A Review of the South African Construction Industry
Part 3: The Built Environment Professions



Prepared by:

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Preface

Working towards a better built environment, CSIR Building and Construction Technology, also known as CSIR Boutek, serves the building and construction industry, including government at all levels. CSIR Boutek is active in various fields categorised under construction technologies, sustainable human settlements, facilities planning and management, development management services, Agrément, and forensic fire investigations.

The construction technologies field includes initiatives to improve performance in the construction industry. CSIR Boutek produces publications of relevance to professionals in the building and construction industry, decision-makers in central, provincial and local government, as well as students.

Boutek is undertaking this review of the South African construction industry to evaluate the industry against global standards and local demands. This is the third part in the review series, in which a critical assessment is made of the current performance of the built environment professions measured against international and national expectations. Thirteen key impacts are analysed and contextualised within the South African environment, and specific impediments identified for further attention.

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Executive summary

Infrastructure is crucial to the economic development of South Africa. Institutions such as the World Bank recognise that infrastructure investment plays a fundamental role in poverty reduction. The construction industry – as a deliverer of infrastructure – bears the burden of delivering construction products that are efficient, robust, fit-for-purpose, have a long life and are economical to operate.

The built environment professions are charged with the responsibility of assessing the client's need and converting that need into improved productivity through added value engineering. This requires the continuing development of skill, application and experience in a knowledge-intensifying cycle.

The process of conceptualisation and problem solving begins at school and continues throughout the life of the participant. For the profession to be effective, it needs to attract bright young people into its ranks. Unfortunately, the image of the construction industry conspires to undermine this effort, supported by low levels of technology and the low margins evidenced within the industry. Feecutting by clients (up to 50 percent in certain instances) has reduced margins and resulted in salaries lagging behind comparable industries by up to 40 percent.

Consequently, the industry in general, and the professions in particular are showing signs of capacity distress. Large practices are disintegrating into many smaller practices, shedding employees in the process. Financial rewards are reducing whilst liability increases, inhouse research and professional development have slowed, and innovation has been replaced by replication.

Teaching at tertiary institutions is going through traumatic times as the institutions struggle to transform in response to changing socioeconomic trends. Low salaries and high student-to-teacher ratios place additional burdens on their teaching capacity. The current pedagogical approach at architectural schools is still, in the main, predicated on 19th century models. Anecdotal evidence from engineers suggests that some engineering graduates cannot undertake basic calculations.

The poor economic environment and deficient tertiary preparation have resulted in deteriorating standards of professional practice. In fairness, the construction industry seems determined to continue using delivery models borne out of the pre-industrial revolution, doggedly relying on guild-like craftsmanship in an age demanding innovation, productivity and technological dynamism. The South African construction industry is the fourth highest employer of workers having no formal education, after agriculture, households and mining. It also has the fourth smallest number of participants with a tertiary education, after the same industries indicated above. In this chickenand-egg scenario, it is difficult to determine who shares the greatest

responsibility for this perpetuation – the construction industry or the professions.

Regulatory changes have added their own dimension to this contest, as the competing forces of targeted procurement and lowest price bidding drive down innovation. Although much of the legislation is now in place, consistent implementation throughout all levels of government remains a challenge.

The professions remain dominated by males: whilst this is an international trend, it poses critical transformation challenges to our developing country. Construction-related circumstances and post-apartheid realities conspire to undermine current efforts at redressing this circumstance. Critical interventions in the education system are being undertaken to redress past equalities in school attendance and facilities.

Against this barrage of domestic challenges, including the scourge of HIV/Aids, the built environment professions, and indeed the construction industry, have to face global forces that are setting new performance benchmarks in terms of corporate governance, sustainable development imperatives and technology advances.

The built environment professions will not remain untouched by these challenges. Significant changes will be required with regard to education, training, skills development, knowledge enhancement and service delivery. What is indisputable, however, is the need for all the industry participants to collaborate in improving the products for which they are responsible, for the benefit of the society they serve. We all stand to benefit from high quality infrastructure that is constructed efficiently and satisfies the aspirations of the community it serves.

1 Introduction

The construction industry – comprising both the building (residential and non-residential) and civil engineering sectors - plays a vital role in the South African economy. The industry is responsible for the delivery of the infrastructure that is central to the continuing development of South Africa and, increasingly, of the region as a whole. Its activities and products affect the lives of the communities that it serves, both present and future. Its role is critical to the government's programme of providing infrastructure underdeveloped areas. Lately, institutions such as the World Bank have reiterated their belief that infrastructure investment is a core component of poverty alleviation. It is no wonder, then, that the government of South Africa seeks to get the construction industry to play a more strategic role in social development and economic growth in the future¹.

The built environment professions as defined by the Council for the Built Environment $(CBE)^2$ – namely, architects, engineers, landscape architects, project and construction managers, valuers and quantity surveyors – are crucial to the industry's ability to deliver this infrastructure. They are required to provide imaginative thinking, exercise strategic managerial skills, and be skilled craftsmen in conceptualising and managing the delivery of the physical infrastructure that is so fundamental to the development of the country and its people.

