

Director and Executive Officer, Unisa Graduate School of Business Leadership

Professor M.A. Ferreira

Editor

Professor D.T. Beaty, Director (Research), Unisa Graduate School of Business Leadership

Subeditor

Professor R. Pellissier, Manager (Research), Unisa Graduate School of Business Leadership

Advisory editor

Mrs R. Arnold

Editorial Committee

Professor K. Adendorff, Emeritus Professor
Professor D.T. Beaty, Unisa
Professor H.M.R. Becker, Unisa
Dr S.J. Benade, PQ Business Consulting
Professor A.E. Booysen, Unisa
Dr L. Carstens, Gemini Consulting
Professor S. Claassen, University of Pretoria
Professor G.J.deJ. Cronjé, Unisa
Professor D. de Villiers, University of Pretoria
Professor F. du Plessis, University of Pretoria
Professor G.S. du Toit, Unisa
Professor W.M.J. Hugo, Emeritus Professor
Professor P. Kruger, University of Pretoria
Professor L. Lewis, Professor Extraordinarius
Professor M.P. Mangaliso, University of Massachusetts
Professor P.J. Nieuwenheuzen, Unisa
Professor R. Pellissier, Unisa
Professor L. Pitt, Curtin University of Technology
Professor D. Remenyi, Brunel University
Professor S.R. van der Walt, University of Pretoria
Professor C.F. van Veijeren, Emeritus Professor, Independent Consultant

Editorial Policy

The aim of the Southern African Business Review is to serve as a vehicle for the publication and dissemination of research in the field of business leadership, management and administration, with a special focus on Southern African business issues and concerns.

Submissions and correspondence to

Professor David Beaty
Graduate School of Business Leadership
Unisa
P.O. Box 392
Pretoria 0003
Tel: +27 11 652-0237
Fax: +27 11 652-0299
E-mail: beatydt@unisa.ac.za
Web site: www.sblunisa.ac.za

Design of contents by Studio M Design, Pretoria
Cover design by Liana Schröder Graphic Design
Printed by Print Dynamix, Johannesburg

© 2000 by SBL and individual contributors. All rights reserved. No part of the publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic or mechanical, as a photocopy or otherwise, without the written permission of the publisher. ISSN 1561 896 X Southern African Business Review.

Note from the Editor

It is with pleasure that I introduce this edition of the *Southern African Business Review*. We are indeed privileged to be the conduit of publication for authors interested in presenting scientific management research to a broad audience of academics and practitioners in South Africa and abroad. I am particularly pleased to report that the articles contained in this edition reflect a diverse mix of topics from functional areas of management. Indeed, consistent with the aim of the review, we present research and articles that are grounded in the context of Southern Africa. Also, we welcome articles that shed new light on management issues from a global perspective.

In the first article, Professor Hellicy Ngambi asks the question: 'Can job-sharing improve the quality of work life in South Africa?' Through careful examination of the literature on this subject and a rigorous methodological process, she answers her question by concluding that job-sharing has the potential to increase quality of life in South Africa. Dr Bill Raubenheimer, in the second article, provides an interesting examination of the organisation, structure and functioning of manufacturing organisations in South Africa and makes the case for drawing on Aston methodology to research this issue.

In his article, 'The Taming of the IT shrew – Delivering Benefits from IT', Professor Dan Remenyi considers why information technology (IT) benefits have presented such problems to practitioners, academics and consultants for many years. What's more, he advances a new way of looking at IT investments that will help identify benefits. In their article, Professor René Pellissier and Okker Jordaan examine the effect of IT on organisation structure and conclude that firms do not take into account the effect of IT on firm structure.

In his paper, 'Economic value added (EVA) – A South African perspective', Nicholas Wood explains the concepts embodied in EVA and MVA, presents an example of their calculation, and provides the results of two case studies of companies in South Africa and New Zealand to illustrate the points he raises. In their article, 'New service development: A literature survey', Danie Smit and Professor Flip du Plessis conclude on the basis of their literature review that new service success cannot rely on sustainable advantage as a factor in the success equation.

In her paper, 'Information technology – Future perfect?', Professor René Pellissier describes the evolution of information technology and proposes a number of factors that address the differences between the demand and supply sides of information technology.

This edition also reports the doctoral research of Professor Susan Adendorff and Professor René Pellissier. Short abstracts summarising the findings of their research are provided.

The next edition of the *Southern African Business Review* will be a Special Edition. Professor René Pellissier will be the guest editor for article submissions on topics in information technology. Please read the guidelines in the Call For Papers announcement for this edition. The Special Edition will also include regular article submissions, and we invite authors to submit articles for publication in this edition of the journal even though they may fall outside the realm of information technology.

David Beaty

Midrand
July 2000

Southern African Business Review

Volume 4 Number 1

July 2000

Contents

Articles

Can job-sharing improve quality of work life in South Africa? Hellicy C. Ngambi	1
The organisation, structure and functioning of manufacturing companies in South Africa William H. Raubenheimer	15
The Taming of the IT shrew – Delivering benefits from IT Dan Remenyi	28
Exploratory research on the measurement of change in organisational structure caused by information systems O.J. Jordaan and René Pellissier	36
Economic value added (EVA): Uses, benefits and limitations – A South African perspective Nicholas A. Wood	46
New service development: A literature survey D.N.E. Smit & P.J. du Plessis	54
Information technology – Future perfect? René Pellissier	66

Doctoral theses completed in 1999

Abstracts

The impact of information technology on business organisations of the future René Pellissier	80
A decision support model for the cash replenishment process in South African retail banking Susan Adendorff	81

Events and announcements

Special issue

Information technology, November 2000	82
---	----

Forthcoming conference

Africa's century: Challenges for management and leadership Midrand, 31 October–2 November 2000	83
---	----

Guidelines for contributors to the <i>Southern African Business Review</i>	85
---	----

The *Southern African Business Review* is a publication of the Unisa Graduate School of Business Leadership.

Can job-sharing improve quality of work life in South Africa?

Hellicy C. Ngambi*

In recent years, the issue of redesigning jobs has gone beyond the determination of the most efficient way to perform tasks and improve productivity, to ways of improving the employee's dignity, trust and wellbeing through a philosophy that has come to be known as quality of work life (QWL). Industrial unrest, strikes and retrenchments, among other things, have characterised the South African labour market. These pose a challenge to most organisations, which have to take cognisance of the fact that, to increase employee productivity and thrive competitively in the global market, they have to develop more humanistic workplaces. One of the ways that organisations can improve QWL is by enriching the context of the job through giving employees autonomy to choose their work schedule, or when the job is performed. An alternative work schedule, which provides employees with flexibility and increases their motivation and work satisfaction, is job-sharing. This paper, based on literature and research survey results, explores the relationship between job-sharing and QWL, and concludes that job-sharing has the potential to improve QWL in South Africa.

Introduction

The concept of quality of work life (QWL) is now widely used to refer to a philosophy in organisations that enhances the dignity of all workers, introduces changes in an organisation's culture, and improves the physical and emotional wellbeing of employees. In some organisations, QWL programmes are intended to increase employee trust, involvement and problem solving so as to enhance both worker satisfaction and organisational effectiveness. Thus, the concepts and application of QWL are broad and involve more than jobs, but the jobs that people do are important sources of satisfaction. QWL can be improved by enriching the content and/or the context of the job. One aspect of job context relates to when the job is performed, or the work schedule. Giving employees decision-making control over when they perform their work is an approach to job-redesign that is becoming increasingly popular. It has led to a variety of innovations that are collectively referred to as alternative work arrangements. An alternative arrangement that increases employees' discretion is job-sharing. As a voluntary work alternative, job-sharing allows individuals to share a full-time job, including the associated benefits, because working full-time may be impractical or undesirable. It provides maximum flexibility for the employee. The payoff for the employer is being able to draw upon the talent of two individuals in one job (Ivancevich & Matterson 1999; Hampton, Summer & Webber 1982). This research article aims to explore the potential for job-sharing as an alternative work arrangement to improve QWL in South African organisations.

QWL, which can generally be said to be primarily concerned with humanisation of the workplace (Blunt & Jones 1992), is an important challenge facing South African organisations, especially in view of the legacy of apartheid. Even though Hillard (1990: 4) alludes to the fact that QWL means different things to different people, he defines it as a "collaborative attempt by labour and management to improve the working lives of employees to enhance their ability to produce".

The most commonly cited benefits of QWL programmes include job satisfaction, increased productivity, reduced absenteeism, a lower labour turnover and fewer grievances filed (Hillard 1990; Ivancevich & Matterson 1999), all of which

are not being adequately addressed in South African organisations (Butler 1995; Gool 1996).

South Africa is experiencing acute productivity problems that need immediate attention for survival. It was discovered in some studies done in South Africa that organisations that pay close attention to QWL receive large productivity gains (Taylor 1988). Thus, it is important for there to be an appropriate balance between improvements in productivity and QWL if actual positive results are to be realised. Alluding to this viewpoint, Parsons (1992: 8) states that "productivity improvements must occur in such a way that quality of work life also improves. Either/or must yield to the philosophy of both/and!"

It is therefore clear that the QWL challenges in South Africa, in view of diversity, must also be addressed to alleviate the adverse effects of low productivity that result from poor QWL. This is discussed further in the sections that specifically present the literature and studies relating to QWL.

This paper reports on the results of a research study that aimed at exploring whether job-sharing could be used as an alternative solution to poor QWL in South Africa. The study, as reported later, revealed that there is interest in job-sharing in South Africa and that the willingness to job-share is influenced, among other things, by employees' perceived QWL.

Research objectives

The purpose of this research survey was to explore and describe the characteristics of potential job-sharers and to explain why job-sharing is a feasible and appropriate alternative work schedule that can be used as strategy in South Africa to improve employees' QWL by meeting diverse needs for flexibility and equity in the workplace. To achieve this purpose, the study addressed the following three research objectives:

1. To explore, through literature review, whether job-sharing has been used as an alternative work schedule to improve QWL
2. To explore the relationship between workers' perceived QWL and their willingness to job-share

*Hellicy Ngambi is an Associate Professor at the Graduate School of Business Leadership and Deputy Dean: Faculty of Economic and Management Sciences, University of South Africa.

3. To explore the areas of work (jobs) more suited to job-sharing.

The first objective is addressed through the literature review section. The second and third objectives are addressed in the results section of the paper.

Sample survey data were obtained from workers at all levels and cross-tabulated and analysed for this purpose. This provided a database that can be consulted by job-sharing users to assess the feasibility of job-sharing in the South African labour market and the appropriate policies and conditions required to facilitate its use as a tool for improving QWL.

Poor QWL as a challenge to be addressed in South Africa

Before presenting the literature survey, QWL challenges facing South Africa are addressed. An aspect of job-sharing which has emerged from studies in Africa and which might help in finding the appropriate solution to the problems of poor QWL is its 'sharing' characteristic, in terms of being compassionate and caring (Hofstede 1980; Kiggundu 1988; Harari & Beaty 1990; Blunt & Jones 1992; Christie, Lessem & Mbigi, 1993; Aliquo 1994; Mbigi & Maree 1995). Terms such as communalism, collectivism, Afrocentrism and Ubuntu all express some aspect of the 'sharing' values that characterise most African countries.

In describing the relevance of Ubuntu to African management, Mbigi & Maree (1995: 1) state: "Ubuntu is a metaphor that describes the significance of group solidarity on survival issues, that is so central to the survival of African communities, who as a result of the poverty and deprivation have to survive through brotherly group care and not individual self-reliance."

Against such a background, it seems that sharing jobs would be an appropriate, and even effective, alternative strategy to address QWL problems facing South Africa. Job-sharing, which can be defined as "an arrangement where two or more people voluntarily share one permanent full-time job with benefits prorated", has been used by many employers and employees, especially abroad, as a strategy for addressing this challenge (Walton 1990; Meltz, Reid & Swartz 1981; Meier 1978).

There is need to find solutions to the many work-related problems, including that of poor QWL, in South Africa. One of these alternative solutions is job-sharing. As pointed out by Blunt & Jones (1992: 2) about Africa in general: "A great deal has been, and continues to be, written about Africa's seemingly endless economic crisis ... If the descriptions of Africa's economic predicament are accurate, urgent action is certainly needed."

It is not debatable that these turbulent conditions in Africa call for no less answer than a search for practical ways to address them (Blunt & Jones 1992; Kiggundu 1989). We believe that policies to encourage job-sharing deserve serious consideration as a practical response to the problems of poor quality of life and low productivity in Africa.

The paper reviews literature and empirical data on the potential for job-sharing to improve QWL in South African organisations in an attempt to provide an alternative solution to poor QWL. Many agree that solutions to problems in Africa have to be found in Africa by people that are familiar with the environment (Balogun 1989; Blunt & Jones 1992; Christie, Lessem & Mbigi 1993). It is hoped that, by meeting diverse needs for flexibility and equity in the workplace through job-sharing, organisations will improve the QWL of their employees.

Job-sharing has mostly been used as a strategy to address QWL in the USA and Europe (Olmsted & Smith 1989; Meltz et al. 1981).

Literature on job-sharing

This section surveys the literature on job-sharing by first reviewing the interest in job-sharing, the types of jobs most suited to it and some of the associated benefits and costs.

Interest in job-sharing

Interest in job-sharing has been increasing progressively. "Job-sharing has been suggested as a way of making challenging, high-skilled jobs accessible to men and women who want to pursue a career but prefer not to work full-time" (Meltz et al. 1981: 4).

In the industrialised nations, most studies of job-sharing indicate that many of the job-sharers are women. However, little is known about the users, if any, of job-sharing in South Africa. There is an increased interest among men in job-sharing as well (Poe 1999). As pointed out by Walton (1990: 5): "Although it is largely women who are jobsharing, men increasingly want to change the balance of their lives, in particular, so that they can be more involved in child care and domestic work."

Warne, Lundy & Lundy (1992: 316-317) – quoting the findings of a survey by a Canadian Commission of Inquiry, which found that 31% of the respondents were willing to take a cut in pay in order to have more time (thus improving their QWL) – summarises the reasons for choosing to job-share as follows:

- Opportunity for a more balanced life
- More time for family
- A mental break from children
- More flexibility for arranging days off
- A way to develop team skills
- An opportunity to keep a foot in the door
- More time for continuing education
- An opportunity for working with a more experienced person (on-the-job training)
- Personal enrichment and psychological support as a result of close contact with a job partner
- A way to maintain one's link to professional networks and to stay in the running for other jobs.

Various research findings on why people want to job-share support the above views (Meier 1978; Walton 1990; Dancaster 1993; Lunt 1994). With regard to South Africa, it would appear from a survey reported by Bennett (1998) that women are more dissatisfied than men with their work environment. Bennett reports, on the basis of the results of the survey, that: "Promotion prospects and a balanced personal and working life are far more important for South African working women than how much they earn ... Lack of flexibility of working hours and little allowance made for family commitments are seen as significant obstacles to getting ahead." Based on these results, it would not be far-fetched to conclude that, in South Africa, job-sharing is likely to be more attractive to working women, especially those with school-going children or dependants.

Interest in job-sharing has been growing, as revealed by the above literature. However, it is not known if such interest exists in the African context.

Jobs most suited to job-sharing

Cases of job-sharing reveal a wide range of jobs that could be shared, even though some are more obvious than others.

"Certain types of jobs lend themselves especially well to sharing, such as jobs with widely varying activity levels, high-pressure jobs, boring jobs and jobs requiring a variety of skills" (Lee 1984: 30).

Even high-level professional jobs may be shared, as long as there is proper job specification, and the organisation's situation and the job-sharers have been evaluated to establish the suitability and appropriateness of the job to be shared (Polsky & Foxman 1987). It has been acknowledged that many different types of jobs are opening up for sharing as people become more aware of the job-sharing option. "As knowledge of the concept has spread, jobs across a wide variety of occupations and grades have been opened to sharing including librarians, doctors, social workers, teachers, lecturers, researchers, local government officers and health service workers" (EOR 1987: 13).

The study conducted by the Industrial Society and the Essex Institute of Higher Education (Leighton 1986: 22) reveals that job-sharing could also work in jobs that are often prone to stress. "The conclusion from the research was that all the job sharers had proved successful, and two outstandingly so. Interestingly, they were in the most senior and policy areas of work."

Lussier (1990: 9) is of the view that "jobs that need continuity, such as supervisory positions, are often unsuitable for job-sharing". He advocates, however, that "jobs that are tedious and physically and/or mentally stressful are good candidates for job-sharing".

A number of research projects conducted in the United Kingdom reveal that "major areas of work have job-share schemes. They occur in administrative, clerical and a range of professional work, including nursing, computing, teaching and librarianship and, perhaps less predictably, are to be found in manufacturing work and the retail trade" (Dancaster 1993: 5). Job-sharing is also said to be widely used in the librarianship profession. As pointed out by Stennett (1993: 13): "As so many women are involved in librarianship, job-sharing is particularly pertinent to this profession." Both Meier (1978) and Walton (1990) report on research findings that indicate a wide range of areas suited to job-sharing. These include teaching, lecturing, library work, planning, landscape architecture, personnel and training, social work, community work, journalism, medical and health workers, administration, secretarial work and research.

In view of the above literature, it would probably be safe to agree with the view (EOR 1987: 13) that "all jobs [are] suitable in principle for job-sharing ... Both Leeds and Sheffield City Councils state that all jobs are considered eligible for sharing, but have developed procedures to be followed if management takes the view that one is unsuitable".

However, individual countries and organisations need to establish, through research, the jobs suitable for sharing in their own context. This paper reports on some of the areas of work that are perceived as suitable in the South African environment (see Table 8).

Benefits and costs of job-sharing

Since there are many possible variations of the job-sharing option, it is important that a proper managerial cost-benefit analysis be conducted before any option is implemented. This section discusses the literature on some of the benefits and costs associated with job-sharing.

Benefits of job-sharing

Lee (1984) cites a wide range of benefits to employers resulting from job-sharing, to which many writers and researchers agree (Warne et al. 1992; Walton 1990; Lussier 1990; Ivancevich & Matterson 1996). "Employers benefit from job-sharing programs in a variety of ways, including: greater flexibility in work scheduling, retention of valued employees, reduction of turnover, wider range of skills in one job, recruitment from a broader labour pool, options for older employees, more energy on the job, reductions of absenteeism, and continuity of job performance" (Lee 1984: 28).

Job-sharing also allows individuals to balance their family, leisure, education and work life. One of the Oklahoma State University job-sharers, Marita Jonson, says that: "Job-sharing in the Personnel Office has provided a way to re-enter the work world which I left to raise my family and yet it provides the flexibility for my partner and me to adjust our work schedules to accommodate our interests and meet the needs of our families. It has also brought my family closer together, because we each assume responsibility to help make each other's day a little bit better" (Olmsted & Smith 1989: 129).

From the above review, it is clear that job-sharing could benefit both the individual employee, the organisation and society at large in various ways.

Costs of job-sharing

One of the most frequently cited disadvantages of job-sharing is the increased cost of benefits to the employer (Olmsted & Smith 1989; Warne et al. 1992). Other commonly cited disadvantages of job-sharing include "higher costs of payroll administration; difficulties in recruitment of job-sharers; possible personality conflicts between sharers; work space problems if sharers overlap; increased workload for supervisors (or increased cost of supervision); problems of accountability if responsibility is divided; and the necessity of developing a coordinating mechanism" (Warne et al. 1992: 318).

Ronen (1984) agrees with these disadvantages. Lussier (1990: 10) indicates with regard to job-sharing that, as a result of the planning and organisation requirements, increased supervision, difficulties in coordination and increased cost of record keeping, productivity may decline. The above literature reveals many aspects, with regard to the interest in and the benefits of job-sharing, that could translate into QWL factors.

Literature on QWL

The previous sections presented the literature on job-sharing as it may impact on QWL. This section reviews the reasons for attention to QWL, its definition, benefits and relationship to job-sharing. A working definition of QWL is provided in order to render the concept measurable.

Reasons for attention to QWL

As alluded to above, QWL is an important concept, with the potential to bring employees, management and unions closer together through positive outcomes that could benefit all parties.

If employees do not feel fulfilled in their careers and only tolerate their jobs as a means to an economic end, they are unlikely to be loyal to the organisation and might engage in sabotage, absenteeism, alcohol and drug abuse and labour-management conflict, or they may suffer boredom and personal stress at work, which would adversely affect QWL and productivity (Gray & Starke 1984; Boonzaier & Boonzaier 1994).

In South Africa, workers are decreasingly enthused by conventional jobs in traditional autocratic structures. In essence, employees would like to have substantially more influence over their work environment than was traditionally acceptable by participating in decisions relating to their work, thereby enhancing their self-esteem and work-satisfaction (Bluestone 1977; Manning 1996).

Boonzaier & Boonzaier (1994), report that the problems alluded to above may be attributed to job alienation and worker dissatisfaction with their QWL including:

- Lack of recognition
- Uninteresting work
- Poor relationships with colleagues
- Isolation because of working on their own
- Lack of meaningfulness because workers do not experience a sense of fulfilment from what they are producing.

Workers also have different attitudes concerning work. Most of them want more than just a salary and benefits; they also want fulfilment and growth on the job. Employees also want to have a 'voice' in decisions (Ndala 1996; Manning 1996). The gap between what employees want and what is available seems to be widening, and organisations need to determine how to improve jobs and make them satisfying, for a better and more productive work environment (Ndala 1996; Manning 1996).

Mullins (1993: 498) quotes the conclusion of the authors of a US survey of workers' experience at work that: "If one believes that our economic system exists to serve the people rather than that the people exist to serve the system, it follows that increased attention should be directed towards two basic human problems in the workplace: (1) satisfaction of people with the economic and tangible returns from their efforts; and (2) self-fulfilment of individuals through their work. Although considerable progress has been made in solving the first problem, the importance of the second has barely begun to be recognized. The health of the economy is still measured solely in terms of the efficiency with which it can produce large quantities of consumer goods. A second measure – and concern – is needed: one which considers the contribution work is making to the quality of life and to the growth and happiness of the worker."

Whether the reasons for attention to QWL are genuine social responsibility or economic efficiency, one thing is clear – its primary goal is the satisfaction of employees. The process of adapting organisations to the needs of employees continues to receive attention. Gray & Starke (1984: 636), citing Walton's analysis, indicate that "the costs of employee alienation are high, and organizations are attempting to improve the relationship between work and human needs through a concept known as 'quality of work life' (QWL) programs".

If the above adverse effects on the organisation are to be alleviated, it is important that the people affected by a system are integrated in its design and operation. Stein (1983: 8) points out another force in QWL discussions – "change in national and international economic environments characterised by an increasing scarcity of critical resources, a growing interdependence of countries and industries, doubts about the benefits of growth, a questioning of ethics of present economic distribution, a considerable mistrust of technology and, in different countries at different times, high inflation".

According to Stein (1983), since changes create a shifting and increasingly competitive environment, the need to educate employees to cope with these changes means learning to man-

age in new ways and training people for more responsibility. In addition, increased competition requires that organisations be able to take advantage of every source of new ideas to remain responsive to the market.

Workplace issues are partly the concern of the legal system, with a significant emphasis on the rights and entitlements that affect the way employers may treat employees. New laws bring about new pressures and concerns. Stein (1983: 8) asserts: "Changes in the labour force produce increasingly dissatisfied workers, including managers and professionals, competing for a scarce resource: good jobs. Under the circumstances, traditional approaches to managing organisations won't work. Quality of work life, understood in this light, is no longer a fringe benefit."

QWL is thus seen, in this regard, as neither theory nor technique (Luthans 1995), but as being more concerned with the overall climate of work. Therefore, the primary purpose of QWL is to change the climate at work so that the human-technological-organisational interface may lead to a better QWL.

Definitions of quality of work life (QWL)

Even though many writers on QWL appear to agree on its significance, there appears to be little agreement on what the term implies (Kolodny & Van Beinum 1983), as may be seen from the definitions that follow.

Hillard (1990: 4) defines QWL as "a collaborative attempt by labour and management to improve the working lives of employees to enhance their ability to produce". This definition implies a move from the adversarial relationship between labour and management to one that is more collaborative in improving the wellbeing of employees and enabling them to be more productive.

Kast & Rosenzweig (1985: 652) define QWL as "a way of thinking about people, work and organisations. Its distinctive elements are (1) a concern about the impact of work on people as well as on organisational effectiveness, and (2) the idea of participation in organisational problem solving and decision making". This definition holds that QWL entails people's perceptions of how their jobs affect their lives and their ability to be productive, and the degree to which they are allowed to participate in problem solving and the decisions that affect them.

Gray & Starke (1984: 636), citing Suttle, define QWL as "the degree to which members of a work organisation are able to satisfy important personal needs through their experiences in the organisation". Since work experiences vary in different environments, this definition implies that QWL will mean different things to different people. The environment, therefore, is likely to have an impact on translating work into 'workable' programmes, which affect the overall quality of life.

Even though definitions vary, the essence of QWL lies in creating job satisfaction and democratising the workplace. The major components of QWL (Gerber, Nel & Van Dyk 1995; Gray & Starke 1984) include:

- A safe and healthy work environment
- Growth and development of human resources
- Growth and security
- Social integration of people
- Constitutionalism
- Protection of total life space
- Social relevance of work.

