

CHAPTER 14 - CONCLUSION AND RECOMMENDATIONS

14.1 Introduction

The primary objectives of this study were:

- To investigate the impact of recent business environmental changes on the South African consulting engineering industry in order to improve understanding of their external business environment

and

- to develop a practical and relevant industry-wide strategic management information system (SMIS) for the South African consulting engineering industry. This SMIS had to be able to provide South African consulting engineers with an improved understanding of the business environment in which they operate and provide some advance warning of new trends in order to extend the strategic planning horizons of management and owners of firms.

This final chapter presents the conclusions drawn by the author at the completion of this study.

14.2 The consulting engineering industry in South Africa

South African consulting engineers, whose main business it is to supply technology-based consulting intellectual services for the built and natural environment, play a pivotal role in capital formation projects to the value of

approximately R35 000 million per annum [51]. This represents a significant amount in a small developing country economy with a gross domestic product (GDP) of R945 863 million and gross domestic fixed investment (GDFI) of R145 540 million [203].

The pool of professional engineers, technologists and technicians constitute a valuable resource in the economy of any country and even more so in a developing country. The South African consulting engineering industry employs a significant proportion of this resource pool. For example, in 1999 the consulting engineering industry employed more than 20% of the 15 000 registered professional engineers in South Africa [182, 47].

It is widely acknowledged that services are the crucial force for change towards a global economy [64] and that the next wave of world economic growth will mostly originate in the services sectors, especially in the area of intellectual services [209, 138, 67]. In the era of globalisation it is therefore imperative for any country to look after its services sector and especially its intellectual services sector, which includes consulting engineers. In the local environment, South African consulting engineers furthermore have a key role to play in improving the quality of life of all South Africans and of the people of the greater region. This role will primarily be to manage the creation of new infrastructure and to optimise the utilisation and management of existing infrastructure. Internationally South African consulting engineers are already earning in excess of R350 million outside South Africa, but the industry has the potential of becoming a much more substantial earner of foreign exchange by increasingly exporting its professional services.

In the light of the key role that consulting engineers can play in regional development as well as their potential for contributing to the economic success of South Africa, it is important to improve knowledge and understanding of the health, external business environment and dynamics of the local consulting engineering industry and to thereby optimise the management and utilisation of these professional service firms.

14.3 The external business environment of South African consulting engineers

The strategic management of an enterprise is the ongoing process of analysis, planning, and action that attempts to keep the enterprise aligned with its external environment while capitalising on organisational strengths and environmental opportunities and minimising or avoiding organisational weaknesses and external threats [33].

Successful strategic management in the modern business environment, characterized by accelerating, largely unpredictable and continuous change, therefore presupposes a thorough understanding, not only of the enterprise itself, but also of the enterprise's dynamic external business environment.

Awareness, interpretation and anticipation of changes in the external environment are central in the concept of strategic management. The macro external environment represents environmental factors that are outside an individual company or even an industry's sphere of control. The transitional nature of all aspects of South African society has resulted in an abnormally high incidence of such change factors. The macro business environment is therefore more important to South African firms than it is to most of their competitors and counterparts in developed countries.

Every individual firm also operates in a more immediate and individualised task environment. The task environment comprises the firm's stakeholders, i.e. the organisations, groups, and individuals who directly affect (and are affected by) the firm's strategy and actions. Important stakeholders in the task environment include regulators, labour organisations, suppliers, clients and competitors.

It was demonstrated that knowledge and understanding of the external environment is central to successful strategic management. Consulting engineering firms must therefore have access to suitable information systems to provide them with accurate information on their external environment so that they can make appropriate and effective strategic decisions in the interest of their firms.