The Construction Education and Training Authority (CETA) Report³ identifies the following strategic functions that built environment professionals have to perform in the delivery process:

- Identification of the needs of the users of infrastructure;
- Interpretation and conversion of the needs into practical, workable and affordable infrastructure components appropriate to the South African population, geographic and climatic environment, and the capabilities of available human and technological resources;
- Preparation of designs and costing of construction projects;
- Evaluation of alternative tenders for execution;
- Administration of construction activities as well as overall project management; and
- Preparation of workable operation and maintenance programmes.

A healthy, viable and dynamic professional corps is therefore vital to the ability of the construction industry to improve its performance and to create a climate in which our industry can adapt to the rapidly developing changes impelled by local transformation and international globalisation.

The White Paper on creating an enabling environment in the South African construction industry. Department of Public Works, 1999.

² Council for the Built Environment Act, 2000

³ CETA: Sector Skill Plan, April 2000 – March 2005

2 Issues and challenges

Whilst the construction industry within South Africa is capable of delivering the most innovative and complex projects at times, it is widely acknowledged that the industry, as a whole, is underachieving. If the industry wishes to deliver improvements in, amongst others, quality and efficiency, it will need to radically improve the process through which it delivers its projects.

Improvements to the delivery process will require the built environment professions to review their current practice methodologies and to examine the scope of improving, through innovation, their own products and processes. Enhanced construction industry performance will require a vibrant and dynamic professional corps.

This report presents a series of trends and impacts that will require addressing if we wish to ensure the long-term viability and vitality of the built environment professions in South Africa.

The scope of this document will focus on the following Built Environment Professions (BEP) sector issues:

- Capacity;
- Knowledge intensity;
- Skills development;
- Business performance and service:
- Information technology;
- Transformation;
- The changing legislative environment;
- Sustainable development imperatives:
- Innovation:
- Education and Training Outcomes;
- Globalisation;
- International trends; and
- HIV/Aids

2.1 Capacity

All indications are that the capacity of the professional sector within the industry is declining.

The Skills Sector Plan (SSP) of CETA indicated that the number of people employed within the architectural sector reduced by 50 percent between 1993 and 1999. Reducing financial margins and the need to improve productivity have directed practices toward increasing their use of information technology in order to significantly reduce the number of people employed in professional practices.

Since civil engineering is heavily dependent upon government spending (75 percent), the declining investment by government over an extended period – opportunities for consulting engineers have reduced by approximately 50 percent in 25 years – has had a huge impact on employment levels within this sub-sector too. Employment

in the consulting engineering sub-sector decreased from just over 12,000 in 1997 to 10,382 at the end of 1999, a drop of 13.5 percent. Research surveys undertaken by SAICE⁴ reveal that the membership profile pattern is remaining the same, except that the peak representing the older group simply moves forward each year. Reduced industry demand, growing international demand and low rewards locally all conspire to influence engineering professionals to leave the profession in search of greener pastures elsewhere, be that through emigration or new career paths. Regular salary surveys confirm, for example, that the gross remuneration package for consulting engineers is some 40 percent lower than for engineers employed elsewhere. SAFCEC estimates that more than 200 of the civil engineering pool emigrate annually⁵.

The percentage contribution to Gross Fixed Capital Formation (GFCF) by construction has remained relatively constant since 1992, but declined from 1998 to 2000⁶to the current level of 5.1 percent of GDP. Consequently, employment levels have almost halved within the construction sector since the eighties, with less than 12 percent of newly hired people being transferred to another project. Events of the past three years have, however, shown a marked improvement – expanding employment and turnover by 50 and 68 percent respectively⁷. Although sustained investment of this order may well result in capacity bottlenecks among the built environment professions, the very recent decline in growth, if persistent, suggests that this is unlikely.

Nonetheless, South Africa faces an enormous infrastructure development challenge that requires economic stability driven by substantially increased investment in GFCF. Increasing GFCF investment will require enhanced skill capacity and expertise that, according to current evidence, is a diminishing resource in South Africa.

2.2 Knowledge intensity

A characteristic of the built environment professions is their broad knowledge base. Problem solving and maximising opportunities despite the constraints of the project are among the BEP skills most admired by customers.

The demand for better quality and value in industry products has given rise in the UK to the notion of 'lean construction'. Lean thinking forms the intellectual context for the proposals in the Rethinking Construction strategy.

⁴ Allyson Lawless: Capacity in the Civil Engineering Industry, Johannesburg, November 2003

⁵ H P Langenhoven: SAFCEC, Johannesburg, October 2003

⁶ DPW: Draft Status Report on the South African Construction Industry, 2002

⁷ SAFCEC: Quantitative Landscape of the Civil Engineering Contracting Industry, Johannesburg, October 2003

The built environment professionals in South Africa will need to deepen their knowledge in the following areas if they wish to remain competitive against their global peers:

- Appropriate construction materials, components and technologies;
- Capacity to apply appropriate assessment tools for the above;
- Energy management;
- Water management;
- Safety management;
- Building physics;
- Materials science:
- Contaminated land management;
- Environmental planning;
- Risk assessment:
- Brief development;
- Design management;
- Documentation management and control;
- Production planning;
- Information Technology Systems and Management;
- Procurement: and
- Sustainable Development Design Parameters.

Essentially, what is required is a paradigm shift by practitioners in how they apply their knowledge. Unfortunately, the combination of a reduction in new entrants bringing new knowledge, and the departure of existing experienced practitioners will conspire to impede the professions from developing these additional competencies.