There is an inherent 'systems effect' among these aspects of QWL that affects almost every aspect of the employee's work and non-work life.

Benefits of QWL programmes

QWL as a process is designed for and on behalf of the worker. Its philosophical base, rooted in the principles of democracy and participation, is people oriented. From the labourer's viewpoint, therefore, the QWL process, properly effected, represents an extension of the union's historic goals (Bluestone 1977). The benefits derived from the QWL processes are not just for the workers and unions, but also for management and society (Cherns & Davis 1975). Properly developed and implemented QWL programmes are said to result in a win-win situation for the worker, management, union and society (Bluestone 1977). According to Hillard (1990: 5), QWL programmes may generally result in "job satisfaction, increased productivity, reduced absenteeism and less labour turnover".

QWL programmes may reduce unnecessary and unproductive labour-management friction, in that they aim to improve working conditions (union's primary interest) and encourage workers to identify with management goals (management's primary interest). While adversarial relationships between management and unions can probably not be completely eliminated, the collaborative aspect can be increased through proper implementation of QWL programmes. The premise for both parties for valuing QWL appears to be that jobs that provide more responsibility are more satisfying and frequently more productive (Hillard 1990).

Bluestone (1977: 44) asserts: "The workers gain the benefit of increased job satisfaction, mainly through meaningful and direct participation in the decision-making process on the job. Rewards – both social and economic – are not only possible but likely ... management, the union and the workers gain because a more satisfied workforce results in reduced absenteeism, improved quality of product, less scrap, fewer repairs, fewer disciplinary measures, a lighter grievance load – altogether a constructive collective bargaining relationship." Gomez-Mejia, Balkin & Cardy (1995) and Gerber et al. (1995) agree with Bluestone on most of the above benefits.

Since QWL seeks to empower workers by making them more resourceful and innovative (Kolodny & Van Beinum 1983), its benefits could include that of 'decolonizing' the mindsets, perceptions and attitudes of many South African workers and managers. Unless QWL is improved, however, it would be difficult, if not impossible, to attain the above benefits.

Improving QWL through job-sharing

As a matter of economic and, indeed, social survival, organisations in South Africa must discover the principles and parameters of a new organisational paradigm that is organic, adaptive and innovative.

Workers are not alike and do not have the same job objectives. Workers come to the organisation in what Glaser (1976: 43) calls "assorted shapes, sizes, education and experience, attitudes and ambitions". What constitutes QWL for one employee may not for another. That probably explains why different methods are advanced for improving QWL. These methods include alternative work schedules, industrial hygiene, job design, participative management, employee counselling, autonomous work groups and career manage-

ment (Gray & Starke 1984). This paper looks at job-sharing, an alternative work schedule, and how it impacts on QWL.

According to Bluestone (1977: 40), if QWL is to be improved, it would entail "the realistic acceptance by management of the fact that workers are adults in the workplace as they are in society; that the democratic values we cherish as free citizens in our homes and communities are in good measure transferable to the place of work; that these democratic values entail direct individual and collective worker participation in the decision-making process".

This means that organisations in South Africa have to stop paying lip-service to pledges of participation, transparency and consensus-seeking. They need to acknowledge that organisational employees comprise the same adults that make life and family decisions and are even allowed to choose who governs the country. Hence, organisations need to stop treating these adult employees like ignorant and irresponsible children (Manning 1996).

Employees often start work with a willingness to work hard and be productive, but if the job fails to meet their expectations, they lose interest. Job enrichment, which is the application of Herzberg's two-factor theory of motivation, entails that factors that meet the needs of individuals for psychological growth, responsibility, job challenge and achievement should be characteristic of their jobs. However, this does not just relate to the job content but also to its context (Ivancevich & Matterson 1999). One aspect that relates to the context of the job is when the job is performed, or what its work schedule is. Giving employees the autonomy to choose when they perform their work, as an approach to redesigning jobs, has led to a variety of innovative ways to schedule work, collectively known as alternative work schedules, one of which is job-sharing.

Boonzaier & Boonzaier (1994) conducted a study that provides the job diagnostic survey as a functional tool for South African managers. On the basis of the results of their study, they recommend vertical loading as one of the implementing concepts to enrich the characteristics of the job. In vertical loading, employees would be given the discretion or autonomy to set their own work schedules and methods, which would contribute to their internal motivation and job satisfaction, thus improving their QWL. This implies that strategies like job-sharing would create job experiences for employees that could simultaneously fulfil their own personal goals and those of the organisation.

While QWL programmes, including job-sharing, do not present a simple stimulus-response situation, they may be represented as a learning principle (Glaser 1976: 44) in a systematic way as follows:

$$S \rightarrow C \rightarrow O \rightarrow R$$

Where

S = Stimulus (QWL programme: Job-sharing)

C = Certain appropriate conditions

O = Organisation (its culture, history, receptivity to change, etc.)

R = Responses and results.

If, due to poor QWL resulting from rigid work schedules and job context, job-sharing is opted for as a stimulus, certain

responses and results will occur, given appropriate conditions (such as the culture, receptivity to change and commitment of the organisation). These results might give rise to better QWL. If they do not, adjustments should be made to the model to yield the desired results.

According to Ronen (1984), the capacity of a job to meet employee expectations and provide incentives is equivalent to their quality of life. Employees pursue a lifestyle that combines both work and non-work activities as may be satisfactory to them. As pointed out by Pierce, Newstrom, Dunham & Barber (1989: 22): "Employees need various kinds of fulfilment and therefore quality of life can be divided into two broad domains: work and non-work."

This implies that when employee needs are satisfied in each of these domains, the outcomes impact both quality of work life and quality of non-work life. In Ronen's view (1984: 20), there is a relationship between the two domains. He states that "one domain – work or non-work – has the potential to influence values held in another domain".

Figure 1 illustrates the effects of job-sharing on the quality of work life and quality of life. This figure implies that priorities in the non-work domain may influence outcomes in the work domain, and vice versa. This viewpoint is also supported by Stein's (1983: 37) description of QWL: "A programmatic way of generating employee involvement, expanding opportunity, power and attention for the whole person to ensure that organisations and their people grow together."

While attempting to improve the quality of work, realistic organisational approaches to improving productivity also pay

attention to employees in their non-work circumstances, "and that means a sensitivity to their family situations in particular" (Stein 1983: 36).

Given that almost half of all economically active women are in the workforce (Central Statistical Service 1995), including those with pre-school children and the growing number of single parents, organisations can no longer assume that their male employees have female support systems at home to ensure that family problems do not encroach into the workplace. Astute organisations, especially in Western countries, recognise the need to establish personnel policies, like flexitime and job-sharing, to ameliorate the work and non-work dilemma (Stein 1983).

Since job-sharing as an alternative work schedule affords employees a choice to work less than full time, it would therefore be expected to improve employee autonomy and satisfaction in both the work non-work domain, which translates into a better quality of work life (Gray & Starke 1984; Ronen 1984; Pierce et al. 1989).

The effects of job-sharing on quality of life are similar to those of flexitime. Ronen's intrinsic-extrinsic job characteristic taxonomy can be contextualized as a vehicle to further explain how job-sharing influences motivations (Pierce et al. 1989: 23-25). It may be argued that job-sharing can satisfy needs that are associated with both the extrinsic (work environment or context) and intrinsic (feelings that stem from work itself) categories and can therefore influence QWL and quality of life via both routes, which ultimately impacts on productivity (see Figure 1).

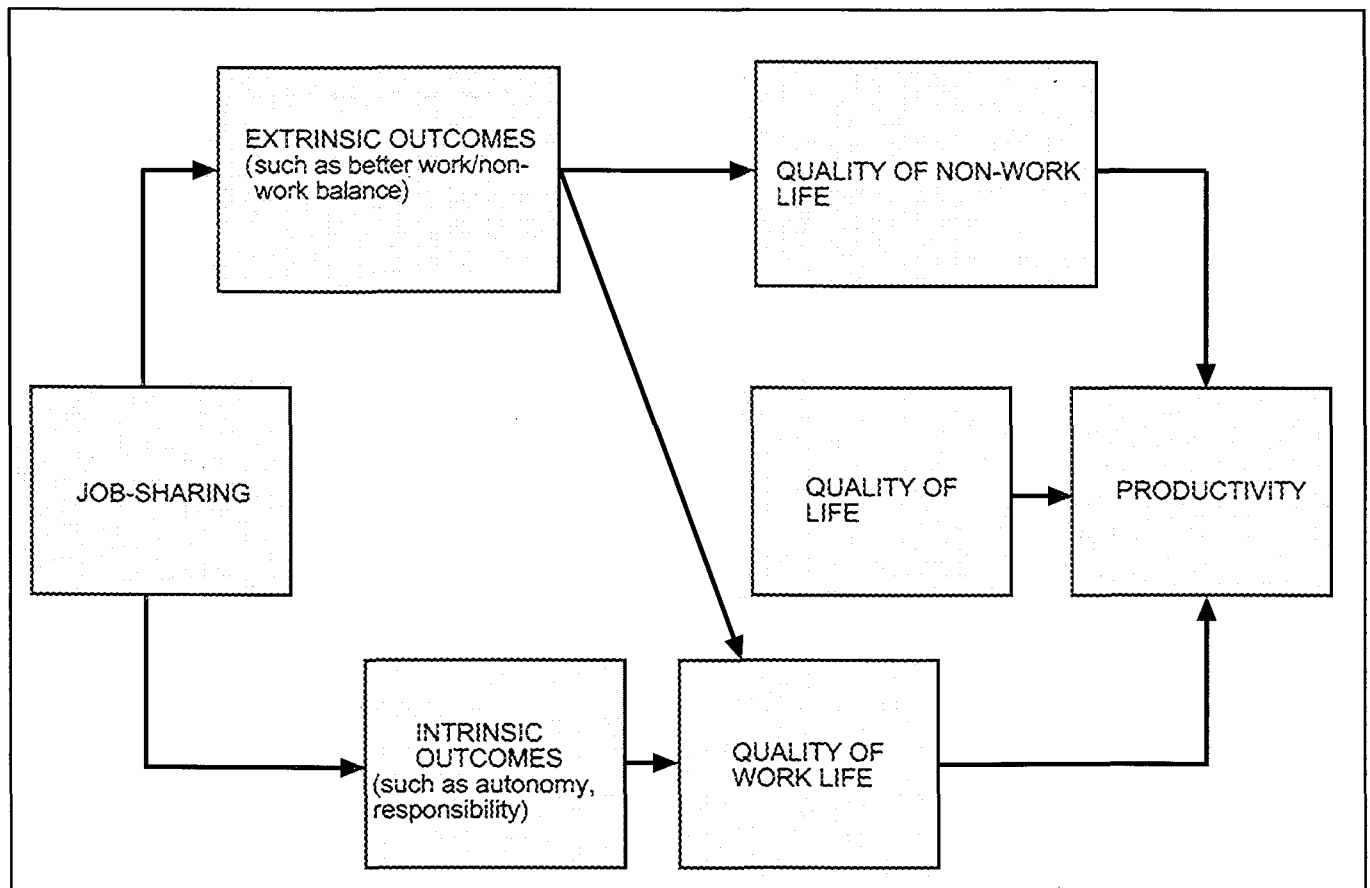


Figure 1: Effects of job-sharing on the quality of work life, quality of life and productivity

Implementing job-sharing as a voluntary option for employees could provide job satisfaction since their rights (constitutionalism) to this option would be protected. Also, employees would be able to balance their work and non-work life according to their choice (protection of total life space). These translate into a better QWL. Voluntarism is a necessary ingredient for the success of any QWL programme (Bluestone 1977). Job-sharing, being a voluntary strategy, might be well suited as a tool for improving QWL.

Job-sharing could provide the employee with extrinsic rewards, since basic working conditions are improved to include the choice not to work full-time. For example, employees may be comfortable only to come to work three times a week in their job-share schedule, giving them time to attend to their children's school or other non-work activities on the other days.

From the literature reviewed, job-sharing may also be seen as an intrinsic outcome for employees, to the degree that it allows employees the autonomy and flexibility to choose the option they desire. This would therefore contribute to and/or influence their QWL. Therefore, a poor QWL would be indicative of the need for an alternative work schedule, such as job-sharing.

A working definition of QWL

The analysis above reveals that the primary goal of QWL practices is to extend growth, challenge, participation, responsibility and control to all employees, so as to increase job satisfaction, self-esteem and self-fulfilment and enhance the dignity of individual workers and enable them to produce to their full potential.

QWL is regarded by some as a philosophy (Shareef 1990; Gray & Starke 1984) and by others as a goal and a process (Ault 1983; Gerber et al. 1995). This study adapts an all-encompassing approach, which would enable a practical translation of QWL practices into workable programmes. For the purposes of this paper, QWL is thus viewed as a goal, a process and a philosophy. In this regard, this paper adapts Mullins's (1993: 499) description of these elements of QWL as follows:

- | | |
|------------------|---|
| As a goal: | Improving organisational performance through the creation of more challenging, satisfying and effective jobs and work environments for people at all levels of the organisation. |
| As a process: | Calling for efforts to realise this goal through the active involvement and participation of people throughout the organisation. Through their involvement, people can make more meaningful contributions to the business and can experience greater feelings of satisfaction, pride in accomplishment and personal growth. |
| As a philosophy: | Viewing people as 'assets' to be 'released' and developed, and capable of contributing knowledge, skills, experience and commitment, rather than 'costs' that are merely extensions of the production and that need to be controlled. |

The indicators of poor QWL would include human resources problems like labour unrest and strikes, absenteeism, labour turnover, low labour productivity and sabotage.

If these conditions, as they relate to job-sharing, are satisfied, QWL would be expected to be high. If they are low, it would be an indication that there is potential for job-sharing as an alternative work schedule to help address these factors. The results of the research study, reported later in this paper, reveal some specific QWL variables, which are grouped into five categories through factor analysis (see Table 1).

This section has presented literature on QWL as it relates to job-sharing. A working definition of QWL has also been provided. There is an implied relationship between QWL and productivity, as revealed by the discussion above. Workers that are satisfied with their QWL can be said to be productive, and vice versa. This paper focuses only on the relationship between QWL and job-sharing.

Research methodology

This section outlines and describes the methods and procedures used in collecting data to address the research question. It describes the procedures and methods used to select the sample and collect and capture the data.

A quantitative, *ex-post facto* survey research methodology was used to conduct this study and obtain data from employees. Creswell (1994: 2) defines a quantitative study as "an inquiry into a social or human problem, based on testing a theory composed of variables, measured with numbers and analysed with statistical procedures, in order to determine whether the predictive generalizations of the theory hold true". Since little, if anything, is known about the job-sharing concept in South Africa, it does not lend itself to observation in the 'natural' work setting in a qualitative way (Gay & Diehl 1992).

Even though the question of causation is of interest in this study, it cannot be investigated experimentally by manipulating variables. Subjects could not be assigned to treatment and control groups in advance. It is therefore possible that there might be multiple causes, rather than just one, for any of the responses. The *ex-post facto* design was therefore used as the most appropriate to determine causal explanations between variables (Cooper & Emory 1995: 129–31).

This study was conducted in Gauteng, where approximately 50% of all economic activity in South Africa takes place (Central Statistical Service 1995). The sample of the study with which this paper is concerned was composed of workers (operatives, supervisors and shop stewards). To reduce the sampling error, the multi-stage, stratified (Babbie 1992: 233), systematic sample of the employees was obtained. A stratified systematic and proportionate sample of 560 individual employees – based on gender, union leadership and supervisory status – was selected from company personnel records from 20 organisations. This constituted 28 individuals in each organisation. Within the geographic, time, cost and accessibility constraints, stratification was done only up to the organisation level, to limit the number of strata. Thus, for the worker, the stratification was limited to gender, operative, supervisor and shop steward. The response rate was 77%.

Validity and reliability

To establish the content validity of the instrument, working university students and staff in supervisory and non-supervisory positions were given the research instrument to judge how well suited it was (Cooper & Emory 1995) to the South African context. The respondents were asked to make comments as to whether they felt the items were essential and appropriate.

Principal component analysis with a rotated factor pattern was conducted to establish construct validity, to identify the underlying constructs being measured and to determine how well the test represented them (Cooper & Emory 1995: 151–152).

Cronbach's alpha was used to re-establish the reliability of the constructs. Cooper & Emory (1995) are of the view that "Cronbach's Alpha has the most utility for multi-item scales at the interval level of measurement". Thus, it can be said to be appropriate as a reliability test for this study, which consisted of multi-item scales.

The principal component analysis was conducted for this study; five major constructs relating to QWL could be detected. To establish whether these grouped items actually measure their respective constructs, each Cronbach alpha coefficient was determined. The QWL grouped items and corresponding alpha coefficients are presented in Table 1.

Table 1 shows, by the results of the Cronbach coefficient alpha, that the items do measure QWL (0.85), in that the coefficients are above the acceptable level (Hair, Anderson, Tatham & Black 1992).

Questionnaire administrative procedures

This section gives a report of the procedures followed in administering the questionnaires used in the study. Exploratory, descriptive and explanatory self-report survey questionnaires were delivered to individual employees, to obtain quantitative data on their attitudes, current job satisfaction factors, productivity factors and proneness to job-sharing as appropriate. To obtain a high response rate, questionnaires were dropped off where an informed person was in charge of personnel records and picked up within ten days.

Rationale for the statistical analysis

Data were collected by means of a questionnaire. The majority of the questionnaire items took the Likert form, based on 5-point scales ranging from 'very easy' to 'very difficult' and from 'strongly agree' to 'strongly disagree'. For example, respondents were asked to rank statements such as: "I am satisfied with my physical working conditions" and "I like the kind of work I do". Other questions were asked to provide factual, demographic information, such as gender and age.

Description of respondents (frequencies)

Descriptive statistics of respondents are presented in Tables 2 and 3. The description of respondents according to gender, ethnicity, age, marital status, number of children, number of dependants and level of education is given in Table 2. The results pertaining to area of work, level in the organisation, union involvement and tenure are presented in Table 3.

There were 431 respondents in total, distributed almost evenly between men and women. The majority of the respondents (72%) were between 21 and 40 years of age.

In terms of ethnicity, 55% of the respondents were white and 33% were black. Table 2 shows that the majority of the workers (63%) were married, 28% were single and the rest were either divorced, separated or widowed. The majority of the respondents had at least one child, although approximately one third did not have any children. The majority of the respondents had some high school education.

The remaining descriptive statistics are reported in Table 3. Regarding the area of work, the majority of the respondents were in administration (38%), followed by other areas (25%), with clerical or secretarial ranking third.

The majority of the respondents were general workers (45%), followed by supervisors (28%) and managers (14.7%). Most of the respondents reported having no job-sharing positions.

Most of the surveyed organisations were unionised (82%). Only 42% of the representatives were union members, of whom 5.4% were union representatives. Only 11.4% of the respondents had worked for the organisation for less than a year.

Results

This section presents the statistical results of the study as they pertain to QWL and job-sharing.

QWL and job-sharing

The objective of this part of the research question is to explore the relationship between workers' perceived QWL and their willingness to job-share. The aim is to determine whether job-sharing could address the QWL problems in South Africa.

Table 1: Cronbach coefficient alpha

Constructs	Cronbach alpha
QWL:	0.85
Satisfaction with organisation	0.74
Autonomy and flexibility	0.76
Satisfaction with co-workers, work and supervision	0.66
Physical working conditions	0.66
Satisfaction with pay and work	0.51

Table 2. Description of respondents: Personal factors

Gender	Worker %	Dependants	Worker %
Male	50.2	0	36.9
Female	49.8	1	13.8
	N=431	2	14.5
Ethnicity		3	15.2
Asian	7.5	4	12.4
Black	32.9	5	7.1
Coloured	3.7	Number of children	
White	55.1	0	35.4
Other	0.7	1	18.7
Age		2	27.2
<21	2.3	3	13.1
21-30	35.4	4	5.6
31-40	36.8	Education	
41-50	18.3	Primary school	3.0
51-64	6.8	Some high school	12.4
65 or >	0.5	Matriculation	40.0
Marital status		Tertiary/Diploma	15.2
Single	28.3	Bachelor/Honours	23.6
Married	63.0	Masters	3.7
Divorced	6.8	Other	2.1
Separated	1.6		
Widow/er	0.2		

Table 3. Description of respondents: Organisational factors

Area of work	Worker %	Unionised organisation	Worker %
Education	5.1	Yes	82.2
Administration	38.1	No	13.6
Social Work/Counselling	1.7	Don't know	4.2
Clerical/Secretarial	15.4	Union membership	
Library	2.2	Yes	42.2
Banking	6.3	No	57.8
Manufacturing	6.7	Union representative	
Other	24.6	Yes	5.4
Level in organisation		No	94.6
Management (top)	3.4	Organisation tenure	
Management	14.7	<1 year	11.4
Supervision	28.0	1-3 years	23.5
Operations	45.1	4-8 years	30.1
Other	8.9	9-15 years	22.6
		16-25 years	10.7
		>26 years	1.6

Statistical tests were conducted using stepwise regression and discriminant analysis to determine any statistically significant relationships between QWL variables and perceived suitability of job-sharing and personal preference for the work schedule. Willingness to job-share was measured on two dimensions, firstly, whether the respondents felt that the job-sharing work schedule would be suitable in their organisation (suitability) and, secondly, whether they would personally prefer to job-share (preference). These results with regard to whether willingness to job-share would be influenced by QWL are presented below.

To measure QWL, 17 items were grouped into five constructs through factor analysis. Respondents were asked how they felt about a variety of work-related factors on a scale of 1 (strongly disagree) to 5 (strongly agree). The higher the score, the more satisfied the respondents were with the item. When the items were categorised into the QWL construct, the mean was 3.4 and the standard deviation was 0.6 (see Table 4).

QWL against suitability of job-sharing

This section presents the results with regard to the relationship between these QWL variables and perceived suitability of job-sharing and personal preference for the work schedule (in other words, willingness to job-share).

A stepwise multiple regression analysis was conducted to determine the relationship between QWL and perceived suitability of the job-sharing schedule. Firstly, analysis was done for the overall QWL (mean = 3.4) variable to determine if it has any significant relationship with perceived suitability of job-sharing. Table 5 reports the results.

QWL entered the model as a significant explanatory variable of the variation in the perceived suitability of the job-sharing work schedule at the 0.05 level of significance. The R-square value indicates that it explains 6% of the variation in the dependent variable 'suitability of the job-sharing work schedule'. The study went further to determine which of the QWL variables might explain most of the variation in the perceived suitability of job-sharing through stepwise regression analysis.

The summary of the stepwise procedure presented in Table 6 reveals that the variables which entered on steps 1 and 2 are 'satisfaction with pay and work' and 'physical working conditions'. Satisfaction with pay and work explains 9% of the model, and satisfaction with physical working conditions adds 1%, which is the next highest increment to R-square, raising it to 10%. Although these explain only 10% of the variation in suitability of the job-sharing work schedule, they are the two most significant QWL explanatory variables with regard to the workers' attitudes towards the job-sharing schedule.

Thus, whether respondents perceive job-sharing as a suitable alternative work schedule or not, depends on how satisfied they are with their QWL, especially as it pertains to pay, work and physical working conditions.

QWL against preference for work schedule

Discriminant analysis was also conducted to determine the relationship between QWL and workers' personal preference for the work schedule. The stepwise selection summary results of the discriminant analysis reveal that QWL is a significant (0.0001) explanatory variable of the personal preference for the work schedule at the 0.05 level of significance. The study also

Table 4. Means and standard deviation of QWL grouped items: Workers

Variable label	N=431	Mean	Standard deviation
Satisfaction with organisation	421	3.33	0.74
Autonomy and flexibility	420	3.08	0.92
Satisfaction with co-workers, work and supervision	421	3.62	0.72
Physical working conditions	420	3.72	0.95
Satisfaction with pay and work	424	3.19	0.77
Quality of Work Life (QWL)	422	3.44	0.61

Table 5. Quality of work life against suitability of job-sharing

Summary of stepwise procedure for dependent variable: Suitability of job-sharing						
STEP	Variable entered	Number in	Partial R**2	Model R**2	F-Value	F-Probability
1	Quality of Work Life (QWL)	1	0.061	0.066	25.74	0

Table 6. Quality of work life variables against suitability of job-sharing

Summary of stepwise procedure for dependent variable: Suitability of job-sharing (V67)						
STEP	Variable entered	Number in	Partial R**2	Model R**2	F-Value	F-Probability
1	Satisfaction with pay and work	1	0.092	0.092	39.37	0
2	Physical working conditions	2	0.01	0.1	3.67	0.05

Table 7. Quality of work life against preference for work schedule

Summary table							
STEP	Variable entered	Number in	Wilk's lambda	Significance	Minimum D squared	Significance	
1	Satisfaction with pay and work	1	.90525	0.0000	.11527	.0371	
2	Autonomy and flexibility	2	.84325	0.0000	.39207	.0033	
3	Physical working conditions	3	.82325	0.0000	.59440	.0006	
Canonical discriminant functions							
Function	Eigen value	% of variation	After function	Wilk's lambda	Chi-square	Df	Significance
1*	.16719	80.60	0	.8236	79.1698	6	.0000
2*	.04023	19.40	1	.9613	16.0929	2	.0003
* Marks the 2 canonical discriminant functions remaining in the analysis							
Structure matrix							
			Function 1	Function 2			
Satisfaction with pay and work			.77096 [†]	.36288			
Autonomy and flexibility			.75889 [†]	.63846			
Physical working conditions			.59808 [†]	.44449			
Satisfaction with organisation			.54676 [†]	.02845			
Satisfaction with co-workers, work and supervision			.42825 [†]	.01798			
† Denotes largest absolute correlation between each variable and any discriminant function							
Group centroids							
Group			Function 1	Function 2			
Group 1: Prefers current schedule			.28117	.02098			
Group 2: Prefers job-share schedule			.65136	.19694			
Group 3: Prefers other alternative			.42298	.53943			
Grouped cases correctly classified: 67.72%; Proportional chance ratio: 49%							

went further to determine which of the QWL variables might explain most of the variation in the personal preference for the work schedule through stepwise discriminant analysis.

