New technology	Company IT infrastructure planning IT user skills	IT user skills Computer aided visualisation	IT user skills Computer aided design Computer aided costing	IT user skills

Change Driver	Changes demanded by this group	Skill for senior managers	Skills for business developers	Skills for professionals	Skills for site managers
Labour shortages	Need to attract new people	Promoting company mage Create better links with schools and training providers		Communicating the variety and creativity of the job Market the attractiveness of the career.	Re-engineering the site to make it attractive to diverse workforce
	Need to improve working conditions and the image	Public relations and publicity			Re-engineer the site to make it cleaner, safer and more user friendly
	Re-engineer the construction site to make it more attractive to a wide range of people	Culture change		Re-engineering construction	Re-engineering construction
	Provide clear career pathways	Training the trainer Broader careers			Training and instruction
	Communicate the quality of career available	Communication			

7 The sector's ability to change

Before the workshops went ahead, the delegates were presented with a brief questionnaire to gauge their preconceptions on a number of topics that might later be discussed. During the course of the meeting, these were analysed, and the results presented graphically. The graphs from each meeting are presented below.

7.1 The results

There are two interesting outcomes of the questionnaire process – the first is the perceived areas of strength and weakness themselves, and the second is the disparity between different stakeholder groups. The latter is illustrated nowhere more clearly than in the Scottish contractors and clients groups, held on the same day, but polar opposites in their interpretation of the sector's ability to confront change.

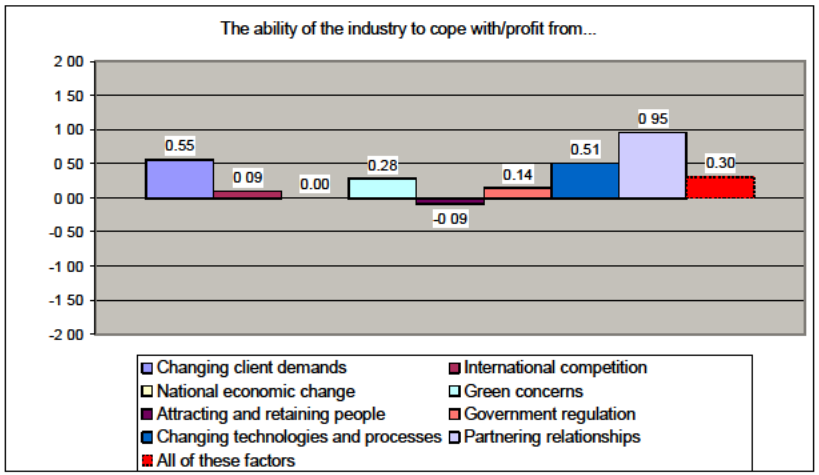
Clearly, there are some areas where there is consensus – most delegates agreed that the industry was having some difficulty filling all of its job vacancies. Most delegates agreed that the sector had some difficulty confronting and adapting to change in the national economy. Most delegates agreed that partnerships had an important role in future procurement. Most did not worry that government regulation would be an insurmountable problem for the industry.

Other areas were more liable to swing according to the content of the group – contractors and suppliers tended to believe they were moving far and fast enough on green building and new technologies – this was generally not enough for clients and professionals. Generally the contractors and suppliers reckoned their ability to deal with change in client demands was rather better than clients thought it was.

Perhaps the single most important point to take from this process though is the almost universal appreciation that the sector has a serious recruitment problem – a fact that was repeated in all of main parts of the workshops.