2.3 Skills development

According to the CETA Report, the professional consultancies subsector has indicated that many experienced members were retiring or nearing retiring age and that a replacement void was developing. It suggested that steps be taken to ensure that high levels of competence and experience be retained through a succession programme. Unfortunately, the limited number of construction projects and the scope thereof do not enable the retention of experienced people or allow inexperienced professionals to gain the necessary hands-on experience.

Similarly, the lower level of business activity has reduced the extent to which time and money can be spent on mentoring and in-house training. In-house training and mentoring as a means of knowledge transfer has been a strong tradition within built environment consultancies in South Africa: many of the current professionals still active in South Africa gained highly specialised skills through this practice.

The loss of mentoring opportunities and in-house training is impacting particularly on young graduates, who find it difficult to obtain pre-registration employment. They are increasingly being forced to become self-employed and consequently gain their experience at the expense of their clients.

The industry's delivery chain consists of many composite parts (complex), often operating and/or resulting in difficult and aggravating circumstances (complicated), involving multiple participants operating from inside and out of the industry, resulting in a system or systems that may be assembled with completely new and never-ending variations and combinations. This multipartite structure results in unpredictable consequences, increasing risk to all participants without allocating liability to any. Developing the required skills to successfully manage these risks requires continuous learning.

Continuing professional development is currently not compulsory, with the exception of the quantity surveyors, and thus, whilst most voluntary associations offer courses, attendance is not very high. A consequence of this is that the course content is very narrowly focussed and many of the issues with which consultants should be engaging — such as sustainable development — are not being adequately addressed.

Management training, in particular, was highlighted in the CETA report. The report argued that management development training was required in:

- Managing joint ventures;
- Global competition;
- How to market consulting services;
- Managing a consulting practice;
- Risk management;
- Contract disputes;
- Changing contract conditions and standards;
- HR development and management; and
- Training in international best practice and standards.

In addition, it argues that mentoring and Small, Medium and Micro Enterprises (SMMEs) facilitation will also require additional training within the professional corps.

In assessing the demand for future skills, the CETA report concludes that the poor growth forecasts for the near future will not demand additional skill capacity⁸. However, it does note that there is a need emanating from a demand for higher skills, and for training for productivity increase.

2.4 Business performance and service

The outputs of the construction industry are predominantly capital investment goods, i.e. buildings, facilities and infrastructure that others use in the creation of goods and services. When the demand for goods and services decreases, the demand for supporting facilities also decreases, with the obvious exception being the government sector.

⁸ CETA: Sector Skill Plan, April 2000 – March 2005

At the outset one must note that the construction industry's share of national income in South Africa is below that of some developed countries⁹.

During 2002 a total of R57.5 billion was spent on construction works, which includes civil works (R24.542 billion) non-residential (R16.247 billion) and residential (R16.768 billion)¹⁰. The construction sector has shown a continuous decline in its percentage contribution in GDP of 59,3 percent since 1980, reaching its lowest level in 20 years during 2001 and 2002. Significantly, government's contribution to GDP has declined 15,9 percent since 1992 whilst the private sector has increased its contribution.

It is clear that the downturn in government's spending is not due to a decline in demand but rather to its macroeconomic policy aimed at reducing public debt as a percentage of GDP. However, the inability of government in general to spend its allocations has further restrained government's contribution. There has been a recent decline in private sector work following the reported oversupply of office, retail and commercial space in the market.

The professional consultancies' sub-sector is influenced in a similar manner by the macro trends in the industry as a whole. Fee income in the consulting engineering sub-sector decreased by 20 percent in real terms (adjusted for inflation) during 1997 and 1999, to R3 300 million. A survey undertaken by the South African Institute of Architects (SAIA) confirmed that more and more architects are deriving their income from non-architectural sources.

Notwithstanding these economic pressures, or perhaps because of them, the construction industry remains confined to doing 'businessas-usual' including shifting as much of the risk as possible onto others in the supply chain.

Most industries have undergone significant transformations over the past three decades, resulting in substantial improvements in the value of their products and services. Automobile manufacturers, for example, have reduced their concept-to-production cycle from six years to fourteen months.

The construction industry, however, presents an obvious and glaring exception to such trends. It is renowned for its inefficiencies as well as the reluctance of its participants to adopt significant improvements. Paul Teicholz, the retired Director of Stanford University's Centre for Integrated Facility Engineering, wrote in late 1999, "A building that took 1,000 hours to construct in 1964 would have required just 552 hours in 1998 had the industry achieved the same productivity increases as the rest of the non-farm sector. Instead, that building would have taken more than twice as many hours: 1,185."

Engineering News Record recently projected that delays and project overruns may approach \$200 billion of the \$700 billion U.S.

⁹ DPW, <u>Construction Industry Status Report, Draft 4. CSIR, 31 March, 2002</u>
¹⁰ SA Reserve Bank

commercial construction market. Whilst we do not have such detailed information available to us in South Africa, the order of the overrun here is probably much the same, if not worse.

A survey undertaken as part of the research for the Construction Industry Status Report found that "generally clients and contractors are of the opinion that the quality of work by the professions is deteriorating." Regarding the delivery of projects on time and on budget, 50 percent of the respondents were extremely satisfied and 50 percent extremely dissatisfied. The preparation of tender documents by built environment professionals was deemed to pose a substantial problem in the opinion of both clients and contractors. This tends to suggest that work processes in the professional services sector amongst a large number of professional firms are not up to best-practice standards.