The summary of the discriminant analysis results presented in Table 7 reveals that three variables entered and remained in the model as significant discriminators, based on their Wilk's lambda and D-squared values. The model reveals that 'satisfaction with pay and work', 'autonomy and flexibility' and 'physical working conditions' are the most significant explanatory variables of the workers' personal preference for the work schedule.

The canonical discriminant functions reveal that function 1 explains approximately 81% of the variation in the dependent variable; it is thus the most useful. The structure matrix reveals that all variables on function 1, if left in the model, are important determinants of the workers' personal preference for the schedule.

The group centroids results indicate that function 1 discriminates well between group 1 (those that prefer the current work schedule), group 2 (those that would prefer job-sharing) and group 3 (those that would prefer some other alternatives). The classification results of 'grouped' cases, correctly classified, is approximately 68%, as opposed to 49% if classification had been based on chance.

Areas of work (jobs) more suited to job-sharing

To establish whether there are differences among the areas of work in their personal preference for the work schedule, the cross-tabulation, chi-square test of independence (Cooper & Emory 1995) was used. The aim of this analysis was to explore the areas of work (jobs) more suited to job-sharing. Contingency tables were constructed for statistical testing, to determine whether the classification variables are independent or not. Percentages were used, since they simplify all

numbers to a range of 0 to 100 and translate the data into a standard form for relative comparison (Cooper & Emory 1995: 412-413). Contingency tables are appropriate for the preference for the work schedule in that they consist of multi-nominal count data classified on two scales or dimensions (McClave & Benson 1994: 980).

The statistical results of the workers' preference for the work schedule against demographic variables are presented in Table 8. The results reveal that the preference for the work schedule and the area of work are not independent of each other but related, otherwise it would be expected that the job-share row percentages for each area would be similar or close. The row percentages vary from 2.2% to 30.4%, indicating that there is a greater degree of dependency. Approximately 23% of the 403 respondents (or 92 individuals) preferred the job-share work schedule.

The work areas with the highest percentage of people that preferred the job-share schedule were administration (30.4%), followed by clerical/secretarial (22.8%) and other unspecified areas (17.4%). Those that gave job-sharing the least support were in the area of counselling/social work (2.2%) and education (4.3%). Within each work area, the respondents that had the highest percentage opting for the job-share schedule were: librarianship (55.6%), followed by manufacturing (42.9%); clerical/secretarial (35%), counselling/social work (28.6) and education (20.0%). The areas with the fewest respondents preferring job-sharing were banking (16%) and other (16.2%).

Discussion of the results

The results indicate that, while QWL as a variable significantly influences perceived suitability of job-sharing by workers, there are at least two of its five variables (constructs) that are more important. These are 'satisfaction with pay and work' and 'physical working conditions'. In addition to these, 'autonomy and flexibility' would also influence the workers'

Table 8. Preference of the job-share work schedule against area of work (cross-tabulation)

Area of work	Total number of respondents against area	Total number preferring job-share in area	Job-share (row) percentage	Percentage in area preferring job-share
Education	20	4	4.3	20.0
Administration	155	28	30.4	18.1
Counselling/Social Work	7	2	2.2	28.6
Clerical/Secretarial	60	21	22.8	35.0
Librarianship	9	5	5.4	55.6
Medical	-	-	-	-
Banking	25	4	7.3	16.0
Manufacturing	28	12	13.0	42.9
Other	99	16	17.4	16.2
TOTAL	403	92	100	

personal preference for the work schedule. The structure matrix confirms that on function 1, if all the variables were left in the analysis, they would all significantly contribute to explaining the variation in the perceptions of workers with regard to which of the schedules they would prefer.

The literature survey reveals that QWL means different things to different people and that among the areas that would affect employee satisfaction is the context of the work. It was also established through literature that one of the methods for improving QWL is through flexibility and autonomy in work scheduling. The results of this study confirm that there is a relationship between QWL and job-sharing as an alternative work schedule to the traditional full-time schedule. Whether employees perceive job-sharing as a suitable alternative schedule in South Africa and personally prefer it would be influenced by how satisfied they are with their QWL. If they are not satisfied with their pay and work, physical working conditions, and autonomy and flexibility, among other things, they might choose an alternative work option, such as job-sharing, to improve their QWL. To the degree that job-sharing would allow employees to balance their lives between the work and non-work domain (see Figure 1), it would also improve their QWL, as alluded to in the literature review.

The areas revealed by the results as more suited to job-sharing include librarianship, manufacturing, clerical/secretarial work, counselling/social work, education and administration (see Table 8, last column). This finding is also supported by the literature references that indicate that almost all jobs are suited to sharing, subject to proper analysis and implementation.

Conclusion

This paper has presented literature indicating that job-sharing can be, and has been, used in many countries abroad as an alternative work schedule in order to improve poor QWL. The results of this study confirm that QWL would influence whether or not job-sharing would be perceived as suitable in the South African labour market and whether or not it would be preferred as an alternative work schedule. Thus, it would be appropriate to infer that job-sharing would, to some extent, address problems relating to QWL. Therefore, based on the literature review and the research results presented in this paper, it may be concluded that there is potential for job-sharing in South Africa and that it may be used as an alternative solution to address problems relating to poor QWL. It can also be concluded, based on the literature review and the research results, that almost all areas of work are suited to job-sharing, subject to proper analysis and implementation.

Even though job-sharing may be an alternative solution to poor QWL in South Africa, in that it significantly impacts on the willingness to job-share, further research is needed to determine the specific levels of dissatisfaction at which the employees and organisations would opt to implement job-sharing. Research is needed to establish (or test) the specific outcomes of job-sharing in South Africa, once it has been implemented, to determine the degree to which it would improve QWL. Finally, each organisation would need to establish the specific QWL factors that would be addressed through job-sharing.

References

- Aliquo, L. 1994. 'South African managers support "Africanisation"', *SBL Forum*, 5(3): 5.
- Ault, R. 1983. 'The best of times and the worst of times: Defining QWL', In *Quality of Work Life: Perspectives for Business and the Public Sector*. Massachusetts: Addison-Wesley.
- Babbie, E. 1992. *The Practice of Social Research*. Belmont, CA: Wadsworth.
- Balogun, M.J. 1989. 'The role of management training institutes in developing capacity for economic recovery and long-term growth in Africa', In M.J. Balogun & G. Matahaha (eds.), *Restructuring in African Public Administration*. West Hartford, CT: Kumarian Press.
- Bennett, J. 1998. 'Women still tripped up by workplace obstacles', *Business Times: Appointments*, 13 December.
- Bluestone, I. 1977. 'Implementing quality-of-life programs', *Management Review*, July: 43–46.
- Blunt, P. & Jones, M. 1992. *Managing Organisations in Africa*. New York: Water de Gruyter.
- Boonzaier, B. & Boonzaier, M. 1994. 'The job diagnostic survey: A functional tool for South African managers', *South African Journal of Business Management*, 25(3): 101–109.
- Butler, J. 1995. 'Autocrats accelerate absenteeism', *Productivity SA*, 21(2): 8–10.
- Central Statistical Service 1995. *RSA Statistics in Brief*. Pretoria: CSS.
- Cherns, A.B. & Davis, L.E. 1975. 'Assessment of the state of the art', In L.E. Davis & A. B. Cherns (eds.), *The Quality of Working Life* (Vol. 1). New York: Macmillan.
- Christie, P., Lessem, R. & Mbigi, L. 1993. *African Management: Philosophies, Concepts and Applications*. Randburg: Knowledge Resources.
- Cooper, R.D. & Emory, W.C. 1995. *Business Research Methods*. Chicago: Irwin.
- Creswell, J.W. 1994. *Research Design: Qualitative and Quantitative Approaches*. London: Sage.
- Dancaster, L. 1993. 'Accommodating women in the workplace (Part 2): Atypical employment for working mothers', *South African Journal of Labour Relations*, 17(2): 3–15.
- EOR 1987. *Job Sharing*, 16(November/December): 12–16.
- Gay, L.R. & Diehl, P.L. 1992. *Research Methods for Business and Management*. New York: MacMillan.
- Gerber, P.D., Nel, P.S. & Van Dyk, P.S. 1995. *Human Resources Management*. Halfway House: Southern Books.
- Glaser, E.M. 1976. 'State-of-the art questions about quality of work-life', *Personnel*, May–June: 39–47.
- Gomez-Mejia, L.R., Balkin, D.B. & Cardy, R. 1995. *Managing Human Resources*. London: Prentice Hall.
- Gool, S. 1996. 'Absenteeism nightmare', *Productivity SA*, 22(1): 15–18.
- Gray, J.L. & Starke, F.A. 1984. *Organisational Behavior: Concepts and Applications*. Columbus, OH: Merrill.
- Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. 1992. *Multivariate Data Analysis with Readings*. New York: MacMillan.
- Hampton, D.R., Summer, C.E., & Webber, R.A. 1982. *Organisational Behavior and the Practice of Management*. Glenview, IL: Scott, Foresman.
- Harari, O. & Beaty, D.T. 1990. 'On the folly of relying solely on a questionnaire methodology in cross-cultural research', *Journal of Managerial Issues*, 11(3): 267–281.
- Hillard, V.G. 1990. 'Improving the quality of work life', *Boardroom*, 1(April): 4–5.
- Hofstede, G. 1980. *Culture's Consequences: International Differences in Work-Related Values*. London: Sage.

went further to determine which of the QWL variables might explain most of the variation in the personal preference for the work schedule through stepwise discriminant analysis.

The summary of the discriminant analysis results presented in Table 7 reveals that three variables entered and remained in the model as significant discriminators, based on their Wilk's lambda and D-squared values. The model reveals that 'satisfaction with pay and work', 'autonomy and flexibility' and 'physical working conditions' are the most significant explanatory variables of the workers' personal preference for the work schedule.

The canonical discriminant functions reveal that function 1 explains approximately 81% of the variation in the dependent variable; it is thus the most useful. The structure matrix reveals that all variables on function 1, if left in the model, are important determinants of the workers' personal preference for the schedule.

The group centroids results indicate that function 1 discriminates well between group 1 (those that prefer the current work schedule), group 2 (those that would prefer job-sharing) and group 3 (those that would prefer some other alternatives). The classification results of 'grouped' cases, correctly classified, is approximately 68%, as opposed to 49% if classification had been based on chance.

Areas of work (jobs) more suited to job-sharing

To establish whether there are differences among the areas of work in their personal preference for the work schedule, the cross-tabulation, chi-square test of independence (Cooper & Emory 1995) was used. The aim of this analysis was to explore the areas of work (jobs) more suited to job-sharing. Contingency tables were constructed for statistical testing, to determine whether the classification variables are independent or not. Percentages were used, since they simplify all

numbers to a range of 0 to 100 and translate the data into a standard form for relative comparison (Cooper & Emory 1995: 412-413). Contingency tables are appropriate for the preference for the work schedule in that they consist of multi-nominal count data classified on two scales or dimensions (McClave & Benson 1994: 980).

The statistical results of the workers' preference for the work schedule against demographic variables are presented in Table 8. The results reveal that the preference for the work schedule and the area of work are not independent of each other but related, otherwise it would be expected that the job-share row percentages for each area would be similar or close. The row percentages vary from 2.2% to 30.4%, indicating that there is a greater degree of dependency. Approximately 23% of the 403 respondents (or 92 individuals) preferred the job-share work schedule.

The work areas with the highest percentage of people that preferred the job-share schedule were administration (30.4%), followed by clerical/secretarial (22.8%) and other unspecified areas (17.4%). Those that gave job-sharing the least support were in the area of counselling/social work (2.2%) and education (4.3%). Within each work area, the respondents that had the highest percentage opting for the job-share schedule were: librarianship (55.6%), followed by manufacturing (42.9%); clerical/secretarial (35%), counselling/social work (28.6) and education (20.0%). The areas with the fewest respondents preferring job-sharing were banking (16%) and other (16.2%).

Discussion of the results

The results indicate that, while QWL as a variable significantly influences perceived suitability of job-sharing by workers, there are at least two of its five variables (constructs) that are more important. These are 'satisfaction with pay and work' and 'physical working conditions'. In addition to these, 'autonomy and flexibility' would also influence the workers'

Table 8. Preference of the job-share work schedule against area of work (cross-tabulation)

Area of work	Total number of respondents against area	Total number preferring job-share in area	Job-share (row) percentage	Percentage in area preferring job-share
Education	20	4	4.3	20.0
Administration	155	28	30.4	18.1
Counselling/Social Work	7	2	2.2	28.6
Clerical/Secretarial	60	21	22.8	35.0
Librarianship	9	5	5.4	55.6
Medical	-	-	-	-
Banking	25	4	7.3	16.0
Manufacturing	28	12	13.0	42.9
Other	99	16	17.4	16.2
TOTAL	403	92	100	

personal preference for the work schedule. The structure matrix confirms that on function 1, if all the variables were left in the analysis, they would all significantly contribute to explaining the variation in the perceptions of workers with regard to which of the schedules they would prefer.

The literature survey reveals that QWL means different things to different people and that among the areas that would affect employee satisfaction is the context of the work. It was also established through literature that one of the methods for improving QWL is through flexibility and autonomy in work scheduling. The results of this study confirm that there is a relationship between QWL and job-sharing as an alternative work schedule to the traditional full-time schedule. Whether employees perceive job-sharing as a suitable alternative schedule in South Africa and personally prefer it would be influenced by how satisfied they are with their QWL. If they are not satisfied with their pay and work, physical working conditions, and autonomy and flexibility, among other things, they might choose an alternative work option, such as job-sharing, to improve their QWL. To the degree that job-sharing would allow employees to balance their lives between the work and non-work domain (see Figure 1), it would also improve their QWL, as alluded to in the literature review.

The areas revealed by the results as more suited to job-sharing include librarianship, manufacturing, clerical/secretarial work, counselling/social work, education and administration (see Table 8, last column). This finding is also supported by the literature references that indicate that almost all jobs are suited to sharing, subject to proper analysis and implementation.

Conclusion

This paper has presented literature indicating that job-sharing can be, and has been, used in many countries abroad as an alternative work schedule in order to improve poor QWL. The results of this study confirm that QWL would influence whether or not job-sharing would be perceived as suitable in the South African labour market and whether or not it would be preferred as an alternative work schedule. Thus, it would be appropriate to infer that job-sharing would, to some extent, address problems relating to QWL. Therefore, based on the literature review and the research results presented in this paper, it may be concluded that there is potential for job-sharing in South Africa and that it may be used as an alternative solution to address problems relating to poor QWL. It can also be concluded, based on the literature review and the research results, that almost all areas of work are suited to job-sharing, subject to proper analysis and implementation.

Even though job-sharing may be an alternative solution to poor QWL in South Africa, in that it significantly impacts on the willingness to job-share, further research is needed to determine the specific levels of dissatisfaction at which the employees and organisations would opt to implement job-sharing. Research is needed to establish (or test) the specific outcomes of job-sharing in South Africa, once it has been implemented, to determine the degree to which it would improve QWL. Finally, each organisation would need to establish the specific QWL factors that would be addressed through job-sharing.

References

- Aliquo, L. 1994. 'South African managers support "Africanisation"', *SBL Forum*, 5(3): 5.
- Ault, R. 1983. 'The best of times and the worst of times: Defining QWL', In *Quality of Work Life: Perspectives for Business and the Public Sector*. Massachusetts: Addison-Wesley.
- Babbie, E. 1992. *The Practice of Social Research*. Belmont, CA: Wadsworth.
- Balogun, M.J. 1989. 'The role of management training institutes in developing capacity for economic recovery and long-term growth in Africa', In M.J. Balogun & G. Matahaba (eds.), *Restructuring in African Public Administration*. West Hartford, CT: Kumarian Press.
- Bennett, J. 1998. 'Women still tripped up by workplace obstacles', *Business Times: Appointments*, 13 December.
- Bluestone, I. 1977. 'Implementing quality-of-life programs', *Management Review*, July: 43-46.
- Blunt, P. & Jones, M. 1992. *Managing Organisations in Africa*. New York: Water de Gruyter.
- Boonzaier, B. & Boonzaier, M. 1994. 'The job diagnostic survey: A functional tool for South African managers', *South African Journal of Business Management*, 25(3): 101-109.
- Butler, J. 1995. 'Autocrats accelerate absenteeism', *Productivity SA*, 21(2): 8-10.
- Central Statistical Service 1995. *RSA Statistics in Brief*. Pretoria: CSS.
- Cherns, A.B. & Davis, L.E. 1975. 'Assessment of the state of the art', In L.E. Davis & A. B. Cherns (eds.), *The Quality of Working Life* (Vol. 1). New York: Macmillan.
- Christie, P., Lessem, R. & Mbigi, L. 1993. *African Management: Philosophies, Concepts and Applications*. Randburg: Knowledge Resources.
- Cooper, R.D. & Emory, W.C. 1995. *Business Research Methods*. Chicago: Irwin.
- Creswell, J.W. 1994. *Research Design: Qualitative and Quantitative Approaches*. London: Sage.
- Dancaster, L. 1993. 'Accommodating women in the workplace (Part 2): Atypical employment for working mothers', *South African Journal of Labour Relations*, 17(2): 3-15.
- EOB 1987. *Job Sharing*, 16(November/December): 12-16.
- Gay, L.R. & Diehl, P.L. 1992. *Research Methods for Business and Management*. New York: MacMillan.
- Gerber, P.D., Nel, P.S. & Van Dyk, P.S. 1995. *Human Resources Management*. Halfway House: Southern Books.
- Glaser, E.M. 1976. 'State-of-the art questions about quality of work-life', *Personnel*, May-June: 39-47.
- Gomez-Mejia, L.R., Balkin, D.B. & Cardy, R. 1995. *Managing Human Resources*. London: Prentice Hall.
- Gool, S. 1996. 'Absenteeism nightmare', *Productivity SA*, 22(1): 15-18.
- Gray, J.L. & Starke, F.A. 1984. *Organisational Behavior: Concepts and Applications*. Columbus, OH: Merrill.
- Hair, J.F., Anderson, R.E., Tatham, R.L. & Black, W.C. 1992. *Multivariate Data Analysis with Readings*. New York: MacMillan.
- Hampton, D.R., Summer, C.E., & Webber, R.A. 1982. *Organisational Behavior and the Practice of Management*. Glenview, IL: Scott, Foresman.
- Harari, O. & Beaty, D.T. 1990. 'On the folly of relying solely on a questionnaire methodology in cross-cultural research', *Journal of Managerial Issues*, II(3): 267-281.
- Hillard, V.G. 1990. 'Improving the quality of work life', *Boardroom*, 1(April): 4-5.
- Hofstede, G. 1980. *Culture's Consequences: International Differences in Work-Related Values*. London: Sage.

Can job-sharing improve quality of work life in South Africa?

- Ivancevich, J.M., & Matterson, M.T. 1996. *Organizational Behavior and Management*. Chicago: Irwin
- Ivancevich, J.M. & Matterson, M.T. 1999. *Organizational Behavior and Management*. Chicago: Irwin.
- Kast, F.E. & Rosenzweig, J.E. 1985. *Organization and Management*. Johannesburg: McGraw-Hill.
- Kiggundu, M.N. 1988. 'Africa', In R. Nath (ed.), *Comparative Management: A Regional View*. Cambridge, MA: Ballinger.
- Kiggundu, M.N. 1989. *Managing Organisations in Developing Countries*. Connecticut: Kumarian Press.
- Kolodny, H. & Van Beinum, H. 1983. *The Quality of Working Life and the 1980's*. New York: Praeger.
- Lee, P. 1984. 'Job sharing – A concept whose time has come', *Office Administration and Automation*, April: 28–30.
- Leighton, P. 1986. 'Job-sharing: Opportunities or headaches?', *Employee Relations* 8(2): 27–31.
- Lunt, P. 1994. 'Want to share a job? Some people do', *ABA Banking Journal*, 86(3): 88.
- Lussier, R.N. 1990. 'Should your organisation use job sharing?', *Supervision*, 9–11.
- Luthans, F. 1995. *Organizational Behavior*. New York: McGraw-Hill.
- Manning, T. 1996. 'Managing minds', *Productivity SA*, 22(4): 7–10.
- Mbigi, L. & Maree, J. 1995. *UBUNTU: The Spirit of African Transformation Management*. Randburg: Knowledge Resources.
- McClave, J.T. & Benson, P.G. 1994. *Statistics for Business and Economics*. New York: Dellen.
- Meier, G.S. 1978. *Job Sharing: A New Pattern for Quality of Work and Life*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.
- Meltz, N.M., Reid, F. & Swartz, G.S. 1981. *Sharing the Work: An Analysis of the Issues in Worksharing and Jobsharing*. Toronto: University of Toronto Press.
- Mullins, J.L. 1993. *Management and Organisational Behaviour*. London: Pitman.
- Ndala, R. 1996. 'Uncovering the WANTA factor', *Productivity SA*, 22(1): 27–29.
- Olmsted, B. & Smith, S. 1989. *Creating a Flexible Workplace: How to Select and Manage Alternative Work Options*. New York: Amacom.
- Parsons, J. 1992. 'The 21st century Bushmen', *Productivity SA*, 18(2): 7–8.
- Pierce, J.L., Newstrom, J.W., Dunham, R.B., & Barber, A.E. 1989. *Alternative Work Schedules*. Boston: Allyn and Bacon.
- Poe, A.C., 1999. 'The Daddy track (working fathers)', *HRM Magazine*, 44(June): 82–86.
- Polsky, W.L., & Foxman, L.D. 1987. 'Can job sharing work for you?', *Personnel*, 66(9), Sept: 30–33.
- Ronen, S. 1984. *Alternative Work Schedules: Selecting, Implementing and Evaluating*. Chicago, IL: Irwin.
- Shareef, R. 1990. 'Training: QWL programs facilitate change', *Personnel*, September: 58–61.
- Stein, B.A. 1983. *Quality of Work Life in Action: Managing for Effectiveness*. New York: American Management Associations.
- Stennett, R. 1993. 'Job-sharing in librarianship', *Library Management*, 14(6):13–20.
- Taylor, T. (1988). 'Quality of work life', *Productivity SA*, 14(6): 4–6.
- Walton, P. 1990. *Job Sharing: A Practical Guide*. London: Kogan Page.
- Warne, B.D., Lundy, K.L.P. & Lundy, L.A. 1992. *Working Part-Time: Risks and Opportunities*. New York: Praeger.

The organisation, structure and functioning of manufacturing companies in South Africa

William H. Raubenheimer*

In 1994, Dr Piet Human, senior lecturer in Strategic Management and Organisation Theory at the University of Cape Town, wrote: "There is a paucity of serious studies of the South African business firm ... Our researchers and writers on organisation appear to be exclusively interested in idealistic futures and exotic answers and would seem to find the very important project of explaining reality for what it is, distinctly unattractive."

The project upon which this article is based was an endeavour to address just that paucity of serious organisational studies and an attempt to describe the South African organisational reality for what it is, warts and all. An extensive literature search revealed that by far the most influential organisational studies throughout the 1970s and 1980s were the Aston studies, which began in Great Britain and were then replicated throughout Europe, including Poland and West Germany, as well as in the USA and Canada, the Far East and India, and, finally, Korea and Japan. The only study on the African continent was a limited analysis of the public service in Egypt.

The Aston team criticised the popular management and administrative theorists of the time, exemplified by Weber and Fayol, for being overly concerned with the formal aspects of structure and functioning, or "organisations without people". Similarly, they were critical of empirically oriented behavioural scientists, exemplified by Mayo and Lewin, whose sole concern was informal group behaviour and attitudes – or "people without organisations". Their contention that the form an organisation's structure finally assumes is largely contingent on contextual and environmental factors – and there is, therefore, no one ideal way to structure an organisation – anticipated by several years the contingency theory, which was to form the most useful and popular theoretical framework for organisational studies in the 1980s and 1990s.

The Aston team saw their contribution in terms of a break with Weberian ideal types and a transition from a priori to empirical theory based on an open systems orientation. They set objectives to identify, describe and measure the dimensions of structure and to consider the influence of context or environment. There can be little doubt that they succeeded, as witnessed in the wide replication of their work throughout the world.