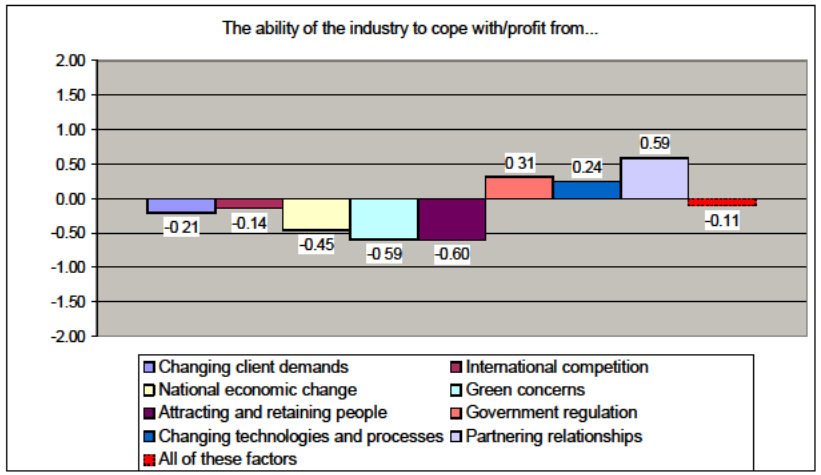
Respondents were asked to rate the industry's success in dealing with a number of current and future threats and opportunities, on a scale which ran from 'strongly disagree' through 'disagree', 'agree' to 'strongly agree'. How well the delegates thought the industry could deal with each factor was converted to a numerical value in the range –2 to +2. a value below zero implied the group thought the industry would deal with the opportunity or threat poorly – a positive value meant the group believed the industry could face the threat or opportunity well.

7.2 Edinburgh Contractors



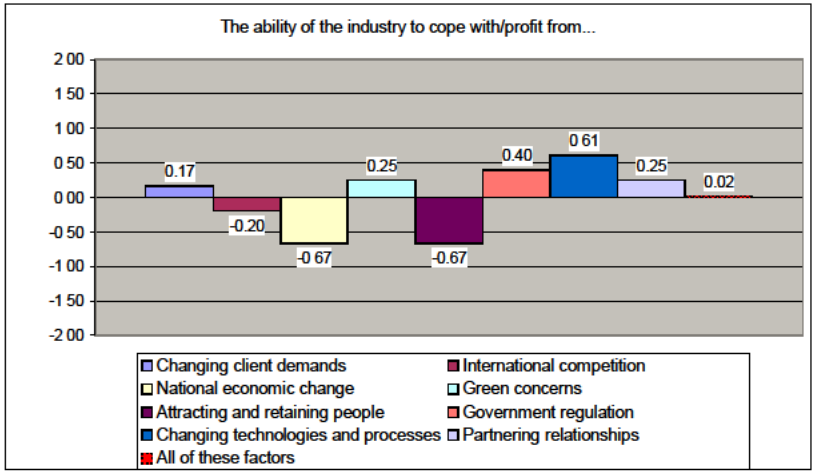
Delegates to the Edinburgh contractors meeting were on the whole very positive about their industry's ability to cope and profit from change. The only areas where there was some doubt were 'attracting and retaining people' and 'national economic change' which were respectively weakly negative and neutral. The meeting perceived a strong role for partnerships, and thought the industry could cope well with changing client demands and changing technologies and processes.

7.3 Edinburgh Clients



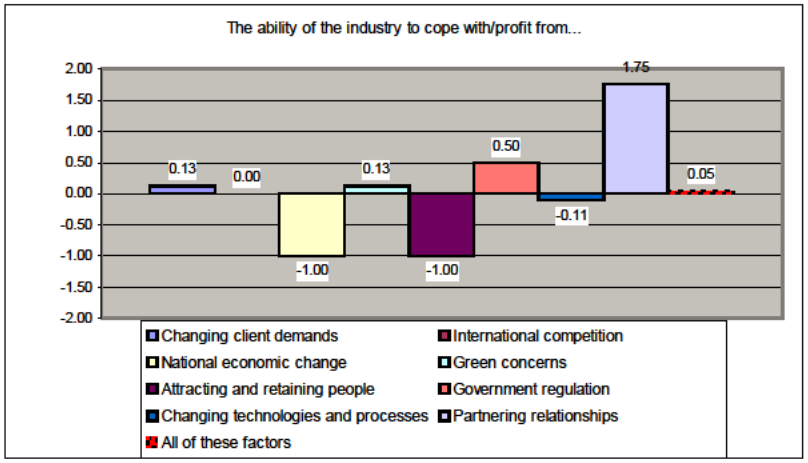
The picture here is something of a mirror image of that presented by the contractors, suggesting there is significant distance between the two communities. The largest disparities are in 'Changing Client Demands' and 'Green concerns' where strong positives for the contractors are negatives for the clients. The only positives were in 'government regulation', 'changing technologies' and 'partnering relationships'. The weakest area is still 'attracting and retaining people', in this case, very strongly negative. The clients meeting had a far more pessimistic view about the ability of the sector to cope with and profit from change, which contrasts markedly with the comparative hubris of contractors.