14.4 A strategic management information system for the South African consulting engineering industry



An information system is a set of people, procedures, and resources that collect, transform, and disseminate information in an organisation [9]. Information systems can play a vital role in business success. They can provide the information that a business needs for efficient operations, effective management, and competitive advantage [127]. A management information system (MIS) is an information system developed primarily to provide information and support for effective decision-making by managers. Such information and support can be for the decision-making needs of strategic (top) management, tactical (middle) management, and operating (supervisory) management.

This study emphasised management information systems that scan the external environment of a particular industry, namely the South African consulting engineering industry. The focus was furthermore on the provision of information to assist strategic management in the South African consulting engineering industry in decision situations regarding large strategic management issues.

The study documented the development process of a strategic management information system to scan the external business environment of the South African consulting engineering industry in order to provide information for the strategic management of consulting engineering enterprises.

The strategic management information system (SMIS) was primarily developed for the needs of the top or strategic management of South African consulting engineering firms, but it also managed to address the needs of other potential users of the system, i.e. operational managers, industry lobbyists, media liaison and public relations managers, human resources managers, financial managers, the management of the South African Association of Consulting Engineers (SAACE), and organisations representing other participants in the construction industry.

The SMIS was successfully developed to have the following specific characteristics:

- An up to date or current reporting system
- A system that ensures confidentiality of source data from individual firms

- A system to ensure that primary data collected through surveys is statistically representative of the South African consulting engineering industry
- Affordability and sustainability.

14.5 Research methodology

The methodology for developing the SMIS made provision for the specific information requirements of different users and the requirement for the proposed SMIS to have certain specific characteristics.

From the outset the problem statement was complex, many important variables were undefined and the reactions of firms to the surveys were unknown. The exploratory study technique [29] was therefore used in order to iteratively develop concepts, methodologies and the final research design.

A literature survey of available historical or secondary data relating to the South African consulting engineering, building and construction industries was conducted in order to determine the relevance and usefulness of such data. The quantitative secondary data was used as a benchmark or reference databank to *calibrate* and/ or *evaluate* the accuracy of the information collected through regular industry surveys conducted to collect primary research data.

Primary data, for the purposes of this study, was regarded as data collected through industry surveys as part of this study, with the particular purpose of developing a SMIS for the South African consulting engineering industry. The

target population surveyed was the membership of the SAACE, which represents more than 90% of the South African independent professional consulting engineering industry.

The study involved both quantitative and qualitative techniques and the surveys collected detailed data on a number of aspects and variables, including:

- Quantitative data on employment and cost of employment.
- Quantitative data on work flow and resultant income.
- Qualitative (opinion) data on future perceptions.

The survey method used was the self-administered computer-delivered mail survey [29]. This distribution method was chosen due to the availability of access to an existing system used for regular electronic communication, by e-mail, to SAACE member firms.



Completed questionnaires were returned to the SAACE offices by normal mail or fax transmission, while future surveys may involve electronic return and automated processing methods. Response rates were monitored on an ongoing basis and appropriate actions were taken to ensure sufficiently high levels of statistical representivity of data.


Confidentiality of sensitive firm data was maintained throughout the study period.

Historic quantitative secondary data was combined with primary data gathered through the ten industry surveys. National and regional time series

were established for key variables such as employment, salaries, fee income, and profits for the South African consulting engineering industry. Historic national and provincial time series were used to interpret whether primary data obtained through surveys was statistically representative and to extend the usefulness of the primary data.

The results of the initial pilot survey were used to plan the standardised format for subsequent survey and reporting forms. Both questionnaires and reports were however improved iteratively throughout the study period. The iterative or exploratory nature of the study determined that new and topical issues were included in surveys and the report format amended accordingly as such issues arose or became irrelevant or insignificant.

14.6 Availability of secondary data



A literature survey was conducted and certain of the information contained in all the previous chapters originated from such secondary data sources as indicated in the text and the List of References appended to this document. Available secondary data sources relating to the South African consulting engineering, building and construction industries were evaluated in terms of their relevance, usefulness and limitations with reference to the development of a SMIS for South African consulting engineers.