Construction projects rely upon a variety of disciplines containing poorly integrated silos of knowledge. The current fragmented processes create enormous inefficiencies that result in substantial delays in delivery times and abortive costs. Generally the cause of these delays and cost overruns can be found in the poorly coordinated and incomplete information that constitutes contract information. The industry standard for completed documentation before contract commencement in the USA is 70 percent. However, it is not a question of improving just the quantity of the information getting through in time, but the quality.

The inefficiencies are in many instances a direct result of each firm placing greater emphasis on protecting its own viability rather than on improving the viability of the project. Consultancies usually place enormous effort on getting the project within budget as early in the design process as possible, but once this is achieved, switch their efforts to completing the documentation in the shortest possible time. Often this is as a result of unrealistic time constraints and tight fee structures to which they are subjected.

Nonetheless, considerable value enhancements may be hidden by the fact that many primary design parameters have been set – and therefore the majority of the major costs as well – before an accurate cost estimate can be completed.

Given all that has been stated above, the designer will be extremely reluctant to fundamentally redesign once this point has been reached. Nor is there any incentive to do so. In most instances, the basic design will be retained but with the scope of work drastically reduced, whereas accurately integrating a cost analysis across multiple design parameters may well have saved both.

Consequently, each discipline performs a variety of wasteful activities within its own discipline in documenting the project. In other words, built environment professional practices streamline their own businesses around wasteful project delivery practices, such as:

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¹¹ DPW, Construction Industry Status Report Draft 4. CSIR, 31 March 2002

- Plans and specifications that are insufficiently coordinated and rarely completed before construction commences;
- Shop drawings that are used to complete the design during construction;
- Variation orders that frequently result from the user's inability to read 2D drawings;
- Drawings that do not incorporate recent changes in manufactured components; and
- The fact that most value engineering evolves into a scope reduction effort and rarely takes into consideration related impacts on design.

Perhaps the greatest barrier to change lies in the fact that margins in each discipline are insufficient to permit firms to invest in better tools and procedures. Furthermore, the fragmented nature of the industry, combined with the usual one-time project experience between firms, does not generate sufficient profit or other incentives to invest in long-term innovations.

Most practitioners are contemptuous of analogies between the construction industry and other manufacturing processes in general, and with the design and documentation process in particular.

However, prototyping products (concept-to-production) in the manufacturing world show a number of marked similarities to the delivery of a building. Both involve a wide variety of disciplines and suppliers in the design/pricing/fabrication process to produce one-of-a-kind results. Both the automobile and aerospace industries provide valuable lessons from this perspective, for example:

- Enormous gains were realised from deploying a 'platform' approach (e.g. Airbus) by combining experts from various departments (design, engineering, manufacturing, purchasing, marketing, etc.) within a team that was held jointly responsible for the development of a particular model. Prior to this innovation, prototypes were developed by handing off information from department to department, none of with assumed full responsibility for the end result;
- Component manufacturers were brought into the design function, thereby increasing the knowledge base from which prototypes were designed, engineered and constructed; and
- Rule-based, object-orientated design technologies were adopted to integrate embedded knowledge held by the various disciplines represented in each team.

There are of course significant differences between these industries and the construction industry, the most significant of which is that the former have the opportunity of amortising development costs across a bigger production run, whereas the diverse and fragmented nature of the latter completely denies that opportunity. Therein lies a significant flaw of the industry.

2.5 Information technology

Dramatic developments are expected within the field of Information Technology. Information Technology Trends (ITTs), such as widespread use of simulation – including modelling and virtual reality – offer far more robust design and specification opportunities. The problems associated with interpreting two-dimensional design and construction drawings are mentioned elsewhere. Rapid growth in ata-distance transactions (client-practice and practice-practice information exchange) will impact upon the documentation method and content.

Significant growth in tele-working and home-working is already taking place. With this trend has come a decline in the number of people employed, caused in part by the inaccessibility of many home locations, and the employment of Computer Aided Design (CAD).

However, as technology develops and products proliferate, the professionals need to upgrade their software and train their staff to stay abreast of the latest technology. This is particularly true of young graduates: budgetary constraints in tertiary institutions have resulted in students not necessarily keeping abreast of the latest technology in their fields. Given the problems surrounding in-house training and mentoring expressed earlier, this places them in a disadvantageous position.

There is a high level of concern at the relatively low proportion of professional consultants who use or have access to the Internet. Current statistics from the South African Institute of Architects indicates that slightly less than half of its members have e-mail addresses. The Internet offers many opportunities for consultants: for example, manufacturers are making their specifications and installation details available on their websites. Many research institutions already offer highly relevant, downloadable publications on best practice without charge. This is one way in which professionals in South Africa can learn from their peers and international experience. Similarly, the Internet offers voluntary associations the opportunity to provide electronic distance learning. Those who are off-line will be out-of-line when it comes to accessing the latest industry advances and trade information.

2.6 Transformation

The number of students from previously disadvantaged communities enrolling in built environment courses is lower than anticipated or desired. This can be ascribed, in part, to a perception that the built environment professions do not offer the financial rewards that some of the other professions, such as accountancy and information technology, do. Consideration of a career in the construction industry is also discouraged by a lack of black role models in the construction industry, particularly in leadership positions throughout the construction industry.