This study, then, owes much to the Aston methodology. It is the first large-scale organisational study of its type to be conducted in South Africa, using mostly the Aston scales, or modifications thereof, to suit a self-administered questionnaire.

Introduction

From time to time over the past thirty years or so, the literature on organisation theory in America and Europe has featured what can be termed the Great Structural Debate. The emphasis has fallen on different issues at various stages as the origin, survival and regeneration of organisational systems and structures have been dissected and studied (Robbins 1987). Most research and theorising has taken place in advanced Western economies and in the industrial giants of the Pacific Rim. There has been little contribution from what are usually termed the developing nations of the world.

The continent of Africa is typical of this phenomenon. Apart from a small number of limited studies, such as an examination of the Egyptian public sector (Badran & Hinings 1981), there have been few, if any, serious and large-scale structural analyses of the institutions and organisations of Africa. South Africa is no exception to this situation, so it seems that the Great Structural Debate has passed unnoticed by the southern tip of the African continent as well (Human 1993).

In many ways, South Africa is very different from the rest of the continent. Prior to the recent fundamental socio-political redefinition of South African society, much of the country's

*Dr Bill Raubenheimer is an independent management consultant, specialising in organisation development and performance improvement. He holds a doctorate in organisation theory from the Graduate School of Business Leadership of the University of South Africa.

uniqueness was attributable to a political and social system that was 'abhorred and universally condemned.

Historically, South Africa's uniqueness is characterised by having been the world's polecat for more than 30 years, accompanied by decades of ever-increasing sanctions. The years of affirmative action for the white Afrikaner section of the population, which attended the rise to power of the Nationalist government in 1948, resulted ultimately in an enormous public sector designed to enforce the rule of apartheid (Oakes 1988). Ken Owen, a former editor of the *Sunday Times*, often reminded his readers, while bemoaning the Nationalist government's profligacy, that one in four economically active adults was a civil servant; a record only beaten by the monolithic bureaucracies of the former communist world.

The private sector in South Africa has been dominated by a few super-conglomerates. Nearly 80% of all private industry is controlled by just five corporations, which have created by far the most developed economic sector in Africa (Nel 1982). There is today a unique combination of First World and Third World elements, exacerbated by a historical shortage of high calibre managers as well as skilled and professional people (Raubenheimer 1995). Finally, there has been a high level of taxation and government intervention in the economy, both by regulation and through controlled industries.

The paradox that is South Africa is perhaps exemplified by the country's electronics industry. Although the technology employed is largely imported, very successful adaptations have been engineered for local operating conditions. More significantly, there have also been important local breakthroughs – particularly in the fields of weaponry and defence – which have been exported with great success. Local software industries have developed adaptations and products that can legitimately be described as leading-edge applications.

So, despite its undoubted Third World status, South Africa is also a world leader in some respects. Its expertise and technological supremacy in the field of deep-level mining and ore extraction, particularly of gold, are also acknowledged throughout the world.

With the election of a democratic government and the lifting of sanctions, including academic isolation, it was felt that the

time to make a purely South African contribution to organisation theory was compellingly ripe, even overdue. As a case study, the natural demographics of the country, combined with its uniqueness and political history, held many intriguing possibilities for the Great Structural Debate. At the outset, five hypotheses were advanced as the *raison d'être* for the study:

1. South African manufacturing organisations are shaped and influenced by contingencies and imperatives that determine their structure, design and functioning. Prominent among these contextual variables are organisation size, power control, technology, dependence on external organisations, and the degree of environmental turbulence and change.
2. The contextual variables exercise a differential influence on the structure, design and functioning of South African manufacturing organisations. Generally, the structuring of activities (in terms of specialisation, standardisation and formalisation) will be more closely related to size and power control. Design or configuration variables will be more closely related to power control and technology and less closely related to size. Finally, centralisation will be related mostly to dependence and power control.
3. In South African manufacturing organisations, organic structures will be associated with conditions of high environmental uncertainty and low dependence. Conversely, mechanistic structures will be associated with conditions of low environmental uncertainty and high dependence.
4. A number of internal variables will exhibit relationships to one another that are consistent with findings in other organisational research projects throughout the world.
5. Contextual variables that shape structure will also influence aspects of organisation climate.

Research design

The research design of this study employed an empirical approach with a strong quantitative bias. Data were gathered in a structured manner with a view to testing specific hypotheses based on defined research problems, which were, in turn, drawn from a body of accepted theory and based on an extensive literature review (Raubenheimer 1995).

Table 1. Geographical dispersion of SIC manufacturing organisations

Geographical Area	Number	%
Western Cape	2 282	16.6
Northern Cape	235	1.6
Free State	537	3.6
Eastern Province	968	6.5
KwaZulu-Natal	2 644	17.7
Mpumalanga	444	2.9
Northern Province	303	2.0
Gauteng Province	6 732	45.0
North-West Province	348	2.3
Other	269	1.8
Totals	14 964	100.0

Table 2. Independent and dependent variables

Independent contextual variables	Dependent structural variables
1. Actual size	1. Specialisation
2. Age	2. Formalisation
3. Technology	3. Standardisation
- workflow integration	4. Configuration
- process technology	5. Centralisation
4. Dependence	6. Organicity
- internal dependence	
- customer dependence	
- supplier dependence	7. Organisation climate
5. Power control	- 9 dimensions
6. Environment	
- change	
- uncertainty	
- operating environment	

Database

The Bureau of Market Research at the University of South Africa has a database called the Standard Industrial Classification of all Economic Activity (SIC). The category of 'manufacturing' contains records of 14 964 organisations, and it was from this group that the research population was drawn. The study was confined to manufacturing organisations, because it was felt that the effects of technology as a possible causal variable of organisation structure would be more apparent and measurable in such organisations than, for example, in service or retail organisations.

The types of activities embraced by organisations classified under the SIC category of manufacturing included: food, beverages and tobacco; textiles and clothing; wood, including furniture; paper, printing and publishing; industrial chemicals; plastics and refineries; glass and non-metallic substances; iron steel and non-ferrous metals; and electrical machinery, machinery, motor vehicles, fabricated metal products and scientific equipment.

The geographical dispersion of manufacturing organisations in the SIC database is illustrated in Table 1.

It will be seen that the regions of the Western Cape, KwaZulu-Natal and Gauteng together account for 80% of all manufacturing activity, with Gauteng alone being responsible for 45%.

Research population

It was decided that the cut-off size for organisations included in the population would be 150 employees. This resulted in a research population of 2 288 organisations that were suitable for inclusion. The chief executive of each of these organisa-

tions was contacted and requested to fill in a comprehensive questionnaire. The total number of responses from this population then became the research sample.

By including all the organisations from the SIC database that complied with the two criteria – that they fell into the manufacturing category and had more than 150 employees – a complete census was carried out, rather than taking a smaller, stratified sample. Some of the problems associated with sampling bias were thus overcome. As to the integrity of the Bureau of Market Research's SIC database, it was established that it is the largest and most current of its kind in South Africa, outside the Bureau of Statistics of the Department of Manpower.

Sample

The SIC database provided three key parameters by which constituent organisations were described and compared, namely: the size of the organisation, the development region in which it was situated, and, finally, its type of activity as indicated by its SIC code.

It was felt that a reasonably high response rate of 528 returned questionnaires enhanced the representativeness of the data, as well as the potential to generalise from the data. The criteria used for including completed questionnaires were very strict in disallowing errors and missing data, and the final number of usable questionnaires was 458, or 22%.

The degree to which the organisations in the sample and in the population were comparable can be gauged by the Pearson correlation coefficient between the range of scores of their descriptive dimensions. Respectively, these were 0.997 for size, 0.867 for the type of industry, and 0.989 for the geo-

graphical region. Taken as a whole, then, it could be said with confidence that the sample and the population were closely comparable along three descriptive dimensions of size, development region and type of activity.

Data collection

Data were collected by means of a questionnaire designed to measure a number of independent and dependent variables. Table 2 presents a summary of the variables that were analysed. Most of the variables will be immediately familiar to students of organisation theory. This should hardly be surprising, since organisation studies over the years have distilled a number of preferred exogenous and outcome variables. The scales used to measure the independent variables were developed and drawn from a number of sources.

Contextual scales

The benchmarks used to gauge the independent variables of size and dependence were either original Aston measures (Pugh, Hickson, Hinings & Turner 1968) or modifications of the abbreviated Aston scales (Inkson, Pugh & Hickson 1976). The Aston measure for dependence was modified, in that an item indicating ownership by a foreign multinational was added to the public accountability scale. There was obviously no call for such a category in the original British sample.

In measuring technology, it was decided to follow the example of the Okayama study (Marsh & Manneri 1981) and to use two diverse measures: firstly the Aston measure, entitled 'workflow integration', and secondly a 'process technology' scale, developed by Khandwalla from the original classification of technology by Woodward (1958) (Marsh & Manneri 1981).

Power control as a structural imperative looks at an organisation purely in terms of those in power, the dominant coalition, selecting a structure that will maximise their control. This viewpoint postulates that the dominant coalition is not necessarily synonymous with those who hold formal authority, and decision-making is always self-serving – even if it is couched in terms of maximising organisational effectiveness (Robbins 1987: 176–200). A literature search failed to reveal a worthwhile gauge of power control, and so a perceptual scale was devised, based on Robbins's (1987) definition, in which the presence or absence of five different factors was assessed, namely:

1. Structural choices to enhance power
2. Structural constancy over time
3. Self-serving ideas
4. Occasionally illogical strategies
5. A dominant coalition differing from the formal authority structure.

Three measures of the environment were included:

1. A six-item organisation change scale developed by Lincoln & Zeitz (1980) that measured environmental turbulence
2. A predictability measure developed by Robbins (1987: 162), with only minor amendment to the scoring system to make it more explicit
3. A scale developed by Anshoff & Sullivan (1993), which was reworded to suit an African context. The qualifier 'operating' was added to the word 'environment' throughout.

Respondents were instructed to disregard the recent momentous political changes, which might have influenced them to overrate the turbulence in their historical operating environments.

Structural scales

The questionnaire measured the dependent structural variables by presenting scales for specialisation, formalisation, standardisation, configuration, centralisation and organicity. The specialisation scale was a development by Reimann (Stewart, Hetherington & Smith 1984) of the original specialisation index of the Aston researchers. Formalisation was measured by an adaptation of the original Aston scale, as was configuration. The standardisation scale was drawn from the work of Hage & Aiken and was more a measure of the amount of routine than of the similarity of tasks (Price 1972: 151). Configuration was gauged by the usual point and ratio measures used by the Aston and similar studies.

Centralisation and its relationship to other variables have also been the subject of much debate in organisation theory circles. It was deemed important to distinguish between the types of decisions that are centralised. To this end, the autonomy scale of Inkson et al. (1970) was supplemented by two further measures: a first line decision-making discretion scale developed by Robbins (1987) and a policy decision scale developed by Reimann (Stewart, Hetherington & Smith 1984).

The final structural scale was a seven-item organicity scale developed by Covin, Prescott & Slevin (1990). It was based on a similar scale devised by Khandwalla to assess an organisation's tendency to organic or mechanistic operating management philosophy.

The demographic section of the questionnaire called for information on the organisation's life cycle stage, major industry and sector, age and approximate turnover. It was felt that any or all of these factors could prove important from the point of view of controlling for extraneous variables – or even of testing additional hypotheses that may have arisen in the course of the research.

A pilot study was carried out on 23 respondents drawn from various industrial organisations in the East Rand area of Gauteng, as well as from among the membership of management forums to which the researcher belongs. The questionnaire was generally well received, and very few response problems were experienced by the participants.

Processing and treatment of the data

The entire project took almost two years to complete from the initial proposal to the completion of the final thesis. The data capture of the 458 completed questionnaires was carried out by the researcher over a three-month period. The format used was a spreadsheet that is compatible with most statistical software packages. It allowed the inclusion of formulae to calculate item totals, to reverse negatively keyed items, and to perform ad hoc manipulations of data before they were downloaded on to SPSS/PC+, which was the statistical software package used.

The statistical analyses involved three stages:

1. Testing the reliability and validity of the scales
2. Testing the scales for multidimensionality by searching for underlying factors
3. Stepwise multiple regression analyses of the independent and dependent variables.

It was deemed necessary to go through all these stages because many of the measuring instruments were being used in a South African context for the first time. One of the objec-

Table 3. Reliability of the structural scales

Scale	Alpha
1. Specialisation	0.853
2. Formalisation	0.811
3. Standardisation	0.791
4. Centralisation	
- autonomy	0.865
- first line discretion	0.774
- policy decision-making	0.715
5. Organicity	0.788

tives of the study was to test the applicability of accepted organisation theory methods and precepts in a local situation.

Results

Dependent structural variables: Reliability

Reliability data with respect to the dependent structural variables are illustrated in Table 3. In a Canadian study, Clark (1990: 49) indicated that a reliability coefficient of 0.75 or higher was desirable; but for an exploratory study (such as this one) a level of 0.6 or higher would be acceptable.

Taken as a whole, then, the scales measuring the dependent variables showed an acceptable level of reliability. Interestingly, the three scales exhibiting coefficients higher than 0.80 were all Aston measures, reflecting the soundness and wide applicability of the original Aston methodology in its first application in South Africa.

Dependent structural variables: Multidimensionality and validity

Some of the results of the factor analysis carried out on each of the structural scales are displayed in Tables 4–8. Despite the large sample size, only factor loadings in excess of 0.30 were considered to be significant in this study. It was felt that applying such rigorous norms would enhance the credibility of any comments that were made with respect to the validity of any of the scales.

The principal factor analysis for the first of the structural scales – that of functional specialisation – is set out in Table 4. Every item had at least one significant loading, and three easily identifiable factors emerged. These were labelled:

	Alpha
Factor 1: Core activities – throughput and direct support	0.79
Factor 2: Ancillary activities – boundary spanning and indirect support	0.74
Factor 3: Human resources – procurement, development and care of people	0.76

The three underlying critical areas of business activity, which were illustrated by the principal factor analysis and the large amount of variance for which they accounted, reflected well on the scale’s content and construct validity in a South African situation.

In examining the factor analysis of the formalisation data (Table 5), it was evident that all the variables except one loaded significantly on at least one factor. Three factors were extracted by the principal factor analysis method:

Table 4. Functional specialisation: Principal factor analysis

Item	Factor 1	Factor 2	Factor 3
Public relations	0.08581	0.46418	0.19070
Sales	0.64049	0.11511	0.05923
Transport	0.34970	0.15455	-0.00539
Employment	0.34378	0.23480	0.57052
Education and training	0.09597	0.28665	0.63625
Welfare	0.19954	0.33328	0.64297
Purchasing	0.67140	0.10547	0.16584
Maintenance	0.44525	0.11860	0.20178
Accounts	0.77957	0.01445	0.06939
Production control	0.46322	0.16469	0.25679
Inspection	0.49105	0.12420	0.29435
Methods	0.12778	0.40911	0.29190
Research/Development	0.14896	0.45055	0.23577
Records	0.22301	0.45798	0.12887
Legal/Secretarial	0.08474	0.63837	0.07219
Market Research	0.07350	0.69684	0.17626
MIS	0.39056	0.37297	0.25550
Rotated Factor Matrix:	Varimax converged in 6 iterations		

	Alpha
Factor 1: Formalisation – roles and relationships	0.74
Factor 2: Formalisation – procedures and policies	0.69
Factor 3: Formalisation – information and organisation renewal	0.61

If a fourth factor with the eigenvalue of 0.992 (the default was set at 1.0) were to be included, then 62.2% of variance would be accounted for. The three logical and recognisable factors, together with the high percentage of variance explained in the principal component analysis, lead to the conclusion that the validity of the scale was also good.

The three areas of formalisation described firstly embraced the human aspects of South African organisations. Secondly, they covered the task activities of these organisations, and, thirdly, they portrayed the organisation’s survival and continuous renewal. Many aspects of Weber’s ideal type, together with Parsonian structural functionalism, are evident in the three factors that were extracted by this scale. This is to be expected, since the nub of bureaucracy lies in the formalisation of roles. In terms of the structural functional viewpoint, formalisation presents an effective strategy for mastering the

Table 5. Formalisation: Principal factor analysis

Item	Factor 1	Factor 2	Factor 3
Information booklets issued	0.19846	0.26080	0.59253
Number of information booklets	0.14779	0.12626	0.71984
Organisation charts	0.35388	0.28714	0.27495
Job descriptions - directs	0.37536	0.28632	0.17216
Job descriptions - line supervisors	0.70518	0.27260	0.08723
Job descriptions - staff	0.81478	0.16645	0.11625
Job descriptions - chief executive	0.53064	0.01868	0.14924
Operating instructions	0.11824	0.44845	0.19108
Procedure manual	0.15474	0.77815	0.17363
Written policies	0.28590	0.60176	0.21669
Production schedule	0.05868	0.28517	0.25380
Research and development programmes	0.09473	0.21535	0.33654
Rotated Factor Matrix:	Varimax converged in 6 iterations		

Table 6. Autonomy or decentralisation: Principal factor analysis

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Management headcount	0.51142	0.04913	0.27312	0.14079	0.24334
Appoint managers	0.70702	0.11193	0.20626	0.16036	0.09526
Promote managers	0.83018	0.07720	0.14456	0.06305	0.08356
Managers' salaries	0.64075	0.06736	0.13404	0.02464	0.27906
Dismiss a manager	0.57330	0.08048	0.04654	0.12847	0.06392
New products/services	0.13245	0.19734	0.64301	0.06335	0.14534
Market territories covered	0.08776	0.00682	0.61925	0.03746	0.06962
Extent/type of markets	0.13139	0.01003	0.77802	0.02338	0.02725
Price of output	0.23786	0.21347	0.51990	0.16128	0.11565
Type/brand new equipment	0.31958	0.23535	0.05919	0.03155	0.24005
What will be costed	0.12561	0.29231	0.33173	0.15083	0.21295
What will be inspected	-0.13436	0.50316	0.13760	0.03263	0.12511
Operations to be work-studied	-0.01232	0.55841	0.08453	0.04501	0.00659
Suppliers of materials	0.11052	0.40652	-0.01123	-0.00563	0.08935
Buying procedures	0.20962	0.53982	0.13882	0.08955	0.19189
Training methods	0.22482	0.42700	0.02270	-0.05168	0.00847
What/extent welfare facilities	0.29700	0.21382	0.12008	0.12283	0.30331
Unbudgeted capital expense	0.24429	-0.00055	0.06068	0.08851	0.64967
Unbudgeted revenue expense	0.12342	0.14388	0.17682	0.05218	0.46965
Define responsibilities - specialists	0.13683	0.56820	0.18993	0.20423	0.04872
Define responsibilities - line departments	0.05355	0.53021	-0.00854	0.09098	-0.02236
Create a new department	0.32302	0.17490	0.20377	0.86030	0.16698
Create a new job	0.45292	0.21115	0.13497	0.46569	0.16158
Rotated Factor Matrix:	Varimax converged in 5 iterations				

preservation and renewal challenges of adaptation, goal attainment, integration and pattern maintenance.

The standardisation scale resulted in a single factor solution (not illustrated), and all the items loaded very significantly. Principal component analysis indicated that the first and only factor accounted for 55.1% of the variance; the scale thus measured what it was intended to measure, and its content and construct validity were probably good.

Principal factor analysis of the autonomy or decentralisation scale, shown in Table 6, yielded a five-factor solution. Clark (1990: 50-51), in his analysis of Canadian textile firms, also produced a five-factor solution for his decentralisation scale. Overall, the validity of the scale seemed to be sound. Analysis of the factors indicated logical groupings, which were labelled:

	Alpha
Factor 1: Autonomy – decisions affecting management corps	0.82
Factor 2: Autonomy – operating policies and responsibilities	0.71
Factor 3: Autonomy – strategic marketing decisions	0.75
Factor 4: Autonomy – operational expansion decisions	0.78
Factor 5: Autonomy – extraordinary expenditure decisions	0.56

The only illogicality occurred in the first factor, where the type and brand of new equipment was included in decisions affecting the management corps.

Perhaps, when they marked this item, respondents had in mind that uniquely South African institution of the company car fleet. Because of the critical shortage in the job market of middle and junior managers, professionals and high-level spe-

cialists, such people are routinely able to demand a company vehicle as part of their remuneration package. For most companies, the company car fleet is a very significant item on their balance sheets.

The factor analyses of the other two measures of centralisation are not illustrated here. The scale that measured centralisation of policy decisions yielded another single factor solution, although its validity was a little disappointing. The final centralisation measure, that of the first line supervisory discretion, proved more robust. It yielded two very clear factors, both of which exhibited extremely high loadings on every single one of the items. These factors were readily labelled:

	Alpha
Factor 1: Centralisation – top management involvement	0.76
Factor 2: Centralisation – first line supervisory discretion	0.86

In principal component analysis, both factors together accounted for 59.2% of the variance, and the scale proved to be a robust measure with strong construct and content validity. It was used with confidence in all further analyses.

The last of the structural scales, that of organicity or operating management philosophy, is shown in Table 7. This scale also distilled two very strong factors on which all the items loaded very significantly. The factors were labelled:

	Alpha
Factor 1: Structure (procedures, controls and parameters)	0.68
Factor 2: Behaviour (management style, communication and response patterns)	0.81

Table 7. Organicity (operating management philosophy):

Item	Factor 1	Factor 2
Communication	0.11573	0.65149
Management style	0.22085	0.67418
Influence	0.21456	0.35477
Reaction to change	0.24145	0.57035
Procedures	0.66303	0.35170
Control	0.78250	0.14973
Task definition	0.72013	0.26553
Rotated Factor Matrix:	Varimax converged in 3 iterations	

The strength and clarity of the factors, together with the fact that both of them together accounted for 60.9% of the total variance in the scale, reflected well on its content and construct validity.

Factoring the structural variables

The extent to which the structural variables were independent of one another, or had areas of commonality, was established by submitting their raw scores to both a correlational and a factor analysis. Table 8 illustrates the intercorrelations of all the structural variables. It was immediately apparent that the most significant correlation was between functional specialisation and formalisation. This was not surprising and is consistent with findings throughout the world.

Unusually, however, standardisation or routine was negatively correlated with both specialisation and formalisation. The three centralisation scales exhibited the expected relationships with one another and with most other variables, bearing in mind that the autonomy scale is a measure of decentralisation. In terms of 'classical' organisation theory, the organicity variable displayed the expected relationships with the other structuring variables: namely, a strong positive cor-

relation with decentralisation and strong negative correlations with both centralisation and standardisation. The expected negative correlation with formalisation was present, but very weak. Paradoxically, organicity displayed no significant relationships with any of the configuration variables. The relationships were present – and all in the right directions – but they were all too weak to be considered significant.

Although there was no relationship between formalisation and autonomy, there were still fairly strong negative correlations between formalisation and the other two centralisation scales, both of which were significant at the 0.001 level. In other words, the greater the degree of formalisation, the more an organisation is able to decentralise its decision-making. Thus, support was provided in a South African context for Child's (1972: 163-177) proposition of alternative strategies of control.

However, this apparent support must immediately be tempered by the relationships shown by some of the other variables with formalisation and with standardisation or routine. On the one hand, (i) the greater the formalisation, the greater the decentralisation, and (ii) the greater the decentralisation, the greater the need for managers as decentralised decision-makers, and the fewer the subordinates and support staff. On the other hand, (i) the greater the standardisation or routine, the greater the centralisation, and (ii) the greater the centralisation, the less the need for managers as decentralised decision-makers, and the greater the number of subordinates and support staff.

The question that now arises is whether the above pairs of relationships could be a pointer to South African manufacturing organisations' structural peculiarity in terms of their mix of Third World and First World components. The first pair of relationships was closer to the more common and expected configuration and would undoubtedly apply to the First World (mainly white and advantaged) component of the workforce.

In terms of the Third World (or disadvantaged) component, formalisation could not work as an alternative control strategy simply because large segments of the labour force are illiterate.