A number of industry-wide management information systems were reviewed to determine the relevance of these systems to the South African consulting engineering industry and whether these systems may be useful in the development of an industry-specific SMIS for the South African consulting engineering industry. It was found that none of these systems provided a model

for the type of SMIS proposed, but that certain aspects of each of the reviewed systems were useful and several of these were incorporated in the consulting engineering SMIS.

The only recent official statistical data on the South African consulting engineering industry was found in the reports on the two Censuses for Consulting Engineering, which were conducted during 1987 and 1993 [198, 199]. The data from these two censuses therefore served as the main source of quantitative secondary data for the development of the SMIS. Statistical data that was published by the South African central statistical service (previously CSS, now STATSSA) on actual and expected capital expenditure by the public sector [200] served as the supplementary source of quantitative secondary data. The quantitative secondary data was utilised to limit the extent, time and cost of primary data collection by ensuring that survey samples were statistically representative of the target population and by rendering primary data useful within the shortest possible time. These two objectives were achieved by developing a number of historic time series.

Historic national and provincial time series were successfully constructed from very limited available secondary data using simple methods. These historic time series were used for rendering the primary data obtained from industry surveys useful to the industry within the shortest possible time.

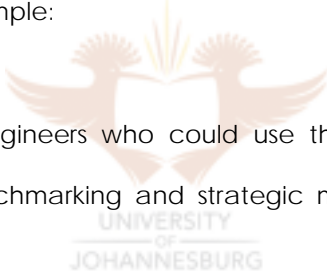
14.7 Developing the strategic management information system components

A standardised survey questionnaire was developed to ensure both respondent familiarity with the format and continuity of key indicator tracking. The

questionnaire format did however make provision for ongoing iterative improvements and amendments to take account of changes in the external business environment.

A standardised reporting format was developed and used from the fourth survey onwards with only minor additions and omissions to address changes in the external business environment. Examples of such changes for which the surveys and reports were amended are the impact on the industry of the increased application of targeted procurement policies or the impact on the industry of the application of employment equity legislation.

The standardised reporting format was developed for use by various industry-stakeholders, for example:

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- Consulting engineers who could use the more detailed quantitative data for benchmarking and strategic management purposes in their firms.
 - Contractors and material suppliers who could interpret the provincial market and client type distribution of consulting engineers and the analysis of the phases of the product cycle to forecast trends in their markets.
 - The media who could use sections of a report and the accompanying presentation slides in various media releases and industry articles.
 - Industry lobbyists who could use the reports and presentation slides for informing clients or lobbying government on various issues.

This standardised reporting format can be retained in future as the backbone of the SMIS for the South African consulting engineering industry. The capability was however also developed to produce customised individual SMIS reports on request for firms who had participated on an ongoing basis in the surveys. An example would for instance be a report that benchmarks a particular firm of a certain size (by either staff employed or turnover) against all other similar-sized firms. Benchmarking reports can similarly be produced for individual firms against all firms working in similar disciplines, similar geographic areas or for similar client types.

14.8 Primary data collection through industry surveys

A pilot survey and nine periodic surveys of the South African consulting engineering industry were conducted over a period of six years. This involved more than 3 800 questionnaires of which 1 309 were completed by respondents and returned during the study period. A 30% minimum response level (by number of questionnaires dispatched per survey) was achieved throughout the study period.

Data was captured and processed by an independent economist using an enterprise identification coding system to ensure confidentiality of individual firm data. The surveys produced important, useful and interesting data on the local consulting engineering industry that has not been available before this study.

The SMIS tracked quantum of and trends in:

- Key indicators of the health of the South African consulting engineering industry, e.g. employment, salaries, fee income and profits (including short-term forecasts) and
- several market features such as the type or discipline of work executed, the geographic distribution of work, the proportional contribution by client type category to the total industry turnover and the firm size distribution in the industry.