Admission requirements to tertiary institutions are a further impediment to black enrolment. The built environment professions, particularly engineering, require mathematics and science as core course subjects: however, mathematics and science proficiency among school-leavers is very low, thereby further reducing the available undergraduate pool.

In general, built environment courses are lengthy and expensive and the salaries for graduates far lower than the professionals involved in commerce, information technology and law. Salary adjustments are also far slower and far less, as they are experienced-linked. Even so, a professional with 10 years' experience is most likely to be earning far less than his financial or IT counterpart.

Of those individuals from previously disadvantaged communities entering the profession, women constitute a greater proportion. This does pose some interesting medium to long-term challenges to the some of the professions, for example, architecture. In many instances, women who elect to begin a family will open and run relatively small architectural practices from home, accepting commissions that will allow them to attend to their family commitments. The consequences of this, should it become the predominant practice type, will dramatically reduce the capacity of the architectural profession to undertake large commissions.

Transformation initiatives within the industry – such as government's targeted procurement – are also exerting an impact on practices. Work to SMMEs, for example, has increased, resulting in huge management challenges both for clients and service providers. Currently practitioners are generally ill equipped to deal with these challenges and receive no training to assist them or additional remuneration for the extra work.

2.7 The changing regulatory/policy environment

The legislative environment has changed dramatically since 1990, with much of this legislation impacting on the construction industry and on professional consultancies. The new Constitution of the Republic of South Africa, 1996; the Reconstruction and Development Programme (RDP); the Growth, Employment and Redistribution Policy (GEAR); Broad-based Black Economic Empowerment and the suite of Acts governing the built environment professions are some of the most significant changes.

Current legislation governing the built environment professions is separating the role of the professions into distinct and separate silos, contrary to emerging international demands for collaboration and integration. Legislation identifies work to be performed by a category of person, and in some instances might require a professional to register in terms of more than one registration requirement. Current legislation does also not recognise specialisation in any category of registration.

This regulatory approach is entrenching the practices of the industrial economy (S1 economy) into our economic landscape at a time when

most of our international competitors are moving into a multifaceted and integrated serviced-based economy (S2 economy). 'It is this holistic approach to building culture that is lacking – particularly in the awareness of those involved in creating it.'12

2.8 Sustainable development imperatives

Almost all commentators refer to the widespread and profound changes that will be pursued during the coming decades to protect the environment, both natural and built. These changes are encapsulated in the 'green-centred' agenda and the 'people-centred' agenda.

Construction activity is a consumer of materials and scarce resources (water and energy), is generally a contributor to global warming emissions (including CO2 from the burning of fossil fuels), contributes to air pollution (smoke and dust pollution), generates vast quantities of waste, contaminates the soil, destroys existing vegetation and alters the characteristics of both the natural and built environments. Accordingly government, and increasingly users and neighbours of facilities, are demanding that these impacts on the quality of their lives be reduced through legislative and other means.

Owners, too – particularly those who have adopted a strong social and environmental corporate image – are feeling empowered by a notion that enables them to express and enforce design objectives that support their 'green-and-caring' image. Emphasising sustainable design practices includes the added value of associating with the new as well as achieving a better picture of how their building will perform over its life cycle.

Notwithstanding the pressure for profits, today's consumer and shareholder is increasingly no longer satisfied with the single bottom line approach to corporate governance. In the developed world, consumers and business partners favour companies and products that are socially and environmentally responsible. Critically, public involvement in government and business affairs is rising.

Companies' failures to perform responsibly are publicly highlighted and could erode corporate reputation and harm the company's competitive position. The wave of corporate governance scandals in the US will cost its economy \$35bn, and take 0,34 percent off gross domestic product in a year.¹³

An integrated approach to good corporate governance is being widely advocated in reports such as the King Report of 1994. The 2001 Report recommends a code of corporate practices and conduct that includes, *inter alia*, that every company should disclose the nature and extent of its commitment to social, ethical, safety, health and environment practices. The code applies to all companies with securities listed on the JSE Securities Exchange South Africa; banks,

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¹² Status Report on Building Culture in Germany. Ed. Prof. Dr. Gert Kahler, Berlin December 2001

²⁰⁰¹ 13 Financial Times, September 5, 2002

financial and insurance entities as defined in the various legislation regulating the South African financial services sector; and public sector enterprises and agencies that fall under the Public Finance Management Act and Local Government.

International experience – particularly in the EU, Australia, and more recently in the USA – confirms that commissions are increasingly requiring practitioners to be committed, both in terms of skill and capacity, to integrating fully the principles of sustainable development into their projects.

There are also financial benefits to sound environmental management: although most companies see their social and environmental responsibilities as secondary and not core to their business, current business trends have a direct impact on the competitiveness of a company. Unless companies start adopting sustainable business practices they will be left behind in markets that favour businesses which serve basic needs, enhance human skills, increase economic capacity, help remedy inequities and conserve the environment.

The cost of remediation is being noted as a trend that is shaping business: waste and emissions represent lost value, business costs, a threat to present and future human generations and to ecosystem health. Liability laws are increasingly placing the costs of remedial work arising from these impacts on the polluter, past and present.