Table 8. Intercorrelations of structural variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Functional specialisation	100												
2. Formalisation	0.40	100											
3. Standardisation	-0.17	-0.28	100										
4. Autonomy	0.11	0.04	-0.10	100									
5. Policy decision-making	-0.21	-0.35	-0.21	-0.09	100								
6. Decision-making discretion	-0.17	-0.27	0.26	-0.07	0.29	100							
7. Organicity	-0.03	-0.05	-0.21	0.23	-0.03	-0.28	100						
8. Executive span	0.12	0.01	-0.16	0.07	-0.06	0.02	0.03	100					
9. Subordinate ratio	-0.02	-0.17	0.21	0.07	0.10	0.10	-0.04	0.04	100				
10. Organisation depth	0.15	0.05	0.04	0.05	0.01	0.04	-0.07	0.07	0.01	100			
11. Management ratio	0.12	0.24	-0.22	0.01	-0.13	-0.06	-0.03	0.15	-0.23	0.06	100		
12. Support staff ratio	0.13	-0.13	0.06	0.00	0.11	0.07	0.04	-0.03	0.10	0.01	-0.06	100	
13. Clerical staff ratio	0.05	0.10	-0.08	0.14	-0.06	-0.07	-0.06	0.07	0.07	-0.02	0.33	0.07	100

2-tailed significance: **Bold = .001**

Italics = .01

Table 9. Structural variables: Principal component analysis

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. Functional specialisation	0.67137	-0.03027	0.07096	-0.02163	0.36222
2. Formalisation	0.77130	-0.06423	-0.16507	0.11865	0.02432
3. Standardisation	-0.26822	-0.46379	0.44017	-0.15961	-0.09689
4. Autonomy	0.12617	0.55529	0.28776	-0.01228	0.27907
5. Policy decision-making	-0.64696	-0.13745	0.09152	-0.03306	0.07072
6. Decision-making discretion	-0.51134	-0.45173	0.08812	-0.04034	0.29544
7. Organicity	-0.06913	0.81032	-0.04904	-0.07626	-0.10992
8. Executive span	-0.11800	0.22421	-0.18903	0.12647	0.70845
9. Subordinate ratio	-0.05620	0.00162	0.72038	-0.11571	0.13176
10. Organisation depth	0.13670	-0.15994	0.17855	-0.03527	0.56136
11. Management ratio	0.15768	-0.02901	-0.41239	0.62015	0.22604
12. Support staff ratio	-0.22706	0.12751	0.50903	0.45403	-0.16753
13. Clerical staff ratio	0.08820	-0.04256	-0.00034	0.81598	-0.01005
Rotated Factor Matrix:	Varimax converged in 11 iterations.				

Management often deals with a labour-intensive, unsophisticated workforce that is poorly educated and alienated from the dominant capitalist and First World business norms. In such an environment, a high degree of routine and standardisation would appear to be a more viable control strategy. In a South African context, formalisation and standardisation are thus not simply two sides of the same coin, as has been found to be the case in most other studies throughout the world.

A factor analysis of all the dependent structural variables together yielded a five-factor solution, with every variable loading significantly on at least one factor. Many of the loadings were quite high, and the mean of the significant loadings was 0.6013. The analysis is presented in Table 9. Each of the five factors was interpretable, and the labels that were assigned to them, together with the portion of variance accounted for by each factor, were as follows:

	% of variance	Cumulative % variance
Factor 1: Alternative strategies for control	18.6	18.6
Factor 2: Intrapreneurship	11.0	29.6
Factor 3: Labour intensity	9.8	39.4
Factor 4: Leadership and administration	9.4	48.8
Factor 5: Shape	7.7	56.6

Examining each in turn, the following points emerged:

Factor 1: Alternative strategies for control. This factor was not the expected 'structuring of activities variable' that has often emerged as the first factor in similar analyses in Europe, America and other advanced economies. Nevertheless, the clear nexus between specialisation and formalisation, on the one hand, and decentralisation, on the other, made this factor analogous to Child's (1972) "alternative strategies of bureaucratic control".

Factor 2: Intrapreneurship. (or Entrepreneurship if the organisation is a principal unit and not part of a group). This factor was a combination of low routine, high autonomy and decentralised decision-making, and very high organicity. It smacks of the kind of critical success factors necessary in a turbulent environment.

Factor 3: Labour intensity. The third factor was a combination of high routine, a larger number of subordinates, fewer man-

agers and high numbers of support staff. This factor seems to be peculiar to this study and again seems to be associated with control strategies for the Third World element of a South African manufacturing organisation's workforce.

Factor 4: Leadership and administration. This factor was concerned only with control and processing in terms of the numbers of managers and clerks in an organisation.

Factor 5: Shape. The final factor was simply the depth and width of an organisation's structure. These are the two elements that were missing from the first factor for it to have formed the classical Weberian concept of 'structuring of activities' first highlighted by the Aston team.

The most notable difference between this study and other studies (particularly those of the Aston genre that were mainly conducted in Western and other advanced economies) is the absence of the two composite variables of 'structuring of activities' and 'concentration of authority' as the major factors emerging from a principal component analysis of structural variables.

Again, it needs to be questioned whether we are witnessing something unique to South Africa in the factors that emerged from this analysis. For example, both the first and third factors appeared to deal with strategies for exercising control. Varimax is an orthogonal rotation, which means that the factors are independent of one another and not correlated. The control strategies embodied in Factor 1 are thus very different from those in Factor 3, and their deployment would tend to be mutually exclusive. This appears to be another manifestation of the differing strategies employed to deal with the First and Third World elements of the labour force. High specialisation and formalisation, coupled with decentralisation (Factor 1), is aimed at the more sophisticated, better educated First World element, while control of the less literate, historically disadvantaged component is achieved through high routine or standardisation, proportionately fewer managers, more subordinates and more indirect support staff.

The second factor, that of intrapreneurship/entrepreneurship, also holds interesting connotations for South African manufacturing companies. The current emphases on economic growth, development and job creation are inextricably linked to the international competitiveness of local organisations. The independent variables that bring about a spirit of entrepreneurship are therefore of particular interest.

Independent variables: The contextual scales

A similar procedure to that followed with respect to structural and organisational climate scales was followed in dealing with the six contextual scales, bearing in mind that some of them, such as size and age, were point measures and did not require any further analysis. Reliability data in the form of coefficient alpha are displayed in Table 10.

Several problems were apparent: firstly, in the scale of external dependence, and, secondly, in the measure of the operating environment. It will be recalled that the wording of the operating environment scale was problematic because of the recent momentous political changes in South Africa. It seems possible that, as feared, many respondents allowed their perceptions of the recent political environment to colour their perceptions of the operating environment within which their organisations have historically functioned. This is probably not a reflection of the value of the scale *per se*, and subsequent analyses that used this scale took cognisance of this fact. Insofar as the external dependence scale was concerned, the two dimensions that comprise the scale did not combine well in a South African context. Several measures of reliability were tried, but none could improve on the very poor alpha coefficient. The two dimensions of the scale were therefore split and treated as separate variables for all subsequent analyses, thereby turning them into a form of point measurement. In his Canadian study, Clark (1990) also experienced difficulties with this scale, which, in that instance, achieved a reliability coefficient of only 0.28.

Where appropriate, item correlations and factor analyses were carried out on separate contextual scales. The contextual variables were quite obviously discrete and independent of one another. There was thus no requirement to perform either a correlational analysis or a factor analysis on all the variables combined as a whole.

Statistical associations and causal relationships

Although the term causal is used for the sake of convenience, it is accepted that causality has not been proven and that the most that can be said of the independent variables is that they predict elements of structure and climate, without necessarily causing them.

Possible causal relationships were pursued by means of a stepwise multiple linear regression procedure. This included analyses of residuals to ensure that basic assumptions were not violated. A difference encountered in this study was the

apparently low levels of both correlation (R) and the concomitant amount of variance explained in the multiple regression analysis (R²). Although these statistics were not low in absolute terms, they were certainly considerably lower than those encountered in similar studies carried out in other countries.

This was no doubt because of the considerably larger size of the South African sample. The strongest predictive relationship between two variables yielding a perfect correlation (R = 1.0) would be shown graphically as a straight line. In practice, a batch of observations that exhibits a strong linear relationship between variables shows as an elliptical cluster when displayed on a graph. If a second group of data, showing just as strong a relationship on the same variables, but on a slightly different scale, is combined with the first set, the overall distribution is no longer as elliptical in shape and, therefore, it is not as strongly correlated. The shape of the distribution of a linear relationship therefore tends to be less narrow and elliptical as the sample size grows and encompasses more subsets of data.

Weighed against this, of course, was the fact that the F statistics were quite large and the levels of significance very small. This means that the null hypothesis of no linear relationship between variables can more confidently be rejected in favour of the hypothesis that there is indeed a relationship. This favourable situation was also a function of the large sample size, since the number of observations (N) is a factor in the calculation of both the F statistic and the level of significance.

A measure of the relatedness, or colinearity, was also included in each regression equation. The measure used was a statistic called the tolerance of an independent variable, which is defined as 1 - R_i where R_i is the multiple correlation coefficient when that particular independent variable is predicted from the other independent variables.

Predicting structure

All the dependent variables and their main causal variables are illustrated in Table 11. The relative importance of each of the independent variables was gauged by an elementary index, which measured the combined effects of both the frequency and strength of the independent variables, namely:

$$\text{Importance index} = \text{Frequency} \times \text{Mean R}$$

The results of applying this simple rule of thumb are illustrated below, with the variables arranged in descending order of importance:

Independent variable	Importance index
Organisation size	1.85
Power control	1.68
Environment change	1.27
Organisation age	1.15
Internal dependence	1.02
Operating environment	0.99
Workflow integration	0.98
Customer dependence	0.19
Process technology	0.15
Organisation lifecycle	0.10

Notwithstanding the simplicity and imperfection of this importance index, it did provide a useful indicator of broad trends. These are considered below.

Organisation size. Taking the South African manufacturing sector as a whole, it can be observed that organisation size seems to be the most important predictor of organisation structure. This

Table 10. Reliability of the contextual scales

Scale	Alpha
1. Size	Point measure
2. Age	Point measure
3. Dependence	
- internal	0.63
- external	0.09
4. Technology	
- workflow integration	0.66
- process technology	0.89
5. Power control	0.66
6. Environment	
- change and predictability	0.64*
- operating environment	0.43

*Two similar scales combined

Table 11: Stepwise multiple regression: All SIC codes (N = 458)

Dependent variables	Single R	Multiple R	R ²	F Ratio	Significance Level
Functional specialisation					
Organisation size	0.4007	0.4007	0.1606	84.940	0.0000
Organisation age	0.2009	0.4177	0.1744	46.775	0.0000
Internal dependence	0.1022	0.4302	0.1851	33.461	0.0000
Operating environment	0.1576	0.4387	0.1925	26.276	0.0000
Formalisation					
Internal dependence	0.3445	0.3445	0.1187	60.078	0.0000
Organization size	0.2926	0.4582	0.2099	59.121	0.0000
Workflow integration	0.2889	0.4957	0.2457	48.210	0.0000
Environmental change	0.2305	0.5228	0.2733	41.659	0.0000
Organisation age	0.1611	0.5315	0.2825	34.802	0.0000
Power control	-0.2394	0.5386	0.2901	30.030	0.0000
Standardisation					
Operating environment	-0.2983	0.2983	0.0890	43.571	0.0000
Environmental change	-0.2776	0.3567	0.1272	32.427	0.0000
Organisation age	-0.1275	0.3793	0.1439	24.876	0.0000
Workflow integration	-0.1647	0.3979	0.1583	20.828	0.0000
Executive span					
Organisation size	0.2999	0.2999	0.0899	44.086	0.0000
Organisation age	0.1536	0.3136	0.0984	24.273	0.0000
Subordinate ratio					
Organisation size	0.1342	0.1342	0.0180	8.106	0.0046
Workflow integration	-0.1183	0.2069	0.0428	9.860	0.0001
Operating environment	-0.1163	0.2504	0.0627	9.810	0.0000
Organisation depth					
Organisation size	0.3835	0.3835	0.1471	76.041	0.0000
Power control	0.3748	0.3953	0.1563	40.751	0.0000
Workflow integration	0.1820	0.4084	0.1668	29.300	0.0000
Management ratio					
Operating environment	0.1528	0.1528	0.0234	10.665	0.0012
Organisation age	0.1099	0.1858	0.0345	7.956	0.0004
Environmental change	0.1287	0.2076	0.0431	6.668	0.0002
Indirect worker ratio					
Power control	0.1179	0.1179	0.0139	5.942	0.0152
Organisation age	0.1175	0.1655	0.0274	5.941	0.0029
Clerical worker ratio					
Organisation age	0.1658	0.1658	0.0275	12.602	0.0004
Process technology	-0.1475	0.2121	0.0449	10.480	0.0000
Operating environment	0.1197	0.2396	0.0574	9.015	0.0000
Customer dependence	-0.1045	0.2614	0.0683	8.123	0.0000
Autonomy					
Internal dependence	-0.2889	0.2889	0.0834	40.604	0.0000
Operating environment	0.1502	0.3442	0.1185	29.898	0.0000
Power control	-0.1160	0.3597	0.1294	21.999	0.0000
Policy decision level					
Power control	0.3415	0.3415	0.1167	58.895	0.0000
Organisation size	-0.2746	0.4105	0.1685	45.082	0.0000
Environmental change	-0.2571	0.4288	0.1839	33.342	0.0000
Internal dependence	-0.1239	0.4447	0.1977	27.298	0.0000
Workflow integration	-0.2269	0.4563	0.2082	23.248	0.0000
Customer dependence	0.0806	0.4641	0.2154	20.176	0.0000
Organisation life cycle	-0.1049	0.4716	0.2224	17.974	0.0000
First line discretion					
Power control	0.2746	0.2746	0.0754	36.385	0.0000
Organisation age	-0.1091	0.2966	0.0880	21.459	0.0000
Environmental change	-0.1860	0.3125	0.0976	16.014	0.0000
Organicity					
Power control	-0.2112	0.2221	0.0446	20.820	0.0000
Internal dependence	-0.1586	0.2778	0.0772	18.609	0.0000
Environmental change	0.1859	0.3006	0.0904	14.704	0.0000
Organisation size	-0.0630	0.3237	0.1048	12.958	0.0000

finding is in keeping with most similar studies that have been carried out in both advanced and less developed countries or economies, particularly those that have followed the Aston methodology. The point needs to be made again, however, that the pervasiveness of size as an independent variable does not necessarily imply causality, or even that the relationship is unidirectional. Size may indeed cause structure, but, equally, structure may cause size. A longitudinal study would have to be carried out before causal inferences could be made.

Power control. The power control variable was developed specially for this study and has thus not been tested in any similar studies elsewhere. It came through as a very powerful predictor of structure – even more powerful than internal dependence or any of the environmental variables. It is important to grasp, however, that power control as a structural imperative does not exclude the influence of the more traditional causal variables of size, environment, dependence and technology. It is quite possible that the more established variables would set the parameters within which the power control imperative would go to work in determining organisational structure.

Environment. The influence of the environment on organisations in the manufacturing sector was, as expected, also quite significant. Uncertainty, in terms of the amount of environmental change, exercised the most influence. Turbulence within the operating environment exercised less influence but was still important. Curiously, the unpredictability measure did not feature at all in the overall analysis, although it was significant in some specific areas.

Organisation age. The tendency of organisations to move towards bureaucratisation over time, and to increase structuring as a means of maintaining control while decentralising, has been well documented. The influence of age as a predictor of structure in manufacturing organisations is therefore to be expected. Also, the effects of Parkinson's law are germane, as seen in the context of the configuration variables.

Internal dependence. The overall importance of internal dependence, in other words, dependence on a holding group or company, is also consistent with other studies in many parts of the world. The original Aston studies defined dependence in very broad inter-organisational terms and included dependence on all organisations external to the unit under study. Later studies, however, separated the effects of inter-organisational from intra-organisational dependence. This procedure was also followed in the present study, and the overall trend indicated that this method was probably more sound. While the effects of internal dependence were quite pronounced, only one of the external organisational measures – that of dependence on customers – showed any significance at all, and the other – that of dependence on suppliers – did not feature in any of the regression equations.

Technology. One of the reasons that manufacturing organisations were chosen as the research population for this study was the belief that the effects of technology would be more readily apparent than in a service or retail environment, for example. Two measures of technology were used, namely:

1. Workflow integration, which measured the automaticity of the manufacturing process
2. Process technology, which measured the throughput continuity and flexibility of the manufacturing process.

Both of the measures of technology were important predictors of structure in manufacturing organisations, although the

degree of automation appeared to exercise much more influence than the continuity or flexibility of throughputs.

Testing the hypotheses

The five hypotheses that were advanced as the *raison d'être* for this study are set out below in abbreviated form, together with a comment on the degree to which they were supported by the research:

1. South African manufacturing organisations are shaped and influenced by contingencies and imperatives that determine their structure, design and functioning.

There was overall support for this hypothesis, which accords with similar studies carried out in advanced economies and is in keeping with the assertion of Hickson, Hinings, McMillan & Schwitter (1974: 74) that there is a consistency of relationships between organisation structure and certain contextual variables that holds for organisations in all societies. This study included certain new variables, as well as variables not often used in other studies. For example, the power control variable was developed especially for this exercise and proved to be a very potent predictor of organisation structure – to the extent that it outperformed all the 'traditional' independent variables, with the exception of organisation size.

2. The contextual variables exercise a differential influence on the structure, design and functioning of South African manufacturing organisations.

There was modest support for the second hypothesis as a whole. There was strong support for the notion that contextual variables exercise a differential influence on the structural variables, and there were also significant differences between the subgroups in the manufacturing industry in terms of the causal relationships between context and structure. There was some support for the postulated causality of centralisation. The causal variables of power control and technology, however, did not exhibit the strong influence on configuration that was expected. Instead, the more conventional influences of size and technology were paramount.

3. In South African manufacturing organisations, organic structures will be associated with conditions of high environmental uncertainty and low dependence. Conversely, mechanistic structures will be associated with conditions of low environmental uncertainty and high dependence.

Although the third hypothesis was supported by the results of the study, it was noted that the most important predictor of an organic structure was a negatively directed relationship with power control. This connection was not anticipated in the original hypothesis, but it is an important factor. One would therefore expect that a positive relationship with power control would have the capacity to negate the influence of the other two variables as predictors.

4. A number of internal variables will exhibit relationships to one another that are consistent with findings in other organisational research projects throughout the world.

Looking at the fourth hypothesis overall, there seemed to be general support for the internal structural relationships that were proposed, with three possible exceptions:

- Of the five anticipated correlations, organisation depth showed a weak relationship with one variable and no significant relationship with the other four.

- The relationship between formalisation and the subordinate ratio was also the opposite of what was anticipated.
 - Standardisation was negatively correlated to both specialisation and formalisation, contrary to expectations and to the findings of other studies in advanced economies. The relationships between formalisation, centralisation and standardisation or routine also exhibited characteristics that were dissimilar to those found in other studies.
5. Contextual variables that shape structure will also influence aspects of organisation climate.

Although no specific hypothesised relationships were put forward for the structural variables and organisation climate, it was clear that many of the relationships that did emerge were quite different from those that had been identified in other similar studies. This was particularly true for relationships involving perceptions of bureaucracy as exemplified by the structural variable of formalisation.

Unexpected relationships

This South African contribution to the Great Structural Debate, then, has thrown up a number of unexpected relationships. Some of these are examined briefly below.

Structural variables. Usually, in studies of the Aston genre, there is a strong correlation between specialisation, standardisation, formalisation and vertical span of control. These variables normally appear as a clear cluster in factor analysis and are labelled 'structuring of activities'. In the South African context, however, standardisation was negatively correlated with both specialisation and formalisation. The clearest nexus was between specialisation and formalisation. This situation no doubt reflects the different strategies of control required for the varying levels of education and sophistication of the South African workforce, as discussed earlier.

Life cycle changes. Kim & Utterback (1983) postulated a reverse life cycle for organisations in developing countries. In the more stable and developed economies of the world, the product environment is hypothesised to evolve from turbulent to more stable, and this is illustrated by technology that is initially non-routine and adaptive to accommodate a dynamic environment and rapid product changes until market position is established. Technology then becomes more standardised and routine to accommodate larger production runs and to achieve cost advantages in a more stable environment. In a developing country, conversely, the operating environment moves from relatively stable to more turbulent as an organisation grows, is less protected and comes into contact with foreign competition for the first time. The structuring of its activities would then need to be more flexible at a later stage of its life cycle as a strategic response to environmental pressure. Examination of the relationship between the variables of the operating environment, environmental change, organisation age and workflow integration in this study indicate that the reverse life cycle situation also pertains in the South African situation.

Organisation climate. Although no hypotheses were articulated with respect to the organisation climate variables, a number of interesting relationships were found, particularly with respect to where these variables were associated with aspects of bureaucracy. Formalisation, as the measure of the degree to which written rules, procedures, instructions and communications exist, was probably the structural variable that was most readily associated with bureaucracy.

Formalisation was widely connected to a number of positive climatic conditions. It was by far the strongest predictor of the intel-

lectual, scientific and technical orientation of an organisation. It was the second strongest predictor of an organisation's concern for employee involvement and willingness to question authority, and the third strongest predictor of readiness to innovate. Conversely, the negative aspect of interpersonal aggression was predicted by a lack of formalisation. Formalisation, then, was strongly linked to the climate variables ordinarily associated with organisational effectiveness. This aspect of formalisation is complemented by examining its co-relationships with respect to standardisation and organicity.

Formalisation and standardisation appeared concurrently four times as causal variables, and on three of these occasions the causality was in opposite directions. So, while formalisation seemed to be indicated for creativity, innovation and thinking activities, standardisation was contraindicated for the same activities. Again, the distinction between these two structural variables in a South African context was apparent. It will be recalled that, in this study, formalisation and standardisation were not simply two sides of the same coin with respect to alternative strategies of control. Apparently, the same situation also held true with respect to the influence of these variables on organisation climate.

Looking at the simultaneous occurrence of formalisation and organicity, of the four times that this occurred, three were in the same direction of causality. Thus, organic structures and bureaucracy, as measured by formalisation, occurred simultaneously 75% of the time. What this means is that, in South African manufacturing organisations, it is possible for an organisation to be bureaucratic while simultaneously exhibiting an organic ethos. The implication is that bureaucracy, as exemplified by a high degree of formalisation, is not necessarily synonymous with mechanistic organisation structure, as is often assumed.

This finding should also help to alleviate the bad press that bureaucracy has had for some time. Bureaucracy, *per se*, is not synonymous with inefficiency, ineptitude and waste. "Bureaucracy is merely a type of structure. It is not, in and of itself, good or bad. In some situations it is inefficient. In others ... it can be highly efficient." (Robbins 1987: 232)

Specialisation did not feature at all as a causal factor among the organisation climate variables. This is in stark contrast to the United Kingdom studies where specialisation was very strongly correlated to scientific and technical orientation, intellectual orientation and readiness to innovate. Again, this could probably be ascribed to the demographic and cultural mix of the South African workforce and its comparative lack of sophistication and competency.

Finally, it is worth noting that the configuration variables exercised very little influence on organisation climate. This finding emphasises the futility of shuffling the physical structure and design of an organisation in an attempt to positively influence its climate. Many South African companies, particularly in the high-technology industries, have a penchant for reorganisation as a knee-jerk response to any perceived peril, whether it be increased competition or declining profits. What this analysis has shown is that, to be more effective, any structural reengineering or reorganisation must address all the structural change levers, and not just the configuration variables.

Conclusion

As South Africa emerges from years of exile and rejoins the world, a number of influences will be felt by the country's organisations. Globalisation is an increasing trend, and, in

order to compete appropriately, South African organisations must gear themselves to respond effectively to competitive pressures. At the same time, however, it is important to realise the folly of simply trying to emulate First World models. This study has shown that, in many instances, theoretical precepts, developed in advanced economies, simply do not apply to South Africa's peculiar hybrid economic system with its mixture of cultures and norms. Organisational effectiveness in the South African context requires its own definition – one that takes cognisance of the country's unique circumstances and history. There is no reason why organisations that are able to rise to the challenge of amalgamating the best aspects of, for example, participative management with Ubuntu, should not become the world-beaters of tomorrow.

References

- Anshoff, I. & Sullivan, P.A. 1993. Empirical support for a paradigmatic theory of success behaviours of environment serving organisations. San Diego: United States International University.
- Badran, M. & Hinings, B. 1981. 'Strategies of administrative control and contextual constraints in a less-developed country: The case of Egyptian public enterprise', *Organisation Studies*, 2(1): 3-21.
- Child, J. 1972. 'Organisation structure and strategies of control: A replication of the Aston study', *Administrative Science Quarterly*, 17(2): 163-177.
- Clark, P. 1990. *Describing and Explaining the Structure of Canadian Textile Firms*. Birmingham: Aston.
- Covin, J.G., Prescott, J.F. & Slevin, D.P. 1990. 'The effects of technological sophistication on strategic profiles, structure and firm performance', *Journal of Management Studies*, 27(5):485-510.
- Hickson, D.J., Hinings, C.R., McMillan, C.J. & Schwitter, J.B. 1974. 'The culture-free context of organisation structure: A tri-national comparison', *Sociology*, 8: 59-80.
- Human, P. 1993. 'A population ecology perspective', In P. Christie, R. Lessem & L. Mbigi (eds.), *African Management Philosophies, Concepts and Applications*. Johannesburg: Knowledge Resources.
- Inkson, J.H.K., Pugh, D.S. & Hickson, D.J. 1970. 'Organisation context and structure: An abbreviated replication', *Administrative Science Quarterly*, 15: 318-329.
- Kim, L. & Utterback, J.M. 1983. 'The evolution of organisational structure and technology in a developing country', *Management Science*, 29: 1185-1197.
- Lincoln, J.R. & Zeits, G. 1980. 'Organisational properties from aggregated data: Separating individual and structural effects', *American Sociological Review*, 45(3): 391-408.
- Marsh, R.M. & Manneri, H. 1981. 'Technology and size as determinants of organisation structure of Japanese factories', *Administrative Science Quarterly*, 26: 33-57.
- Nel, A. 1982. 'South Africa', In *Encyclopædia Britannica*. Chicago: University of Chicago.
- Oakes, D. (ed.) 1988. *Illustrated History of South Africa: The Real Story*. Cape Town: Readers Digest.
- Price, J.L. 1972. *Handbook of Organisational Measurement*. Lexington, MA: D.C. Heath.
- Pugh, D.S., Hickson, D.J., Hinings, C.R. & Turner, C. 1968. 'Dimensions of organisation structure', *Administrative Science Quarterly*, 13: 65-315.
- Raubenheimer, W.H. 1995. The structure, organisation and functioning of manufacturing organisations in South Africa. Doctoral thesis, University of South Africa, Pretoria.
- Robbins, S.P. 1987. *Organisation Theory: Structure, Design and Applications*. Englewood Cliffs, NJ: Prentice-Hall.
- Stewart, B., Hetherington, G. & Smith, M. 1984. *Survey Item Bank*. London: MCB University Press.
- Woodward, J. 1958. *Management and Technology*, 4-21. Her Majesty's Stationery Office.