During the study period the SMIS also tracked the response of industry to several specific changes in their operating environment. Such changes included:

- The application of targeted public sector procurement policies and regulations by the state
- International trends towards and the South African government's acceptance of the principle of Public Private Partnerships for providing, operating and maintaining infrastructure
- Changes in market conditions.

The SMIS tracked economic cycle indicators in order to establish short-term trends with regard to the level of economic activity, competition and profitability in the South African consulting engineering industry. The consulting engineering confidence index, which is based on respondents' confidence about current and future prospects in the industry was introduced and changes in activity levels in the respective phases of the product cycle were tracked in order to establish trends for the various phases or stages of the product cycle of delivering traditional project-focused consulting engineering services.

Further characteristics of the local consulting engineering industry that were tracked by the SMIS included cost escalation, education and training, recruitment and employment trends and poor debtor performance problems.

14.9 Evaluation of the strategic management information system

The industry-wide strategic management information system (SMIS) for the consulting engineering industry complied with the primary criterion for such a system in that it provides strategic decision-makers with the previously unavailable industry information that they need to make critical decisions that will affect the future of their enterprises.

The SMIS furthermore provided strategic management with much-needed information relating to decision situations on large strategic management issues such as new business ventures, core competencies, mature or undesirable market interests, long-term market and service development, development of human resources, restructuring, range of services, mergers and acquisitions and geographical office location.

The SMIS achieved all the pre-set goals in terms of meeting the different management information needs of diverse industry stakeholders, such as top (strategic), tactical and operational management of consulting engineering firms, industry lobbyists, the media, human resource managers, financial managers, SAACE management and other construction industry participants.

The SMIS will be more useful if the survey-reporting cycle could be shortened, but this would require intensive ongoing management effort and possibly also

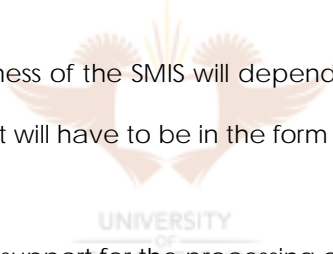
some investment in specialist direct electronic survey software that will allow all firms to be e-mailed survey notices and for respondents to then enter their data directly on a security-protected area of the SAACE website.

The measures that were introduced to secure confidentiality of data worked well and should be maintained as a core requirement for the continued successful operation of the SMIS.

An acceptable level of statistical representivity of survey data was achieved and the affordability requirement was met throughout the study period.

14.10 Recommendations

The continued usefulness of the SMIS will depend on its ongoing support by the industry. Such support will have to be in the form of:

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- Financial support for the processing of data
 - Logistical support by way of communication systems, member data bases and secretarial services
 - Management support for programming surveys, managing processes, maintaining standards, and using industry inputs to identify relevant environmental issues for tracking by the SMIS.

It has therefore been recommended to the SAACE that they continue their support of the SMIS as a service to the South African consulting engineering industry. They should also promote the ability of the SMIS to produce customised benchmarking reports for individual firms as a potential source of income to the SAACE in order to subsidise the cost of the SMIS initiative.

The following issues that provide scope for further investigation and research, were identified:

- The industry's ongoing response to the national targeted procurement and employment equity policies should be studied in the light of shortcomings in the national education system and the small proportion of engineers who come from a previously disadvantaged background.
- The trend of increasing participation by consulting engineers in Public-Private partnership (PPP) projects has to be studied, with particular reference to the nature of their participation and the size of the PPP market for consulting engineers.
- The possible use of the SACOB business confidence index as a leading indicator for the consulting engineering confidence index should be investigated.
- An investigation into the possible use of the consulting engineering confidence index as a leading indicator to predict upper and lower turning points for business activity in the consulting engineering industry is recommended.
- The continued operation of the SMIS will require an investigation to determine the applicability of readily available published escalation indices to cost escalation in the South African consulting engineering industry or to develop an industry-specific consulting engineering cost escalation index.