South Africa's Constitution, by including environmental rights as fundamental, justiciable human rights, by implication requires that environmental considerations be accorded appropriate recognition and respect in the administrative process in the country¹⁴. The applicable sections in the Constitution of South Africa, 1996 (Act No. 108 of 1996) are:

- Section 24(a) that provides everyone with the right to an environment that is not harmful to a person's health and wellbeing; and
- Section 24(b) that provides everyone with the right to have the environment protected through reasonable legislative and other measures. The implementation of sections 21, 22 and 26 of the Environment Conservation Act, 1989 is such a legislative measure to protect the environment.

South Africa, as a responsible member of the world community, has become a signatory to a variety of international agreements dealing with issues such as marine conservation and pollution, the atmosphere, fauna and flora, Antarctica, whaling and the conservation of wetlands. These conventions place specific environmental impact management requirements and obligations on the South African Government in complying with the aims and objectives of these conventions. In cases where the proposed undertaking of an identified activity may influence or affect

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¹⁴ Oliver JA in Director: Mineral Development, Gauteng Region, and Another v Save the Vaal Environment and Others 1999 (2) SA 709 (SCA)

compliance with these conventions or is likely to have a significant detrimental effect across South Africa's international boundaries, special procedures and EIA requirements may be required. The national Department of Environmental Affairs and Tourism is responsible for administering and implementing these conventions.

Section 4.1.5.6 of the White Paper 'Creating an Enabling Environment for Reconstruction, Growth and Development in the Construction Industry' of the Department of Public Works states, "The public sector will use its procurement leverage to eventually enforce the existing requirements of environmental protection legislation on all public-sector contracts. Initially, minimum and best-practice standards will be adapted or developed (such as ISO 14000), and made a condition of contract on a select number of prime public-sector contracts." The thrust of this requirement is to make environmental management a part of the culture of organisations in the construction industry.

"Agenda 21, adopted at Rio de Janeiro, addresses the pressing environment and development problems of today and also aims at preparing the world for the challenges of the next century in order to attain the long-term goals of sustainable development." It is a "comprehensive plan of action to be implemented globally, nationally and locally by organisations belonging to the United Nations in every area in which humans impact on the environment." It recognises that environmental protection and natural resources management must be integrated with socio-economic issues of poverty and underdevelopment. This approach has been captured in the concept "sustainable development", which is defined as "...development that meets the needs of the present without compromising the ability of future generations to meet their own needs". 17

Agenda 21, Chapter 7, (G) 'Promoting sustainable construction industry' is a programme area that deals specifically with the role of the construction industry in promoting sustainable human settlement development. Of particular relevance to the construction industry are the following recommended activities:

Establish and strengthen indigenous building materials industry, based, as much as possible, on inputs of locally available natural resources;

Formulate programmes to enhance the utilization of local materials by the construction sector by expanding technical support and incentive schemes for increasing the capabilities and economic viability of small-scale and informal operatives which make use of these materials and traditional construction techniques:

Adopt standards and other regulatory measures which promote the increased use of energy-efficient designs and technologies and sustainable utilization of natural resources in an economically and environmentally appropriate way;

Formulate appropriate land-use policies and introduce planning regulations specially aimed at the protection of eco-sensitive zones

¹⁵ United Nations Agenda 21, #3.

¹⁶ The United Nations Division for Sustainable Development, 16 April 2001

¹⁷ World Commission on Environment and Development, 1987

against physical disruption by construction and construction-related activities;

Promote the use of labour-intensive construction and maintenance technologies which generate employment in the construction sector for the underemployed labour force found in most large cities, while at the same time promoting the skills in the construction sector;

Develop policies and practices to reach the informal sector and selfhelp housing builders by adopting measures to increase the affordability of building materials on the part of the urban and rural poor, through, inter alia, credit schemes and bulk procurement of building materials for sale to small-scale builders and communities.

Sustainable development poses many challenges for construction and civil engineering, including the realisation that many of the structures being erected now will still be in service in 2050 when it is expected that widespread environmental impacts will begin to manifest themselves.

2.9 Innovation

The need for review and innovation is frequently voiced in the discussion about the quality of services and of the built environment. In many instances, commissions are going to practices that are able to demonstrate an ability to provide new solutions to existing and emerging problems. Innovation is being sought in everything from car design to hospital design. Increasingly companies are positioning themselves as innovators in their sector to maintain or grow market share. This association is required to be expressed in their physical structures as well.

Adaptability and flexibility of facilities are becoming crucial to the ability to remain competitive: many commercial and industrial facilities are being refurbished on a 7-10 year cycle, requiring innovative design strategies at the commencement of those facilities.

In an attempt to meet the 'green-centred' and 'people-centred' challenges facing the construction industry, attention is being turned to innovative development of off-site production (OSP). For OSP to deliver its promise of improved working conditions, reduced wastage, more efficient use of resources and technology, and enhanced productivity, a substantial investment is required to encourage and reward innovation. This will need to manifest itself in a substantial increase in funding and support for a new Research and Innovation (R&I) agenda in South Africa.

2.10 Education and training outcomes

Education and training is by definition the most fertile ground for instituting the culture change required for construction industry development and enhancement. A review of the outcomes of tertiary institutions is required and a realignment of outcomes to explicitly place education in the context of a changing construction industry. If

the construction industry of South Africa seeks to remain globally competitive, it will need to be responsive to this vision statement of the Construction Research and Innovation Strategy Panel (CRISP): "a highly trained, multi-skilled workforce of professional designers, planners and managers, technicians and craftsmen using specialist skills" 18.