The taming of the IT shrew – Delivering benefits from IT

Dan Remenyi*

This paper considers why information technology (IT) benefits have presented such a problem to practitioners, academics and consultants for so many years. The paper proposes a new way of looking at IT investments that will help identify benefits. It also proposes that three principal groups of stakeholders are central to IT investment success. The paper suggests a new locus of responsibility for the identification and delivery of IT investment benefits. It exposes the fact that IT investment benefits have been quintessentially difficult to identify because of the issue of information systems reach, the nature of tangible versus intangible benefits and the question of benefit evolution. The success or failure of the IT investment is primarily a function of the skill and commitment of the information system's principal stakeholders. Finally, the paper proposes that a benefit evaluation process is required to ensure that IT benefits do not remain elusive.

Introduction

The amount of corporate funds spent on IT investment has always been controversial. For many years, some executives have thought that too much has been spent on IT to justify the return. Robert Solow (1987), the famous Nobel Prize-winning economist, suggested that in business one could observe computers everywhere but in the productivity statistics. Brynjolfsson (1993) pointed out that there was a productivity paradox, which meant that computers were not delivering the value promised. *The Economist* reported in 1991 that the return on the IT investment was so poor that organisations "would have done better ... to have invested that same capital in almost any other part of their businesses". But was the performance of the investment made in IT really so terrible?

The business community wanted to be able to see the benefits of IT in the same way that you see a big colourful brass band coming down the street. They wanted their IT benefits right up in their faces, as the modern idiom would say. However, it is not clear why the business community should have expected IT benefits to be so glaringly obvious.¹ Perhaps this expectation was just unreasonable and unrealistic. There are many aspects of business investment where the benefits are really rather subtle, but are no less real for that. Examples include corporate head offices and prestigious motor cars for executives, to mention only two. Perhaps, this is the case with IT investment.

In addition to this, the business community generally demanded that IT benefits always be expressed in terms of financial values, in other words, how much money was saved or how much extra money was earned as a result of the IT investment. Some IT investment benefits, however, cannot be satisfactorily expressed in monetary terms. Nonetheless, they are real business benefits and need to be taken into account in any development of the investment evaluation equation.

Economics of information

The measuring and managing of IT benefits is a difficult business challenge that has plagued the IT industry, IT professionals, consultants and academics for many years. The main rea-

son for this is that, despite the considerable amount of research conducted by academics and consultants, no comprehensive or rigorous economics of information has thus far been developed.

By economics of information² is meant a systematic series of concepts and theories that explain the role that information and information systems play in assisting individuals or organisations in their conception, production and delivery of goods and services, both in the private and public sectors. There are probably several reasons why the economics of information has not been developed. One of the most important is that the topic is very difficult, both from the theoretical and practical points of view, and most practitioners respond to the challenges it offers either by attempting to ignore it (and just getting on with their highly pressurised day-to-day jobs) or by understating its importance. The view that practitioners often tried to assert was that, relatively speaking, IT expenditure was low and should be seen as an 'act of faith' (Lincoln 1990). If this view was a reasonable one, it is certainly no longer valid, as IT investment has become an important part of corporate expenditure.

Fortunately, top managements have begun to insist that much more attention be paid to the economic aspects of information systems than ever before, and this has led to an increasing demand for a comprehensive and reliable IT performance evaluation.³

1 The demand for clear and definite benefits may be attributed to management's apparently desperate need for control. Keidel (1995) clearly identified this need when he wrote: "The overwhelming tendency for management is to be obsessed with control."

2 The term 'economics of information' should not be confused with Information Economics, which is a specific concept developed by Parker & Benson (1987).

3 It would not be true to say that information systems academics, or even consultants, have ignored the challenges offered by this demanding area. However, although much work has been done and hundreds of academic papers published, very little attention has been paid to attempting to consolidate this work into a coherent theory.

Some progress in understanding information systems

During the past decade, some progress has been made in understanding and articulating the role and function of information systems in organisations (Keen 1991; Hirschheim & Smithson 1998; Currie 1989; Sherwood-Smith 1989; Scriven 1991; Symons 1991; House 1993; Walsham 1993; Willcocks & Lester 1993; Farbey, Land & Targett 1995; Remenyi & Money 1991; Remenyi, Money & Twite 1994, 1998; Remenyi 1999; Strassmann 1985, 1990, 1997; Ward, Taylor & Bond 1996).

Business computing is nearly 50 years old, and, for most of the intervening period, this subject has been perceived as essentially a technical one.⁴ Although technical issues have frequently been of paramount or central importance to the success of business computing, this emphasis has been largely at the expense of a business and management understanding of information systems and what their potential and actual benefits are likely to be.

The problems associated with IT benefit measurement and management

Four major areas have contributed to the problems associated with IT benefit measurement and management:

1. Benefits and identifiable performance improvements
2. Information systems reach
3. Tangible and intangible benefits
4. Benefit evolution.

Benefits and identifiable performance improvements

If information systems projects are to be successful, potential benefits need to be identified as early as possible in the systems development cycle. In fact, in an ideal world, benefits would be identified and quantified before the information systems development project began. Although this does happen for some projects, it is seldom possible to produce a definitive statement of all the benefits that an information systems development project will produce. In fact, a high degree of success at early benefit identification is often quite elusive.

This situation may be complicated when attempts are made to use special IT benefit metrics. No special metrics are required. General business performance metrics are adequate for the identification of IT benefits.

Information systems reach

Information systems (even when they are simple, stand-alone systems) often, if not usually, play an important integrating role in organisations. In the words of Evans & Wurster (2000), "information is the glue that holds together the structure of all businesses".

When considered in such terms, information systems may be seen as, *inter alia*, the conduit for that glue, or the tracks over which the glue is laid and business activities or processes flow. An integrating role of this nature brings together a number of different corporate issues, problems and resources. Even for the most straightforward information systems applications, it is never easy to anticipate the results of bringing together information about different business issues. There will almost always be knock-on effects associated with the introduction of any substantial information system, especially when such a system has the effect of integrating business processes, or even simply integrating reports about business processes.

For example, a payroll system, with the primary objective of automating a series of routine and simple clerical tasks, will frequently be used as an interface to a human resource management application, which could include details of training, salary benchmarks and succession planning, for example. Moreover, a payroll system may have connections with various costing systems that show actual and standard costs, drawing on the actual amounts paid each week or month. The payroll system may also be interfaced with staff loans accounting. Of course, a payroll system will need to be able to transfer data to the corporate general ledgers. So, a relatively simple system such as a payroll can have substantial tentacles penetrating into a number of different aspects of the organisation. Clearly, it is a challenge to visualise all the different identifiable performance improvements such a system can offer.

When more complex business applications are considered (such as sales order processing, production planning and control or vehicle scheduling), it becomes even more difficult to identify all the possible benefits of such systems.⁵ The point is that information is at the heart and soul of the business, and our ability to build useful information systems directly affects the way the business itself is, or may be, operated.

The importance of information is well described by Evans & Wurster (2000):

When managers talk about the value of customer relationships, for example, what they really mean is the proprietary information which they have about their customers and what their customers have about the company and its products. Brands, after all, are nothing but the information – real or imaginary, intellectual or emotional – that consumers have in their heads about a product. And the tools used to build brands – advertising, promotion, and even shelf space – are themselves information or ways of delivering information.

When seen in this light, the issue of being able to identify all the benefits in advance becomes a virtually insurmountable challenge. Often the situation is just too complex.

Tangible and intangible benefits⁶

Some aspects of an information system may produce hard, or tangible, benefits that will directly improve the performance of the firm – by reducing costs, for example – and that will therefore be regarded in accounting terms as an improvement in profit and perhaps in return on investment (ROI). Such benefits are, of course, relatively easy to identify and to quantify, both in physical terms (for example, the number of people employed or the number of widgets used) and in financial terms (in other words, the number of pounds or dollars saved or earned). Other aspects of this system will only create soft or intangible benefits that may improve the general circumstances of the staff and thus make employment conditions in the organisation easier, but not lead directly to identifiable performance improvements. They will thus not be easily observed in the accounting numbers of the firm.

Although it is difficult to be precise about their actual value, especially in financial terms, intangible benefits can make a critical contribution to the success of an organisation. Intangible benefits may often be quantified by measuring instruments such as questionnaires, but it is quite difficult to make a plausible connection between what can be measured with such devices and the impact on the corporate financial

results. The whole issue of intangible benefits is one of the major problems associated with benefit measurement and management.

Benefit evolution

There is, however, a fourth issue that makes benefit identification, especially early benefit identification, even more elusive, and that is the propensity for benefits to evolve. The benefits of IT are just not stable. Some benefits dry up, while others, which may originally not have been foreseen, materialise. In short, when planning an IT investment, it is extremely difficult to look into the future and create a comprehensive catalogue of potential benefits. No matter how thoroughly the feasibility study or the business case is produced, it is usually almost impossible to foresee all the potential ramifications of the proposed information system. Forecasting is notoriously difficult, and it is thus perhaps unrealistic to expect a high degree of success in future benefit identification. This is especially true in the current environment in which business is rapidly changing.

Every information system will have some easy-to-identify, or obvious, benefits that will be sustainable over a period of time. However, as the development project proceeds and the ramifications of the system are more fully understood, new ideas about potential benefits will become apparent. This will have been due to the process of creative dialogue between the principal stakeholders, which will bring to light new business processes and practices. In short, potential benefits should not be regarded as static, but rather actually evolve as a greater understanding is gained of the organisation and the role that the system will play in it. Of course, it is necessary to point out that in the same way as new benefits surface during the development project, other benefit suggestions that were originally identified may turn out to be illusionary.

These issues are at the centre of why IT benefits have been so difficult to identify, and are the primary reasons why benefits and value have been so elusive in the past.

Of course, the problem of business and management understanding, and thus of computer evaluation, has not been limited to individual systems. A lack of understanding has also applied to the more general area of the whole information systems function itself. According to Lacity & Hirschheim (1995): "The problem is that meaningful measures of departmental efficiency do not exist for IS."

Fortunately, we are seeing some changes to this unsatisfactory state of affairs. For the past decade, business executives, as opposed to information systems executives, have been demanding (by expressing their dissatisfaction at the way in which information systems departments or functions have been operated) a new approach to the management of information systems. The message is beginning to arrive that the information system is an important aspect of many organisations, and new ideas of how to manage them are under development. A number of different approaches to this problem are discussed here.

Investment, value and economics

One of the first issues to be addressed in coming to terms with a new approach to IT management is the fact that such investment has no direct value in its own right, but has the potential for derived value. Furthermore, it is widely agreed that IT benefits are not directly a technology issue as such, but have to do

with business initiatives. Therefore, they need to be measured and managed by profit and loss (P&L) people focusing on business processes and practices. The value of the IT investment depends entirely upon the way in which it is able to make the organisation more efficient and effective.⁸

To understand how this works in practice in an organisation, it is useful to rethink the role of information systems investment by going back to some fundamental concepts. To use classical economic language, an information system is a capital or producer or investment good – something that is not acquired or valued for the utility it delivers by itself in its own right. Simply, capital goods do not have any intrinsic utility or value in their own right in the way that a television set, a jacket, a meal in a fine restaurant or a holiday in the sun would have.

A capital or producer or investment good is desired because it can be used to produce other goods and services, which in turn may offer utility and value such as those offered by the television set, the jacket, the meal or the holiday. Capital or producer or investment goods are essentially tools. A bulldozer is a clear example of a capital or producer or investment good. A bulldozer has no intrinsic value on its own. In fact, to many individuals and organisations, a bulldozer could be seen as a huge liability as it takes up much space, is costly to move about, needs expensive maintenance and requires a highly skilled and costly operator. It has to be clearly understood that the value of the bulldozer is only derived as a result of its use (in other words, the hole in the ground, the razing of the old building or the preparing of the ground for a new road sur-

4 It is easy enough to identify the start of business computing with the introduction of computers to the Bureau of the Census in the USA by Eckert & Mauchly and to the J. Lyons Organisation in the United Kingdom by Cambridge University in 1952 (Evans 1981; Earl 1992). It is more difficult to be specific about the roots of information systems management. Sometimes it is argued that the first semblance of information systems management may be recognised in the work of Dick Nolan published in the *Harvard Business Review* in 1973 and 1974. There was thus a 20 year lag between the time computers were introduced and when they became the object of serious management study. Even today, however, many IT executives will say that their organisations still perceive them to be 'techies', although, in their daily work, they have actually become quite far removed from the detail of how the technology works. As was recently pointed out to the author, in the course of a discussion with a senior business consultant, some IT executives know very little more about the technicalities related to computers than how to switch on and off their personal computers, and some of them are actually proud of this.

5 When it come to really complex systems, such as ERP, then this problem becomes even more tricky and, in a sense, benefits have to be discovered as the implementation progresses.

6 There are several different definitions of tangible and intangible benefits. For the purposes of this paper, a tangible benefit is regarded as one that affects the bottom line of the organisation, whereas an intangible benefit does not.

7 A P&L (profit and loss) person is someone who has corporate responsibility for making all or part of the organisation's profit. This role is contrasted with that of a staff member or specialist person who does not have the responsibility for making a profit, such as a personnel manager or an information systems manager.

8 An important by-product of this view of the role of IT in an organisation is the fact that, to measure its performance, it is not necessary to create any IT-specific metrics. General business performance metrics are perfectly adequate as measures of the success or failure of IT investment.

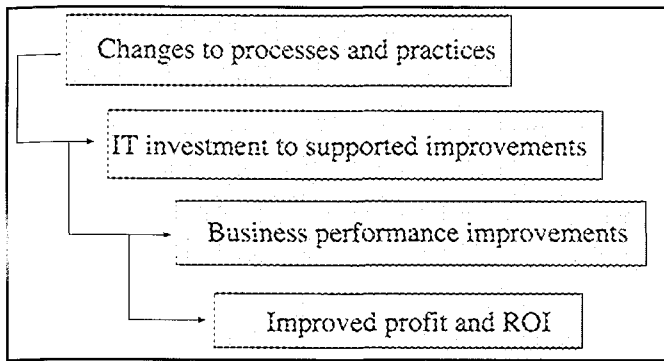


Figure 1: The relationship between business process and IT investment

face). The value potential of the bulldozer is thus linked to the result that may be obtained by its appropriate use.⁹ The same principle applies to IT, or to information systems, and is illustrated in Figure 1, which shows a similar logic to that developed by Soh & Markus (1995).

IT and derived value

As a producer good, IT has a derived, or second order, value that is realised when it is used as a component of an organisational or business process or practice. In fact, for the value of IT to be generated or realised, it is necessary that the business process or practice to which it contributes actually improve the effectiveness or efficiency of the enterprise. Insofar as these organisational or business processes or practices produce improvements to the business, they will, at least in the medium term, positively affect one or more of the corporate performance variables. In turn, this will show in the corporate performance indicators and will thus be regarded as delivering value.

Quite specifically, if the process innovation and improvement that is to be supported by an IT investment is to improve productivity, then the IT investment will be judged primarily on whether that productivity improvement has been achieved. An improvement in productivity would mean that more goods and services would be produced for the same amount of input, or that the same number of products or services would be produced for less input. This is essentially a cost or pricing issue (Handy 1998). However, such a system might also improve the quality of the products being produced and perhaps also have a positive impact on the morale of the manufacturing workers. If so, it would be appropriate to evaluate the process innovation and improvement on all three of these variables.

However, if the purpose of the process innovation and improvement is to improve customer satisfaction, then the IT investment needs to be judged on whether that has been achieved. An improvement in customer satisfaction could be measured by some instrument such as a ServQual scale. In such cases, it might not be very useful to try to reduce such benefits to monetary values. Nonetheless, such benefits are clearly measurable and can give the organisation a major competitive advantage in the marketplace. Another benefit of such a system might be to improve the cost effectiveness of serving customers; if this were the case, it would be appropriate to evaluate the process innovation and improvement also in terms of its financial impact on the organisation.

In practice, it will seldom be appropriate to evaluate a process innovation or improvement in terms of one metric

alone. This type of evaluation therefore really requires multi-metric analysis, managed by the principal stakeholders.

To ensure that the value of the process innovation or improvement is fully exposed, a process approach needs to be taken to its assessment. This is similar to the process perspective suggested by researchers such as Weill (1990), Brynjolfsson & Hitt (1995), Barua, Kriebel & Mukhopadhyay (1995), McKeen, Smith & Parent (1999) Mooney, Gurbaxani & Kraemer (1995). Without this process perspective, the realisation of (and the concurrent research into) the benefits is far more difficult.

At the outset of the business intervention, the process owners need to be quite specific about their objectives and goals, and these need to be stated in a business case, or a value proposition or business model. They need to be quantified where possible and a timetable needs to be established as to when they may realistically be expected to be achieved. The next step is to identify in some detail the exact changes to the current procedures and practices that need to take place, and which individuals will be affected by such changes. Responsibility then has to be allocated for these changes taking place, together with the necessary resources, including time for aspects such as training. Finally, a review mechanism needs to be established, along with a procedure to follow if the proposed changes are not actually taking place.

As a consequence of the above, it is clear that IT investment only derives its value to the organisation through its business applications. This, in turn, can only be effected in the hands of the information system's principal stakeholders, and it is these individuals that need to manage the investment as well as its evaluation. The success or failure of the IT investment is primarily a function of the skill and commitment of the information system's principal stakeholders.

IT investment as an asset

The question of whether an organisation's management of its IT resources is improved if it regards the funds that are spent on this activity to be in the accumulation of an asset, as opposed to simply being part of recurrent expenditure, is an interesting one. It has been argued that by emphasising the asset nature of IT investment, the organisation will somehow manage it more attentively. There do not appear to be many grounds for such an assertion. In fact, from the above, it may be argued that an information system has no intrinsic value in its own right. This is certainly what Strassmann (1990) believes when he points out that "a computer is worth only what it can fetch at an auction".

The type of argument espoused by Strassmann suggests that, by itself, an information system is nothing more than a sunk cost that has been spent on a collection of hardware, software and communications equipment – and the cost of this 'kit' is normally a very large amount indeed. In fact, it may be argued that there is really no overriding reason to regard information systems as an asset,¹⁰ except for the fact that they are reusable (in other words, not instantly consumed). Today, many personal computers and other small systems are being written off immediately and thus do not appear in the balance sheet, but are treated merely as an operating cost.

However, once the computer has been successfully integrated into a business process, the whole picture changes, and, to be fair to Strassmann, he did recognise this in his book. Thus, it is generally agreed that an information system really only acquires value when it is used in collaboration with other

resources as part of a business process or practice that will result in the enhancement of the effectiveness or efficiency of the organisation. This conclusion begs the question of which business processes or practices should be supported by IT, and how this should actually happen.

Processes, practices and people

Business processes or practices are made to function by people, working in groups or as individuals, mostly in line or profit and loss positions.¹¹ In the private sector, such people make, sell and support the products or services for which the organisation was created, but this argument does not only apply to profit-orientated business. In the public sector, governmental or not-for-profit organisations focus on services at the national, regional or local level. It is these line or P&L people who know what is required by their organisations to succeed. These individuals also know how information systems can best support their private or public sector efforts.

In effect, these groups or individuals use the information systems as tools or producer goods to achieve organisational results. It is the efforts of these people that make the IT investment a success or a failure. Furthermore, they intrinsically know what benefits are actually being delivered, and if the information system should actually be regarded a success.

Looking for benefits and value

The main implication of this derived value of IT notion is that the actual benefits of an IT investment cannot be perceived directly or on their own. Only when IT is coupled with other resources, and especially the principal stakeholders, can any benefits or value be perceived. There is no standard way of combining IT with other resources or with people. Davenport (1997) pointed out the importance of people in information systems success when he wrote: "Information and knowledge are quintessentially human creations, and we will never be good at managing them unless we give people a primary role."

Combinations of information systems, people and other resources are entirely dependent on the context of the business process or practice, but, in general, unless IT is an integral part of a greater programme of process innovation and improvement, it is quite unlikely that much value or benefits will be derived.

Primary stakeholders

These P&L people are the primary or principal stakeholders of the IT investment. By primary stakeholder of the IT investment is meant the individual or group of people who have the most to gain or the most to lose if the investment is or is not a success. The characteristic of the principal or primary stakeholder that is of most interest is the fact that he or she or they can directly influence the success or failure of the information systems. Most often, the principal or primary stakeholders are in fact the user-owners, who make the difference between success and failure. This view is supported by Strassmann (1997) when he says: "The lack of correlation of information technology spending with financial results has led me to conclude that it is not computers that make the difference, but what people do with them. Elevating computerisation to the level of a magic bullet of this civilisation is a mistake that will find correction in due course. It leads to the diminishing of what matters the most in any enterprise: educated, committed, and imaginative individuals working for organizations that place greater emphasis on people than on technologies."

The recognition of these line people as the principal or primary stakeholders¹² in any information system is a fundamental change in approach, or paradigm shift, for many organisations. In the 'old days', it was naturally thought that the systems belonged to the information systems people. Having information systems people as systems owners produced the most unsatisfactory state of antagonism between P&L people and IT people, and has been described as the culture gap (Grindley 1991; Townsend 1984; Deckle 1986; Butler, in Lincoln 1990; Palmer 1990).

This new approach largely eliminates that culture gap. It is, however, important to point out that this does not in any way diminish the contribution of the information systems professional to the successful use of business computing. It simply changes the locus of responsibility¹³ for the IT investment decision and the locus of responsibility for ensuring that the new business process is a success.

The locus of responsibility

Placing the principal or primary stakeholders at the centre of the information systems investment does indeed reposition the locus of responsibility for the success of the information system and put it squarely where it should be with the line managers and user-owners. There are several reasons why the user-owners need to be at centre stage in any information systems investment, but by far the most important is that, by so doing, the chances of the information systems delivering the type of support that is required by the business process or practice (in other words, being relevant) are substantially increased. The problems that arise when the user-owners are not regarded as the primary stakeholders are well articulated

9 Off course, it is actually possible that some extraordinarily eccentric and very wealthy individuals might actually collect bulldozers and, in such a case, a bulldozer would indeed become, in classical economic terms, a durable consumer good.

10 For some organisations, there are several issues involved, including the fact that traditionally, purchased hardware has been treated as an asset and thus capitalised. Sometimes, purchased software has also been handled from an accounting point of view as a capitalisable item. However, software produced internally was seldom treated as an asset, and it was quite rare to see it capitalised in the accounts. To make this issue even more complex, Keen (1991) points out that the value of an organisation's data may be worth just as much as all the hardware and software together. Perhaps too much was made in the past of the distinction between assets and cost and investment and expenditure.

11 It is perhaps important to note that information systems are not in any way restricted to line or P&L positions within the organisation, but are used in all sorts of functions and processes including staff or support activities. However, the value arguments will be more easily seen in functions where the organisation's profit is at stake.

12 Svendsen (1998) provides a general definition of the word stakeholder as follows: "The term 'stakeholders' refers to the individual or group who can affect or be affected by a corporation's activities. In the information systems environment, the stakeholders are all those individuals and groups that can affect, or be affected by, the information system."

13 The idea of locus of responsibility is similar to that of IT governance. The locus of responsibility would include issues such as how money is allocated to investment, who can give the go-ahead for IT investment, and who are able to comment on the success of these investments.

- | IT professionals | |
|--------------------------|-----------------------|
| <input type="checkbox"/> | Internal staff |
| <input type="checkbox"/> | Departmental IT staff |
| <input type="checkbox"/> | Contractors |
| <input type="checkbox"/> | Consultants |
| <input type="checkbox"/> | Outsource contractors |
| <input type="checkbox"/> | Vendors |

Figure 2: The more usual sources of IT expertise

by Davenport (1997) who says, when talking as an information systems professional: “We have spent a great deal of time and money bringing water to the horse, but we don’t even know if he is thirsty, and we have no idea how to get him to drink.”

The user-owner – not the only stakeholder

The user-owners are not the only stakeholders in an information systems investment, however. The group of IT professionals who will work with the technical development of the information systems are clearly stakeholders of some considerable importance. They supply the IT expertise that will make the technology aspects of the new processes work. Traditionally, in-house IT professionals have accepted a large part of the responsibility for the success of the IT investment. It was not uncommon for IT professionals to develop information systems for their so-called end-users. Sometimes, this was done without adequate consultation, as IT professionals have been known to believe that they knew what the user requirements were, at least as well as the users themselves. Clearly, this was not very satisfactory, and, as mentioned above, there have been problems of communication between IT professionals and users, as well as the development of what is sometimes referred to as the culture gap. Increasingly, it is thought that the users and owners need to play a greater role in ensuring the success of the IT investment.