7.4 Edinburgh Suppliers



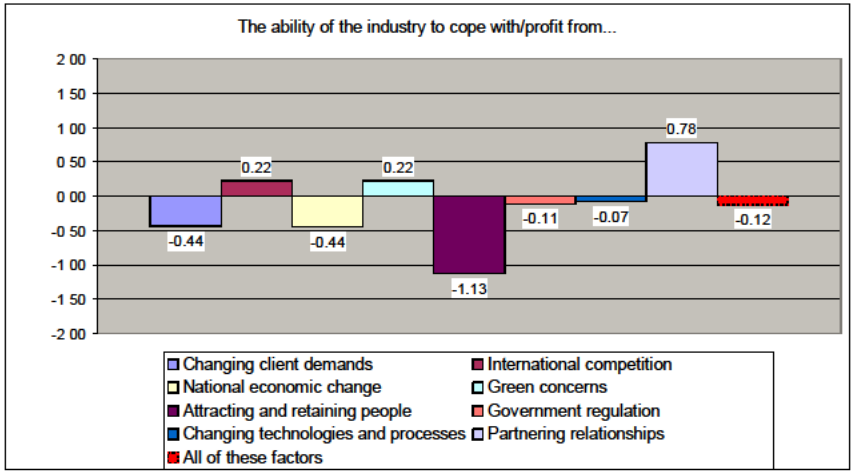
The picture for suppliers who met in Edinburgh is a spikier one – most likely a symptom of a smaller sample size. It is in some areas more pessimistic than the clients, and in others less so. Maximum cynicism is reserved for 'national economic change' and 'attracting and retaining people' while 'international competition is also negative. The key positives are 'changing technologies', government regulation and 'green concerns'/'partnering relationships' both equal on +0.25. It is worth noting that this is the weakest performance for partnering so far, and fits the tone of the meeting, which was cynical about the benefits of partnering for those at the 'bottom' of the supply chain.

7.5 Edinburgh Professionals



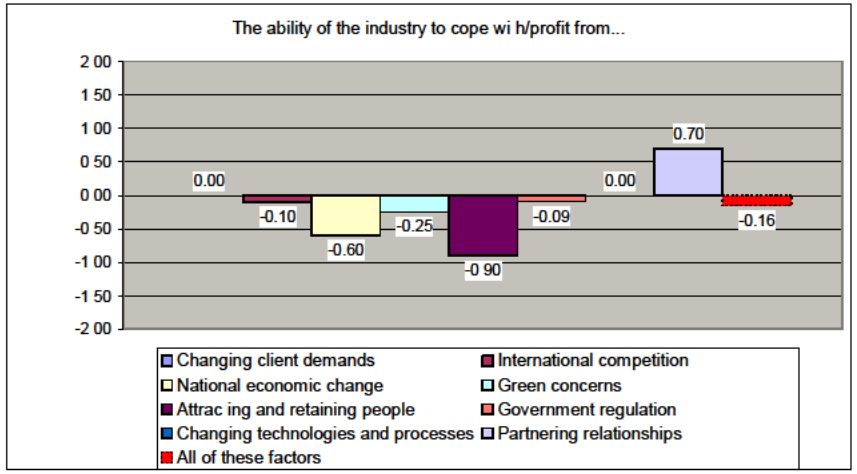
Once again, a smaller sample size has yielded a spiky histogram. Professionals concur with Suppliers on the key weakness of the sector in dealing with economic change and attracting new people. Notably their third weakest area is cited as a strength for all of the other Edinburgh workshops – that of 'changing technologies and processes'. The meeting revealed some frustration amongst professionals in ensuring that best technologies are adopted by often conservative clients and contractors.