Tertiary institutions must assume some of the responsibility for the industry's woes: graduates in each discipline are not encouraged to learn about related disciplines. It has been suggested that teachers at tertiary institutions are not sufficiently comfortable with their own knowledge of related disciplines and therefore rarely encourage students to pursue multi-disciplinary paths. For one, tenure used to be granted on the basis of the expert knowledge in a particular field: there is little motivation therefore, to reinvent oneself after achieving this status. In addition, departments' budgets are based upon the number of students in a specific discipline, thereby forcing Heads of Schools to promote study within that discipline.

Consequently, many graduates enter the workforce unprepared to integrate project knowledge across disciplines and, of greater concern, show no desire to understand why this would be of any importance. Often graduates are predisposed to suspect the motives of their colleagues in related disciplines – a practice that is usually further exacerbated in the workplace.

International surveys indicate that generally practitioners complain that 'the courses do not adequately qualify students for the practical aspects of the job'¹⁹.

2.11 Globalisation

Given the decline in local market conditions, many consultancies are exploring regional, sub-Saharan and other global business opportunities. Few, if any, of these consultancies have any prior knowledge of operating conditions in these new environments. Consequently, many have had bad experiences and have reduced or ceased operations in these markets.

On the other hand, those who have had the necessary resources and financial reserves to persevere, have maximised the exchange rate advantage presented by the weaker Rand and are, in some cases, now solely reliant on off-shore work to remain in business.

International consultancies are also active in this domain, although their engagement in South Africa is only now beginning to manifest itself aggressively. In the World Architecture²⁰ survey of the world's largest architectural firms published in January 2001, 15 of the top 25 practices active in Africa are not African-based firms. Of the 10 top African-based firms, South African firms occupied 9 places, with the remaining slot going to a Kenyan practice.

¹⁸ Ciria News, Issue 1, 2004

¹⁹ Building Culture in Germany, Ed: Prof. Dr. Gert Kahler. Berlin, December 2001.

World Architecture: WA300; issue number 92, January 2002

Whilst this statistic may make pleasing reading at first glance, the activities of South African firms in Africa is creating much resentment among our neighbouring colleagues. Ironically, the complaint being lodged by local practices against international participation in our domestic industry – lack of partnering, lack of knowledge transfer, absence of technology transfer and skills development – are similar to the accusations being levelled against South African practices active in Africa.

South African architectural practices ranked 175th, 195th, 239th, 278th, and 293rd out of the top 300 globally. By comparison, one of our southern hemisphere counterparts, Australia, ranked as high as 25th and another economically smaller country, Mexico, ranked 122nd. The export of architectural services in the UK already accounts for 20 percent of their business. Clearly, the opportunities for all South African practices remains huge, but much work will have to be done to prepare local firms to engage competitively in international markets and to deliver the levels of service expected so that their participation goes beyond the once-off, never-again experience.

To be successful, the following objectives will have to be pursued in addition to those already identified:

- Ensure that commercial skills, for example entrepreneurial and risk management skills, are developed;
- Promote an understanding of the impact of globalisation;
- Improve general and project management and marketing skills;
- Upgrade technical skills; and
- Improve communication skills.

2.12 International trends

As stated earlier, sustainable design is catching on in the USA: recent statistics show that approximately 3 percent of all new construction in the USA is pursuing LEED TM certification with many more being influenced by the LEED TM green building rating system.

Improved quality and better value is also catching on: for most of the 1990s, the construction industry has been receiving unprecedented attention from industry participants and government alike. In the UK, the Egan Task Force²² drafted a vision for transforming their construction industry that enjoys the status of a White Paper. In addition, both the Strategic Forum for Construction, chaired by Sir John Egan²³, and the UK Department of Trade and Industry²⁴, have released documents reviewing the industry. The Scottish Government has released a 'Policy on Architecture for Scotland'²⁵ and the German

²⁵ A Policy on Architecture for Scotland. Ministry for Sport, the Arts and Culture, 1999

 $^{^{21}}$ U.S. Green Building Council: The LEED $^{\rm TM}$ Green Building Rating System, 2001.

Sir John Egan, Rethinking Construction. The Report of the Construction Task Force, 1998

Sir John Egan, Accelerating Change. A Report by the Strategic Forum for Construction, 2000

Sir John Fairclough, Rethinking Construction Innovation and Research. Department of Trade

Industry, 2002

Government has just released a Status Report on 'Building Culture in Germany'²⁶.

These reports all share a common theme, namely to enhance the role of the industry in promoting economic growth and delivering improved industry products.

They all express concern at the dwindling number of professional interns, and the need for the industry and the professionals to be globally competitive. There is a growing understanding of the value of professional services as an export commodity. Indications are that although the number of students enrolling at tertiary institutions is remaining constant — with the notable exception of engineering — many of these students do not enter the professions after graduating. Companies like Arthur Anderson Consulting are employing over 40 percent of the architectural graduates in the USA.

There is a vigorous debate occurring within the international professional community regarding the 'generalist' and 'specialist' approach to professional training and practice. Surveys done within the United States indicate that architects are doing more and more work upstream of the actual design process, with some practices focussing exclusively on this work phase. The perception is that the balance between 'generalists' and 'specialists' is not right. It is likely that further specialisations will emerge from the all-inclusive professional profile of current practitioners, particularly in the fields of general planners, project managers, consultants for investors, project developers, energy consultants, heritage facility consultants, web designers and business consultants.