However, the IT professional still has an altogether indispensable role to play in any IT investment project. The IT professional should be seen as a critical adviser to the users and owners – one who will ensure that the appropriate technology is acquired and deployed. The role of the IT professional has also been complicated by the fact that some organisations have outsourced the supply of IT expertise.

Outsourcing has been a familiar aspect of the supply of IT competencies in many organisations over the past years. Few organisations have never used contractors or, from time to time, employed consultants. However, it has only been in recent years that organisations have outsourced all, or the major part of, the IT operation. Today, organisations increasingly use a portfolio of IT expertise, which includes both internal and external people and organisations. All these sources of IT expertise may be stakeholders in their own right, and are illustrated in Figure 2. Several of these groups are usually involved as stakeholders in any given IT investment.

The third group of principal or primary stakeholders comprises the financial managers and administrators, who are always stakeholders in any corporate investment as they are instrumental in making the funds available for purposes such as the purchase of the equipment. They arrange the contracts and ensure that goods are received and payments made.

Financial managers and administrators are often involved with the detail of the business case accounting, as users and owners

may not be familiar with the costing approaches required. IT investments that are made to improve business processes and practices will often affect the internal controls within the organisation, and, for that reason, both internal and external auditors may be required to advise on the propriety of the new proposals. In addition, investments often have to be audited, which will require further involvement from auditors. Figure 3 lists some of the stakeholders that fall into this category.

Refocus the traditional role of the IT professional

Thus, the traditional role of information systems professionals needs to be refocused. They need to become, primarily, advisors and educators. Information systems professionals, of course, do not lose their action-orientated role altogether, as they have a role to play in making the technology work. They should not, however, try to initiate the innovative processes and practices that are responsible for the benefit creation and delivery. Furthermore, they should not be responsible for identifying benefits or justifying expenditure on information systems. The business case for information systems development needs to be created by the line manager, perhaps with the help of the other principal stakeholders, who will use the system to improve their personal or group efficiency and effectiveness.

Summary and conclusions

The way forward in reducing the degree to which IT investment benefits have been elusive requires the recognition that IT investment must be an integral part of a greater programme of process innovation and improvement. The success of the IT investment is then tightly coupled with the success of the process innovation and improvement, from which it cannot be independently evaluated.

If the purpose of the process innovation and improvement was to improve productivity, the IT investment will be judged on whether that has been achieved. However, if the purpose of the process innovation and improvement was to improve customer satisfaction, the IT investment will have to be judged on whether that has been achieved.

It is also necessary to accept that some IT investment benefits cannot be satisfactorily stated in monetary terms. Nonetheless, they are real business benefits and need to be taken into account in the development of any investment evaluation equation.

Having established the process innovation and improvement element of an IT investment, it follows that IT professionals may not be the most appropriate individuals to initiate

- | Financial services | |
|--------------------------|--------------------------|
| <input type="checkbox"/> | Financial managers |
| <input type="checkbox"/> | Accountants |
| <input type="checkbox"/> | Capital budgeting staff |
| <input type="checkbox"/> | Corporate treasury staff |
| <input type="checkbox"/> | Corporate planners |
| <input type="checkbox"/> | Corporate strategists |
| <input type="checkbox"/> | Internal auditor |
| <input type="checkbox"/> | External auditors |
| <input type="checkbox"/> | Buyers |

Figure 3: Some of the financial managers and administrator stakeholders

or lead such projects. The principal stakeholder of IT-enabled, or even IT-driven, process improvements needs to be a P&L manager who is at the same time the information system user-owner. The success or failure of the IT investment is primarily a function of the skill and commitment of the information system's principal stakeholders.

It is important to recognise the fact that IT investment benefits have been difficult to identify because of the issue of information systems reach, the nature of tangible versus intangible benefits and the question of benefit evolution. A process approach to both the delivery and the assessment of IT benefits is required.

Finally, the locus of responsibility issue needs to be clearly focused if IT benefits are to be identified and evaluated.

The development of a comprehensive approach to the identification and management of IT benefits is not complete, and is unlikely ever to be. In the words of Checkland (1986), writing about systems thinking: "Obviously the work is not finished, and can never be finished. There are no absolute positions to be reached in the attempt by men to understand the world in which they find themselves: new experience may in the future refute present conjectures. So the work itself must be regarded as an on-going system of a particular kind: a learning system which will continue to develop ideas, to test them out in practice, and to learn from the experience gained."

References

- Barua, A.C., Kriebel, H. & Mukhopadhyay T. 1995. 'Information technologies and business value: An analytical and empirical investigation', *Information Systems Research*, 6 (1): 3-23.
- Brynjolfsson, E. 1993. 'The productivity paradox of information technology: Review and assessment', *Communications of the ACM*, 36(12): 67-77.
- Brynjolfsson, E. & Hitt L. 1995. 'Information technology as a factor of production: The role of differences among firms', *Economics of Innovation and New Technology*, 3(4).
- Butler, M., cited in T. Lincoln 1990. *Managing Information Systems for Profit*. Chichester: John Wiley & Sons.
- Currie, W. 1989. 'The art of justifying new technology to top management', *Omega*, 17(5): 409-418.
- Checkland, P. 1986. *Systems Thinking, Systems Practice*. Chichester: John Wiley & Sons.
- Davenport, T.H. 1997. *Information Ecology: Mastering the Information and Knowledge Environment*. New York: Oxford University Press. p. 3.
- Deckle, J. 1986. 'The corporate integration of data processing', *Business*, April-June.
- Earl, M. 1992. 'Putting IT in its place: A polemic for the nineties', *Journal of Information Systems*, September.
- Evans, C. 1981. *The Making of the Micro - A History of the Computer*. London: Victor Gollancz.
- Evans, P. & Wurster, T.S. 2000. *Blown to Bits: How the New Technology of Information Transforms Strategy*. Cambridge, MA: Harvard Business Press.
- Farbey, B., Land, F. & Targett D. 1995. 'A taxonomy of information systems application: The benefits' evaluation ladder', *European Journal of Information Systems*, 4(1): 41-50.
- Gibson, C.F. & Nolan, R. 1974. 'Managing the four stages of EDP growth', *Harvard Business Review*: 76-88.
- Grindley, K., (1984), *Managing IT at Board Level: The Hidden Agenda Exposed*. London: Pitman Price Waterhouse.
- Handy, C. 1998. *The Hungary Spirit*. London: Random House.
- Hirschheim, R. & Smithson, S. 1998. 'A critical analysis of information systems evaluation', In N. Born-Andersen & G. Davis (eds.), *IS Assessment: Issues and Challenges*. Amsterdam: North Holland.
- House, E.R. 1993. *Professional Evaluation: Social Impact and Political Consequences*. London: Sage.
- Keen, P.G.W. 1991. *Shaping the Future: Business Design through Information Technology*. Boston, MA: Harvard Business School Press.
- Keidel, R.W. 1995. *Seeing Organizational Patterns: A New Theory and Language of Organizational Design*. San Francisco: Berret Koehler.
- Lacity, M. & Hirschheim, R. 1995. *Information Systems Outsourcing - Myths, Metaphors and Realities*. Chichester: John Wiley & Sons.
- Townsend, R. 1984. *Further up the Organisation*. New York: Knopf.
- Lincoln, T. 1990. *Managing Information Systems for Profit*. Chichester: John Wiley & Sons.
- McKeen, J.D., Smith, H.A. & Parent M. 1999. 'An integrative research approach to assess the business value of information technology', In M.A. Mahmood & E.J. Szewczak (eds.), *Measuring Information Technology Investment Payoff: Contemporary Approaches*. Hershey, PA: Idea Group Publishing.
- Mooney, J.G., Gurbaxani, V. & Kraemer K.L. 1995. 'A process oriented framework for assessing the business value of information technology', *Proceedings of the Sixteenth International Conference on Information Systems*, 10-13 December, Amsterdam.
- Nolan, R. 1973. 'The plight of the EDP Manager', *Harvard Business Review*, May-June: 143-152.
- Palmer, C. 1990. *A Bridge So Far*. National Computing Centre.
- Parker, M.M. & Benson, R.J. 1987. 'Information economics: An introduction', *Datamation*, 33(23): 86-90.
- Remenyi, D. 1999. *IT Investment Making a Business Case*. Oxford: Butterworth Heinemann.
- Remenyi, D. & Money, A. 1991. 'A user-satisfaction approach to IS effectiveness', *Journal of Information Technology*, 6(November): 162-175.
- Remenyi, D., Money, A. & Twite, A. 1994. *A Guide to Measuring and Managing IT Benefits*. Manchester: NCC-Blackwell.
- Remenyi, D., Money A. & Twite, A. 1998. *Effective Measurement & Management of IT Costs and Benefits*. Oxford: Butterworth Heinemann.
- Scriven, M.S. 1991. 'The science of valuing', In W.R. Shadish, T.D. Cook & L.C. Leviton (eds.), *Foundations of Program Evaluation: Theories and Practice*. Newbury Park, CA: Sage.
- Selig, F.F. 1991. 'Managing information technology in the nineties', *Information and Management*, 21(5): 251-255.
- Sherwood-Smith, M.H. 1989. The evaluation of computer-based office systems, PhD thesis, University College, Dublin.
- Smithson, S. & Hirschman, R. 1998. 'A critical analysis of information systems evaluation', In N. Bjorn-Andersen & G.B. Davis (eds.), *Information System Assessment: Issues and Challenges*. Amsterdam: North Holland. pp. 17-37.
- Soh, C. & Markus L. 1995. 'How IT creates business value: A process theory synthesis', *Proceedings of the Sixteenth International Conference on Information Systems*, 10-13 December, Amsterdam.
- Solow, R.M. 1987. 'Review of S.S. Cohen & J. Zysman "Manufacturing matters: The myth of the post-industrial economy"', *New York Book Review*, 12 July.
- Strassmann, P.A. 1985. *Information Payoff: The Transformation of Work in the Electronic Age*. London: Free Press.
- Strassmann, P.A. 1990. *The Business Value of Computers*. New Canaan, CT: Information Economics Press.
- Strassmann, P.A. 1997. *The Squandered Computer*. New Canaan, CT: Information Economics Press.

- Svendsen, A. 1988. *The Stakeholder Strategy*. San Francisco: Berrett-Koehler.
- Symons, V. 1991. 'A review of information systems evaluation: Content, context and process', *European Journal of Information Systems*, 1(3): 205–212.
- Walsham, G. 1993. *Interpreting Information Systems in Organisations*. Chichester: John Wiley & Sons.
- Ward, J., Taylor, P & Bond, P. 1996. 'Evaluation and realisation of IS/IT benefits: An empirical study of current practices', *European Journal of Information Systems*, 5(4): 214–225.
- Weill, P. 1990. *Do Computers Really Pay Off?* Washington, DC: ICIT Press.
- Willcocks, L. & Lester, S. 1993. 'How do organisations evaluate and control information systems investments? Recent UK survey evidence', In D. Avison, J. Kendall & J. DeGross (eds.), *Human, Organisational and Social Dimensions of Information Systems Development*. Amsterdam: North Holland.

Exploratory research on the measurement of change in organisational structure caused by information systems

O.J. Jordaan* and René Pellissier†

The implementation of appropriate information technology (IT) is a strategic imperative for organisations, bringing with it its own change. Because of the rapid changes in this field, there is a lack of proper definitions in literature, and this issue is therefore addressed first. This IT-related change is discussed (theoretically as well as through an empirical study) and a measurement tool for change in organisational structure is proposed. The emergence of information resource planning is discussed as being of strategic importance to organisations.

Introduction

Organisations are implementing a variety of information systems and applications in order to enable coordination between different functions, to acquire leading technology or to enhance control – without taking into cognisance the advantages or changes such systems could (and should) have on the organisational structure. Structural and process changes occur as a consequence of the implementation of information systems and technologies. Moreover, change may occur before, during or after such projects have been implemented, and their impact on the organisational structure may vary substantially from situation to situation.

The choice of relevant system is a strategic one, because systems are capable of having a major impact on organisational strategy. Thus, it is crucial to understand and use the structural effects of such systems in order to achieve the strategic goals of the organisation. These are generally difficult to quantify in monetary terms, and decisions thus become more a matter of choice of strategy than choice on the basis of cost.

The theoretical concepts relating to the issue of the impact of information systems (IS) and information technology (IT) on the organisational structure are studied first. The theory is then used to explain the interaction between strategy, IS/IT and the organisational structure in order to focus attention on the importance of these business aspects. Some new developments in the field of IS/IT are also discussed with respect to their potential impact on the way that organisations conduct their business. At an empirical level, this paper studies whether and how the organisational structures of a sample of South African manufacturing companies are influenced by the implementation and optimisation of IS/IT. The findings are also compared with theoretically expected changes. The questions to be answered are threefold: (i) Should business process reengineering (BPR) come first? (ii) Should IS/IT implementation come first? or (iii) Should IS/IT and BPR be part of a simultaneous process in order to optimise the outcome for a company?

Definitions

Some of the terms used in this paper could be open to interpretation and are indeed interpreted differently depending on

the field of study concerned. Other terms have not yet been defined in the literature. The terminology used in this study is defined in this section.

Computer systems (CS)

It is suggested that computer systems (CS) is a general term encompassing IT, and, in many cases, the whole concept of computers in the organisation. It is also common to find this term used by earlier writers to refer to the phenomena associated with computers and related systems in the organisation (Blau, Falbe, McKinley & Tracey 1976). Many of the specialised terms currently used in the literature did not exist when earlier research was undertaken, and the term CS was thus used to cover a broad range of concepts that have now been defined separately.

Information systems (IS)

According to Mallach, (1994: 75): "An IS is defined as a system that has the purpose to store, process and communicate information."

Many such systems are available and they perform a variety of tasks. Computerised systems are designed to meet specialised requirements for certain functional areas in a company. IS is also described by Davis & Hamilton (1993) as a term that includes people, data, procedures and technology. The term IS is used to denote a computerised system that stores a large amount of relevant business data, which it can present readily in various combinations and permutations for the use of the organisation.

Information technology (IT)

It is common to find the terms IT and IS used in broad description of systems. However, these two terms are so closely interlinked that it is difficult to distinguish where the one ends and the other begins. In order to clarify the terms, Pellissier's (1999) suggestion for describing the relationship between IS and IT could be useful: "Both IS and IT focus on information – IS on the demand side of information and IT on the supply side of information." This is illustrated in Figure 1.

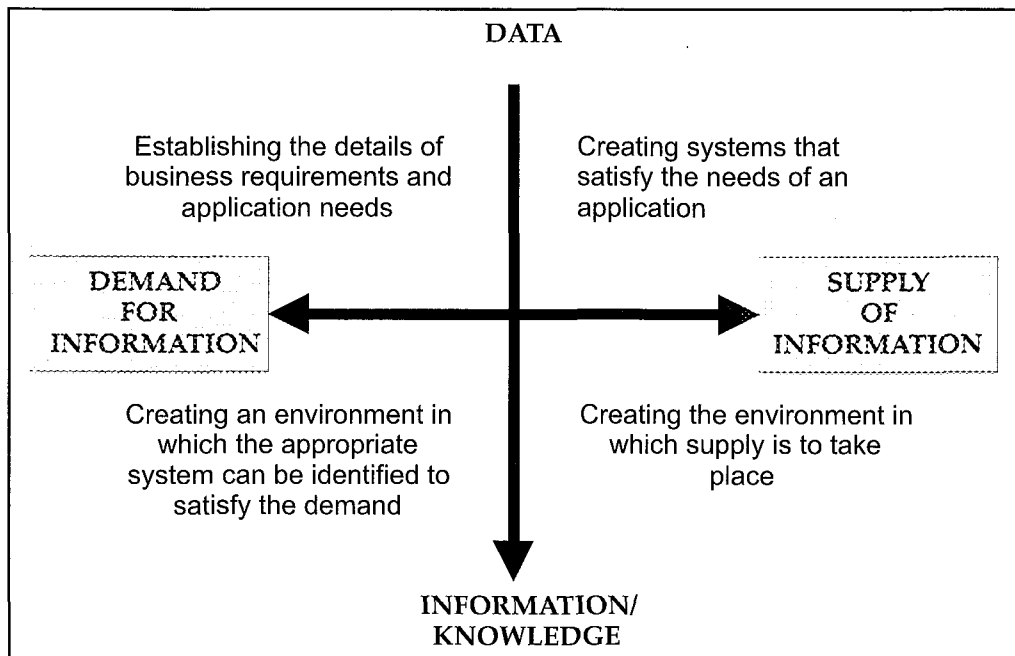
In the definition given by Davis & Hamilton (1993: 1), the term IT is described as a "broader term with respect to tech-

Southern African Business Review 4(1): 36–45

Exploratory research on the measurement of change in organisational structure caused by information systems

* Okker Jordaan is with Deloitte Consulting.

† René Pellissier is an Associate Professor at the Graduate School of Business Leadership, University of South Africa.



Source: Pellissier (1999)

Figure 1. The link between IT and IS

nology because it can encompass the use of the technology in products or service". It is clear from the above that these terms can be, and indeed are, used in fairly broad terms.

Strategic information systems (SIS)

Wiseman (1988) defines the term SIS widely as systems that support and also shape the strategy of a business unit. Laudon & Laudon (1998: 62) have a more narrowly defined view: "Strategic Information Systems are information systems that are designed to change the goals, products, services or environmental relationships of organizations."

Although these definitions are open to some degree of interpretation, it is possible to level the playing field for the present study. For the purposes of the discussions that follow, SIS will be seen as the specialised systems that address specialised needs and/or processes within a business and that impact on the strategy of the organisation.

Enterprise resource planning (ERP) systems

ERP systems, as described in a market survey by Deloitte Consulting (1998: 2) in the USA, can be regarded as many information systems working together towards the organisational goal of "co-ordinating efforts throughout the organisation in order to share information, automate processes and produce and access information in a real-time environment".

The aim of the ERP is to consolidate the separate systems in use into a single system that will share all the common information used throughout the organisation.

Standard package designed ERP systems

In the market, standard designed, off-the-shelf software packages are available and have certain functionalities. These software packages are designed to meet functional requirements and have the capacity to integrate information throughout the company. These packages can be, and sometimes are, 'cus-

tomised' to satisfy the highly specific requirements of a company with processes that deviate from standard processes.

Enterprise requirement management (ERM)

Large companies perform many different and diverse functions with the purpose of achieving the organisational goals set by management. ERM systems can be seen as management systems that coordinate enterprise efforts to achieve the defined organisational goals throughout the organisation, in order to synchronise strategic efforts and create synergy.

Online transaction processing (OLTP)

With the modern capability of processing vast amounts of data faster and converting real-time data into readily usable information on an organisation-wide basis, OLTP has become an increasingly prominent and relevant concept.

In their description of management information systems for the information age, Haag, Cummings & Dawkins (1998: 120) describe OLTP as "gathering input information, processing that information and updating existing information to reflect the gathered and processed information".

In the early years of IT, the capability for doing transactions in a continuous manner had not yet been developed. The ability to process data online – which McLeod (1993) refers to as "transaction processing" – has enabled the updating of data in real-time terms. This was the start of the concept of OLTP as used in the context of the present study.

In this paper, an attempt is made to describe this phenomenon by suggesting that OLTP can be defined as the ability of a system to enable a real-time view of the system information directed at the control function in the organisation.

Decision support systems (DSS)

Decision support systems (DSS) are aimed at supporting the people in an organisation that make decisions based on some

combination of data. DSS are more formally defined by Mallach (1994: 7) as "an information system whose primary purpose is to provide knowledge workers with information on which to base informed decisions".

This definition states clearly that such systems provide information to knowledge workers – the people in the organisation with the business understanding of the impact of decisions, the intelligence to understand the information presented, and the ability to interpret the information they receive.

DSS are systems that can help in converting masses of data into understandable information. After the advent of data warehousing and data mining, as described by Pellissier (1999), DSS together with the integrative capacity of ERP enable people to measure effects and ask unstructured questions based on real-time information. This ability leads organisations into online analytical processing, as discussed in the following paragraph.

Online analytical processing (OLAP)

Modern technology enables greater rapidity and flexibility in examining gathered data than was previously possible. This flexibility emanates from data warehousing and, when combined with the speed of powerful processing, enables calculations of any combination of data in the database, as well as the compilation of information from the available data, using any angle required. This ability to analyse information places an organisation in a strong position in matters of strategic relevance. Haag et al. (1998: 286) define OLAP as "the manipulation of information to support decision making".

Rob & Coronel (1997) describe OLAP systems in terms of the following four characteristics:

1. They use multidimensional data analysis techniques. The ability to define the data of the organisation as part of a multidimensional structure enables these systems to examine related data from different angles.
2. They provide and require advanced database support. OLAP tools require advanced features for accessing data.
3. They are characterised by easy-to-use end-user interfaces. It is important to have easy access to data and visual representation of data.
4. They support client/server architecture. There are vast and complex combinations of different architectures in use by organisations.

Rob & Coronel (1997) also define two tools related to the field of OLAP:

1. Relational online analytical processing (ROLAP)

Many different tools exist in the field of the different architectures and database structures currently in use. One such tool is relational databases. By using such relational tools in the OLAP environment, the ROLAP functionality becomes available to the organisation.

2. Multidimensional online analytical processing (MOLAP)

Multidimensional databases can be described by using the example of a cube. Any cube has three dimensions. A three-dimensional view of the information stored within the cube is thus possible. However, such cubes can be grown within the database, creating what Rob & Coronel (1997) call a hypercube. Once formed, however, such cubes become static data and must be built before analysis.

Organisational structure

Robbins & DeCenzo, (1995: 128) describe the organisational structure as "the organisation's framework expressing the relationship between different functional units of the organisation. Explaining the degree of complexity, formalisation and centralisation in the organisation ... defines and limits the behaviour of its members".

Based on the argument put forward by Robbins (1996: 479–488) it could be suggested that political motives may also turn structures of this nature into fortresses for the protection and expression of power. This dysfunctional use of the structures may affect system implementations and have far-reaching consequences.

Business process reengineering (BPR)

Hammer & Champy (1993) describe BPR as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements". This concept has certain basic principles, as described by Melnyk & Denzler (1996: 230):

1. Process steps should have a natural sequence.
2. Work should be performed at the most sensible location.
3. Multiple versions of a process should be developed, rather than multiple processes.
4. Checking should be minimised and resources controlled.
5. Reconciliation of inconsistencies should be minimised.

Another principle in BPR is to reduce or eliminate the duplication of processes (Hammer & Champy 1993). For example, the same supplier information can be used in purchase orders and receipts and can also be linked to debtors. This enables information to be captured only once and then used in completely different parts of the organisation.

Electronic commerce (e-commerce)

When organisations conduct business transactions through an electronic medium and start moving away from the traditional physical processing of monetary transactions, they are moving towards e-commerce. The United States Department of Commerce (1999) defines this new phenomenon as "business processes which shift transactions to the Internet or some other non-proprietary, Web-based system". This phenomenon is closely linked to the Internet as a global communication entity and can allow transactions to take place between parties virtually anywhere in the world.

There are different methods of conducting e-commerce, and these can affect an organisation and its structure in various ways. These include:

1. Intranet transactions

Transactions between business units in the same enterprise, which are conducted electronically on the enterprise's Intranet, represent one method of e-commerce. This type of e-commerce is known as an electronic data interchange (EDI) method.

2. Extranet transactions

Extranet transacting occurs through a network outside the organisation's network. This is typically an Internet network transaction, but it is also feasible to create an extranet between partners in a supply chain and conduct transactions through an external network.

Information requirement planning (IRP)

Change is an ongoing process. New developments are released and new technologies become available daily. This makes it increasingly difficult for a contemporary organisation to use the latest or best technologies available. In fact, the Gartner Group (1999: 14) states: "Continual investment is required." Continual investment enables organisations to maintain a strategic advantage in the marketplace, based on the technology that they use. The issue is that, in order to have at least the same or better technologies than the competition in the market, at least the same or better technologies need to be a component and a capability of the organisation. Technology is advancing so rapidly that organisational survival is no longer a matter of implementing and using technology but of continuously improving it. The Gartner Group (1999: 14) claims that organisations 'doom' themselves by employing a project methodology to implement technology, because by the time the project has optimised the system, the lost benefit of newly available technology could already have placed the organisation at a strategic disadvantage.

The following definition for IRP is proposed: IRP is the continuous forward planning and enabling of an organisation to cope with and acquire new technology for the purpose of maintaining and building a strategic advantage.

In the technology environment, characterised by the associated fast pace of development, organisations will need to place greater emphasis on the timely availability of applicable technology to meet the strategic requirements of the organisation.

Integration between IS, strategy and organisational structure

The interactions between IS/IT, the strategy of the organisation and the organisational structure have considerable significance in this study, and are discussed below in terms of their interaction with one another and their impact on the performance of the organisation, allowing the organisation to focus on its organisational goals.