7.6 Cardiff All Delegates



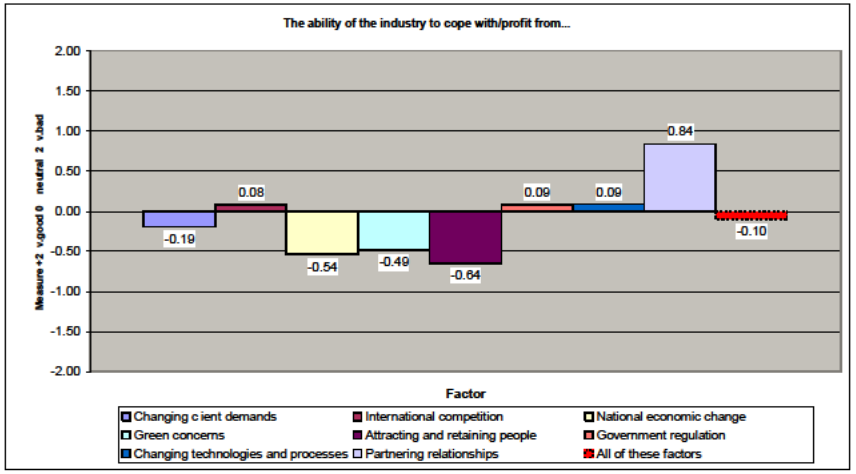
The Cardiff group was a mixed group of clients, contractors, suppliers. As such, the character of its responses is rather confused. The group saw strength in partnering relationships, green building and the UK abroad. All other measures were negative. Particularly weak was the habitual problem – attracting and retaining people, but 'changing client demands' and 'national economic change' were also perceived as poor attributes.

7.7 London Contractors



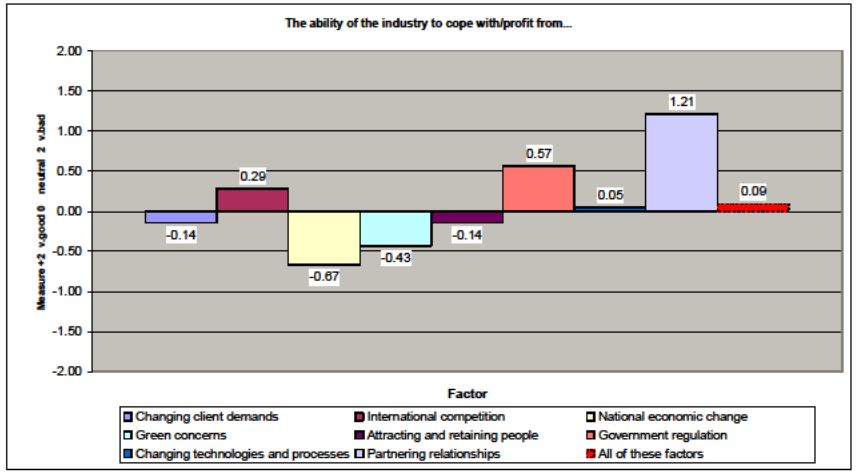
The preconceptions of the London Contractors meeting contrasts strongly with that from Edinburgh for its comparative pessimism. The group is negative or neutral on all points apart from partnering. There is consensus on the weakest areas, those being the national economy and the ubiquitous 'attracting and retaining people'. Rather alarmingly the group is extremely modest about the industry's ability to deal with changing client demands and changing technologies and processes – a net neutral rating.

7.8 London Clients



In some areas, this group was more optimistic about the scope of the sector to deal with change than the parallel contractors meeting. It is significantly more positive in respect of partnering, changing technologies, government regulation and international competition. The key areas of weakness are the regulars 'national economic change' and 'attracting and retaining people'. Clients also did not rate the sector's success in the application of green technologies, returning a strong weakness in this area as Edinburgh's clients had done.

7.9 London Suppliers/Professionals



This mixed group was less pessimistic about the sector's recruitment difficulties than many of the others, but also isolated weaknesses in its abilities to deal with national economic change and greener construction methods. Key strengths were found in partnering, government regulation and international competitiveness. The group was unimpressed by the sector's ability to satisfy changing client demands and changing technologies