The reports, without exception, stress the need for greater integration of processes within the industry. There is a growing understanding that current practice methodologies are wasteful of resources and are not providing the added value that is deliverable when the broader team is able to make its inputs into project delivery. 'The object is not to reduce individual accountability or encourage nepotism, it is to coordinate specific areas of expertise in the interest of a product that satisfies everyone, including the general public.'²⁷

Some commentators in the UK are forecasting a polarisation of professional firms into a few large multi-disciplinary businesses at one end of the spectrum, and smaller more specialist and works-orientated consultants at the other. They also expect to see a rationalisation within professional firms that results in an increase in the number of integrated design and construction companies. The emphasis throughout will be on adding value to the customer and removing unnecessary costs and waste.

The implications for practitioners will be greater design intensity, requiring explicit calculations, whole-life perspectives and using IT to do scenario designing using sophisticated modelling and visualisation packages.

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²⁶ Prof. Dr. Gert Kahler, <u>Status Report on Building Culture in Germany</u>. German Ministry for Transport, Building and Housing, December 2001.
²⁷ Ibid

From the industry's perspective, the ability of the construction industry in developed countries to maintain its contribution to economic growth is being doubted, with one commentator stating: 'In view of the unfavourable demographic conditions it is unlikely that building will ever regain its former position in the national economy.'²⁸

Factors influencing this view include an ageing population and a fully urbanised population. A sector that has been identified for future growth is the rehabilitation of existing buildings: change of use, and/or the upgrading of environmental and social performance are urgently required to the vast stock of existing buildings. In Germany, half of all expenditure on building is already being funnelled into this stock.

2.13 HIV/Aids

The impact of HIV/Aids on the building industry could be devastating simply because the sector employs large numbers of semi-skilled and unskilled workers. It is anticipated that in general there will be 1335 deaths a day in 2008²⁹: that is one funeral a minute. It is estimated that 18 percent of South Africa's workforce could be infected by 2005: given that an estimated 214 000 people are employed in the building industry, an additional 40 000 workers might need to be trained to maintain a similar level of production. This represents a formidable level of funding on future training needs.

The incidence of HIV at some South African universities is 15 percent and more. The millions of rands being spent developing and training these young managers and leaders of the future could be wasted.

The direct cost to companies varies: studies reveal that an infected employee could cost up to six times his or her annual salary. A cost benefit study indicated that it would cost BP and additional \$5.1m a year if it did nothing about the effect of HIV/Aids on its staff. Providing care was costing \$2m a year, saving 45 employees annually and resulting in additional cost savings of about \$800 000 a year.

Deaths due to HIV/Aids will have a significant influence on the built environment: according to the 2000 Annual Report of the Building Industries Federation of South Africa (BIFSA), the demand for housing could drop by 150 000 units by 2010. However, there will be a significant increase in the demand for social infrastructure, particularly orphanages and homes for the aged.

Built environment professions will have to learn to design loose-fit structures that can be adapted to any number of uses in response to the changing demands created by the pandemic. Schools and houses are two building types that will require the most change.

Rodney Harber argues that questions that need to be raised include whether professionals are contributing to the spread of HIV/Aids by

²⁸ Ibid.

²⁹ Dr. Thomas Rehle & Dr. Olive Shisana: Human Sciences Research Council (HSRC), Pretoria. October 2003

designing vulnerable building types such as single-sex hostels; whether their designs present opportunities for the prevention of the disease, for example educational murals and counselling facilities; whether the housing design supports the potential for home-based care or mutual help for supervising orphans; whether the designs are flexible enough to accommodate evolving changes of use; and whether every step has been taken to reduce the costs of all services³⁰.

3 Conclusion

In order to understand the nature of the demand for physical infrastructure and professional services in the future, we need to understand who the customers are likely to be and the nature of their expectations, businesses or operating environments. Even in South Africa, major construction industry customers now have global businesses and reference points: they are better informed (more so than many service providers) and more demanding of construction services and products. It will be a condition of appointment that the relationship deliver added-value to the client's downstream operations and, on occasion, to share the risks – and returns – involved in those ventures. Customers will, in short, expect their service providers to understand and meet their objectives. A crucial part of the objectives will be to get their assets to deliver more value. This insistence on better value for money and quality will trickle down to occasional and individual householder clients as well. Life-cycle costs and the enhancement of health and safety are all being included in their assessment of value for money.

International trends and national objectives are combining to put extraordinary pressures on the construction industry. In the process, the industry will have to reinvent itself if it wishes to remain competitive, deliver acceptable products to an increasingly demanding customer, and deliver the required financial returns to its shareholders.

The built environment professions will not remain untouched by this transformation. Significant changes will be required with regard to education, training, skills development, knowledge enhancement and service delivery.

Much of this is undermined by inadequate remuneration – unravelling whether poor remuneration is a consequence of poor performance or whether poor performance is the consequence of inadequate remuneration – and its correction will be crucial to establishing a way forward.

What is indisputable, however, is the need for all the industry participants to collaborate on improving the products for which they are responsible, for the benefit of the society they serve. We all stand to benefit from high quality infrastructure that is constructed efficiently and satisfies the aspirations of the community it serves.

³⁰ Rodney Harber, <u>The impact of HIV/Aids on the building industry.</u> Architect & Specificator, July/August 2002.