The organisation and its strategy

Investors invest funds in organisations in order to make a profit. It would therefore be fair to say that organisations exist in order to give the investor a greater sum of money than was originally invested. Ward (1993: chapter 1) employs a more frequently used expression when he states that the aim of the organisation is to increase shareholder value, and he explores some financial techniques to support his arguments. In brief, organisations exist to increase the wealth of their owners. Following from this, one would pose the question of how

organisations can increase shareholder value. To this end, Grant (1995) advocates a variety of strategies for organisations, such as low cost, differentiation and leadership. To exist, grow and remain in a market, an organisation must be able to give something to the consumer, such that the consumer will continue to use the goods or services of that organisation, or be willing to pay a premium for what the organisation delivers. In order to have an advantage in a market or industry, an organisation has to decide on a strategy that will ensure the required advantage. The strategies that companies employ generally seek to gain the required advantage by creating a cost advantage over their competitors, or by differentiating their goods and services to the extent that they can command a premium.

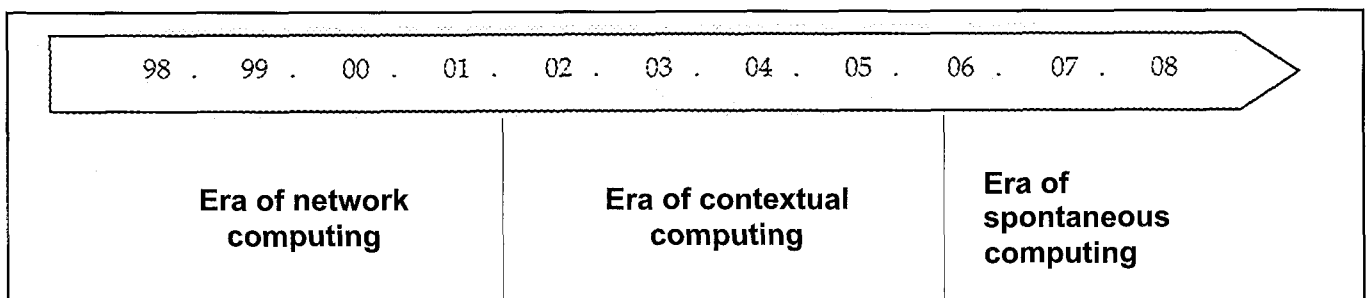
Strategy impacts strongly on all aspects of the organisation. When determining strategy for the organisation, it is important to put systems and processes in place to support it. However, strategy is a dynamic and ongoing task of management and cannot be set at one time and then blindly followed by the organisation. Various internal and external forces affect the organisation's strategy, and it is therefore essential that the leaders of the organisation keep adapting the strategy to keep a step ahead. Systems such as IS/IT can be used to alter the effect of the forces that impact on the organisation (Porter 1985) and that can therefore also affect the strategy of the organisation.

Organisational structure and the strategy capability

In their discussion of factors that influence or shape strategy in organisations and companies, Thompson & Strickland (1996: 47–51) cite an organisation's competitive capabilities. Organisational capabilities enable a company to follow certain strategies.

No two organisations are identical. Organisations have competencies in different fields and emphasise different areas within the business, even though a number of organisations might target the same market. Thompson & Strickland (1996: 240–293) explore issues that impact on the organisational structure related to strategy. Each of the various organisational structures (namely, centralised, decentralised matrix or functional) has strategic advantages and disadvantages in relation to the organisational strategy. According to Davis & Hamilton (1993: 2): "Strategy decisions lead to requirements for business processes, but innovative processes may suggest changes in strategy."

Systems can be used to strengthen structural capabilities in many different areas, for example, synchronised planning for plants at different locations can enhance the coordination of efforts. Supply-chain integration can be strengthened for the delivery of faster and better quality service. This ability can therefore enhance organisational capabilities through the



Source: Adapted from Gartner Group (1998)

Figure 2. The eras of computing development

application of systems, more precisely, IT. Examples in this regard include EDI between business units as regards stock transactions or buy-sell transactions.

The impact of IS/IT on organisational structure

Computer technology is growing in importance in many aspects of companies. Caldwell & Stein (1998) discuss the impact of ERP systems on the organisation, its culture and business-management objectives. They also describe the impact of such systems on the productivity and efficiency of the businesses that have implemented these systems. From the discussion, it is clear that, unless an organisation examines its structure and operational issues, the full benefits of systems will never be realised.

The Gartner Group (1998) makes startling projections in a strategic analysis of technology trends that are expected up to 2008. The analysis divides the period between 1998 and 2008 into three eras and describes them as follows (see Figure 2):

1. The era of network computing

The first era of network computing is the era of communication using networking. The Local Area Network (LAN) and Wide Area Network (WAN) environment of the day highlight this period. Expected growth in the capability for data transfer in communication devices and techniques can lead to the next era, described as the contextual era of computing.

2. The era of contextual computing

In this era, the devices used are expected to be designed around the context of use and will be based on advances in communication capabilities that will enable off-site processing. The lead from this era to the next, called the era of spontaneous computing, will again build on the capabilities that wearable devices will bring to computing, to be used wherever required without constraint.

3. The era of spontaneous computing

The ability to produce more powerful devices in smaller sizes will bring the use of computing to a stage where it is no longer a system-related function but a spontaneous action and a means to an end wherever required. The Gartner Group (1998) forecasts that the office of the organisation will be an 'untethered' office, which will give the employee complete freedom of movement and access to information. A physical office will not be necessary. These projections have a profound impact on structural design in the organisation. The idea of structured workforces reporting to another level of control is called into question in this context. With movement so free, different demands will be placed on the workforce and different assumptions made about their competence and abilities.

It is therefore not possible to argue against the fact that computing is an important technology for organisations using computing capabilities in their processes, decisions and operations. However, it is the IS used by computers and the capabilities of these systems that have the greatest impact on the organisation and therefore become strategically important.

The system and its link to the organisational strategy

Based on the categories specified by Mallach (1994: 8), information systems are developed for specific applications, with specific goals in mind. In the case of a functional department,

an IS developed to suit the functional needs of that department, which in some cases could be described as a specialist system. The problem arises when these specialised and separate systems, designed for very specific goals, are integrated into an ERP system. Integration achieves the combination of efforts and eliminates the duplicate input of information that is shared between these functional systems, which impacts on processes where duplicate information is processed. This is related to the concept of BPR, since one of the main principles of process reengineering is to capture data only once, at the source. Other impacts on the company are also possible, depending on the architecture of the systems and the data. Logistical diversity is also affected by integrating shared processes. These strategies can be linked to IT and vice versa, as systems have been designed to enable the organisation to put such a strategy into effect, for example:

1. Product innovation, where computer-aided design systems can enable the organisation to develop and design products faster and more accurately.
2. Differentiation of service, where systems can enable faster communication, more accurate tracking and a shorter lead-time of service.
3. Supply chain integration, made possible by systems that allow integrated scheduling, costing and coordinated processes.

From the above-mentioned arguments, it is clear that IS can impact on a broad functional front. This directly affects the way that a company is structured in order to fulfil all the required functions that maintain and support it. In confirmation of this, Pellissier (1999) argues that the progress made in IT has taken the issue of system choice for an organisation to another level – the strategic level.

The growing importance of IS/IT for strategic advantage

The field of IT is developing so rapidly that it is difficult to link it to specific applications. In the discussion of eras of development in the previous section, it became clear that the dynamic development of this field will not only rapidly render today's applications obsolete, but will also create future applications that are inconceivable at present. Sanders, Cerveney & Pegels (1993: 14) also advocate the strategic importance of IS by illustrating the effect of the Porter (1985) five-forces model on the environment of the organisation. They set a model that has as its central component the link between the activity in the organisation and the environment. They argue that by using Porter's model, it is possible to identify the ability of IS to influence forces in the organisation's favour or to defend the organisation against negative factors.

Vitale, Ives & Beath (in Laudon & Turner 1989) describe the process of strategy development within what they term 'the top-down model', which is based on the assumption that the managers making and/or developing strategies have a good knowledge of the organisation's capabilities and can thus ensure competitive advantage for the organisation.

The fact that IS/IT-aware people form part of the strategic process will enable the organisation to choose systems that can sustain and/or create sustainable advantage, for three reasons:

1. The organisation becomes aware that management recognises the strategic potential of IS/IT.

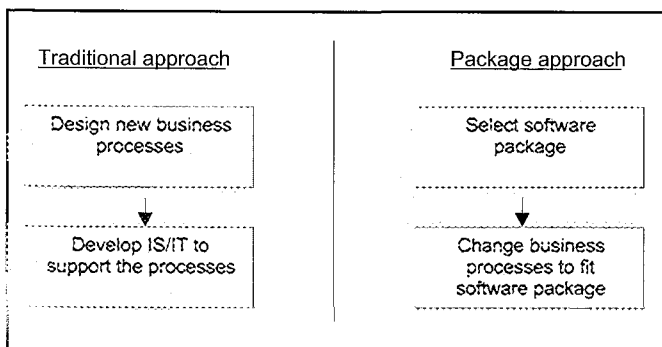
2. The choice of systems being developed or bought at the strategic stage enables greater freedom to explore the effects of the strategy.
3. As IS/IT-responsible people are aware of management thinking at an earlier stage, they can influence movements towards more relevant technologies.

To complete the link between the organisational strategy, structure and IS/IT, it would be appropriate to express similar sentiments to those of Sanders et al. (1993: 30): "IT has high strategic potential in changing industries."

In the current market, the Internet exerts a powerful impact on the way business is conducted. The term used for Internet business transactions is 'e-commerce'. Viewed from the organisational perspective, this entails far more than just purchasing from an Internet shop. The concept of e-commerce originated from the assumption that customers could help themselves better than anyone else could. "E-commerce development is derived from the concept of self service." (pers. comm. Steve Green, Technical Director, Baan SA) This entails that consumers serve themselves by accessing the appropriate website and finding what they require. This impacts on the location and distribution network of small organisations, but as such organisations do not tend to implement ERP systems, they are not discussed further.

However, this external force is a phenomenon that is growing more strongly than anticipated and affecting organisations in more ways than can be foreseen. The United States Department of Commerce (1999) suggests that its own forecast in 1998 of e-commerce growth reaching \$300 million by 2002 could already be considered too low in 1999, since business-to-business e-commerce is growing faster than anticipated. The Department of Commerce cites several factors that have an impact on the growth of e-commerce:

1. A desire and willingness by business to use online transactions
2. Concerns about the privacy and security of transactions
3. The user rates for communication media such as telephone lines, network lines and the costs associated with Internet servers and security
4. The availability of broad band access to organisations and individuals, based on the infrastructure available in the country and the particular organisation
5. Government policy in different countries, affecting the ability of organisations to transact on the Internet.



Source: Davis & Hamilton (1993)

Figure 3. A two-model approach for system implementation

Organisations that implement ERP and also require the capability for e-commerce may have unique problems of their own. Implementing an e-commerce solution in such organisations, where this solution interacts with the organisation's ERP system, may affect the functions of the sales force, for instance. If the client has the ability to interface directly with the system to place an order for goods, to follow the progress of delivery and to make payment, the question is how this alters the task of the salesperson, the creditor and management.

The ability of organisations to conduct business electronically is increasing daily and will place a number of demands on the organisation and its structure.

Which should come first – BPR or IT – or should they be implemented simultaneously?

In a discussion of the approaches that are associated with system implementation, Davis & Hamilton (1993) contrast what they call the 'traditional approach' with the 'package approach'. The discussion is illustrated in Figure 3.

With the advent of off-the-shelf ERP systems that have a suite of functionality, a debate arises around the relative merits of, on the one hand, having a system designed or adapted specifically for an organisation or, on the other hand, using the standard, off-the-shelf packages currently available. There is no single solution to this issue, because all organisations have unique requirements and market conditions.

The traditional method of developing the system to suit the organisation proposes that BPR should come first. This enables the organisation to develop its processes in the way it feels is best for its environment. This method works well if the organisation also has a clean-slate approach to system design and development.

However, the package approach, suggested by Davis & Hamilton (1993), holds that BPR and system implementation should occur together. This can be described as building, or rebuilding, the organisation from the perspective of starting afresh. This is tantamount to starting a new business from scratch, with the exception that it is possible to build on the knowledge base and the resources currently available in the organisation. In other words, all processes are designed from scratch and the IS/IT become an integral part of the complete design.

Another approach, suggested by Caldwell & Stein (1998), is the 'second wave' approach. These authors state that organisations implementing ERP solutions inevitably suffer a drop in productivity. This inevitably requires the optimisation of the processes in the organisation to ensure their compatibility with both the organisation and the system. This optimisation takes place after the organisation and system combination has stabilised.

Based on the proposed approaches mentioned above, a model can be presented of the interaction between the strategy, systems and structure of an organisation. Again, the two approaches (the traditional and the package approaches) should be borne in mind because of the two different angles of attack or dimensions that have been presented. This study proposes a model to illustrate this concept (see Figure 4).

In an article discussing the impact that the combination of ERP and BPR has on the organisation, Pellissier & Kleynhans (1999) also mention three options for the management of an organisation:

1. Reengineer first, then automate. This option describes a situation very similar to the traditional method discussed

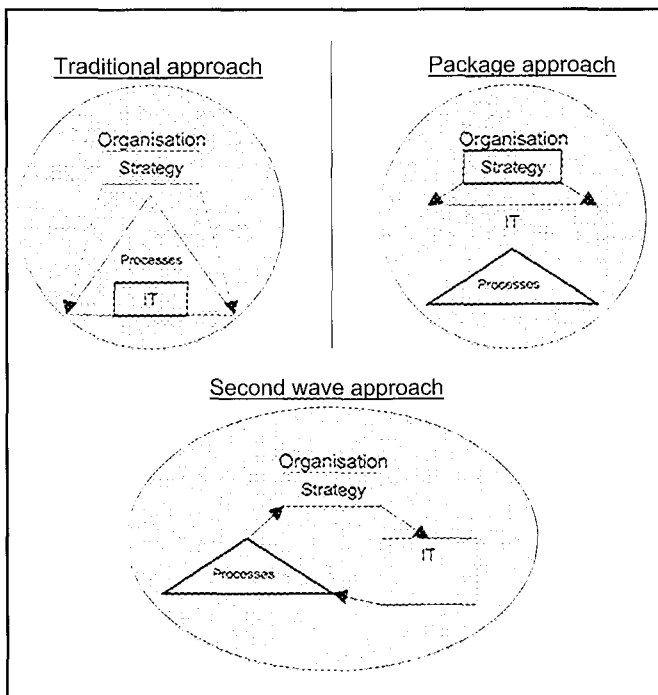


Figure 4. A proposed model of the second wave approach

above. However, these authors apply this method to the implementation of ERP and come to the conclusion that adopting a clean-slate approach does not work effectively with standard ERP packages. Davis & Hamilton (1993) state in their model that the approach of designing an IS/IT system is based on the BPR.

2. Reengineer and automate simultaneously. This approach is the same as the package approach described above and indicates the integration of system design and process design.
3. ERP first and then reengineer afterwards. Although Caldwell & Stein (1998) speak of the same concept, the approach taken by Pellissier & Kleynhans (1999) is distinctly different. Caldwell & Stein (1998) look at this process from the point of view that organisations tend only to perform BPR when they notice that productivity levels have dropped considerably. Pellissier & Kleynhans (1999), however, suggest that organisations implement ERP knowing that it will affect organisational performance but believing that too radical a change will not be possible for the organisation. (Restrictions could include time and money.) Only after reaching stability, albeit at lower levels of productivity than before, can BPR be attempted to ensure greater stability and also a more gradual transition to fully optimised IS/IT implementation.

What is clear in all the above-mentioned approaches is that there has to be some form of BPR. It is this fact that is crucial to any organisation and its management. The importance of this issue lies in the fact that package or ERP systems cannot be implemented just for the sake of having a system for the organisation. There is much more at stake, as argued in the previous section. It is thus clear that change has to take place in organisations that are implementing, or have implemented, IS/IT.

Expected change requirements when implementing IS/IT

Managers in an organisation implementing IS/IT can be sure that change will occur. Change may occur before, during or

after such implementations. System implementations involve several important issues related to the organisational structure, including:

1. Current IS/IT is a valid tool for achieving certain strategic objectives, such as lean manufacturing techniques, fast turn-around times, direct client communication, market niche tracking, downsizing and integrated process development and execution.
2. IS/IT can be used as a vehicle for change in organisations in order to achieve business goals, such as cost reduction, process design or redesign, centralisation or decentralisation, better control and empowerment.
3. Effective use of IS/IT typically goes hand in hand with significant structural changes in processes. This will in turn alter the allocation of responsibility, the reporting structures and other organisational structures.

It is essential to create a good fit between the organisational strategy, organisational structure and IT for any organisation. Demands on organisations are increasing from all sides. The environment offers unique challenges, given the changing political climate, the advent of globalisation, more complex labour relations requiring more attention to individuals, and more competitive markets, as well as the advent of e-commerce and object programming. To be able to cope with all the forces impacting on the organisation, internal harmony is required, in which the strategy, the tools and the structure all work together to ensure the organisation's capacity to survive.

These factors dictate that the structure of the organisation is of great importance as it is one of the elements that keeps the organisation in a state of equilibrium with its environment. The next section therefore takes a closer look at structure-related issues associated with a sample of organisations.

Empirical study

The impact of IS/IT on organisation structure, as proposed by organisational theory, is compared with change in the event of the actual implementation of the technology. This measure of comparison is proposed as a tool to gauge the organisation's path to change in relation to its IS/IT requirements. This may give the organisation an idea of the way forward, based on the change experienced in the implementation of its IS/IT and the expected trends in the development of technology. In short, this can give an organisation a wake-up call to change.

The expected profile of the two extreme implementations

It follows from the theoretical discussion that IS/IT systems will, or should, have an effect on the organisational structure. To have a yardstick for measuring change, two extremes in terms of change within the organisation were considered and their impact on organisational structure was examined. The one extreme was the implementation of IS/IT without any structural changes to the organisation, and the other was the implementation of IS/IT with extensive accompanying structural changes.

Information was gathered using a questionnaire sent mostly to manufacturing organisations that were currently engaged in implementing IS/IT or that had already implemented IS/IT. The findings obtained from the questionnaires were compared with the theory in order to gain insight into the trends in the sample of South African companies and to establish whether

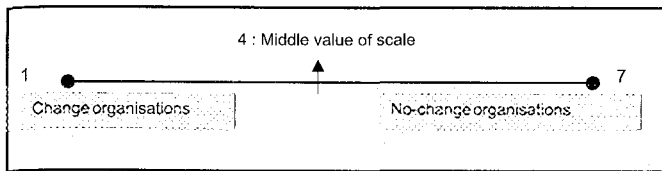


Figure 5. Proposed measurement scale

the organisations, in terms of system implementations, were in the process of change or no change. A theoretical framework is proposed that could be used by an organisation to determine the direction that is taken towards change with respect to IT requirements. The above could also be used as part of the decision-making process around change within the organisation.

The following measurement scale is proposed whereby the sample organisations studied are placed on a Likert scale continuum, with ‘change organisations’ at one extreme of the scale and ‘no-change organisations’ at the other (see Figure 5).

Using the measure of locality (in this instance the median of the Likert scale with a value of 4), it is possible to determine any inherent bias in this sample. Thus, it is possible to determine the degree of bias by examining the difference between this value and the mean of the responses obtained for the categories in a questionnaire, as well as the overall mean of all the responses in all the categories.

In practice, it is rare to find organisations at either of the two extremes, although they tend towards one of the two possibilities, depending on various factors within the company, such as management, culture, strategy and environment.

Questionnaires were sent to 28 organisations throughout South Africa, selected because they had implemented ERP and/or other systems, and/or had upgraded existing IS/IT systems. The organisations were mainly in the manufacturing industry, and the sample spanned mining, food and other manufacturing industries.

Companies in the manufacturing industry comprised the greater part of the response sample. Within the manufacturing industry, a smaller breakdown is also possible, according to the functional areas that have basic similarities in methodology (see Figure 6).

The questionnaires were completed by individuals, each of whom would naturally have some kind of bias towards the

systems within their own organisation. It would therefore not be accurate to state that these opinions represent the absolute value for the industry or the organisations. It would be more accurate to state that the poll represents the views of individuals in industry who were affected by the systems implementations in their respective organisations. This can give an indication of the position an organisation takes towards changing or not changing when implementing IS/IT.

Results from survey

In order to illustrate the impact of system implementations on organisations, sample data depict some of the categories that are affected by system implementations. These are summarised in Figure 7.

In the responses to a 7-point Likert scale (where 1 = Change and 7 = Nochange), the graph delineates and ranks the different categories of changes made by the organisations in the sample. As the mean of the sample over all the categories in the responses is 4.40 and the median of the Likert scale is 4, the following are evident:

- Functional changes were made by most organisations in the sample, in order to use the systems that had been implemented. The mean response, 3.18, is lower than the scale median, and indicates therefore that changes in this category were made freely in order to obtain system fit. As the response mean is also lower than the mean of all the category values, it indicates a definite bias among organisations towards making functional changes when implementing systems.
- Process changes were not made freely, however. The response mean for this category of the sample is above the median of the scale and indicates a bias towards no change for this category in the sample. The response mean is also higher than the mean of all the sample values, thus indicating that organisations do not tend to make many process changes. Although the value is higher, it is not much higher than the mean of all the sample values, and this indicates that the organisations did make process changes to some extent.
- Optimisation of systems is a category showing an even smaller degree of change in the sample of organisations.

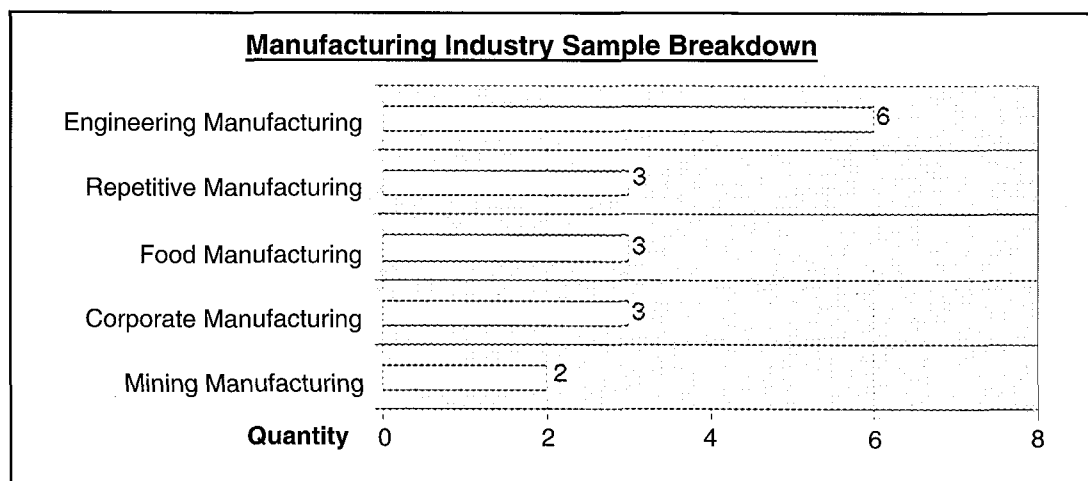


Figure 6. A Pareto diagram of the manufacturing industry sample breakdown

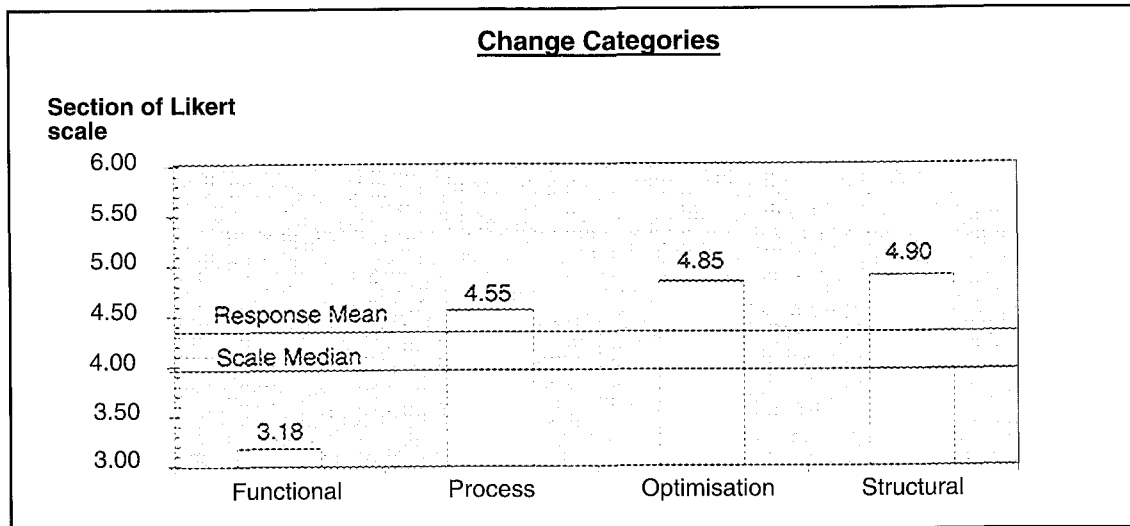


Figure 7. Pareto diagram of change categories in organisations implementing systems

- Structural changes in this sample (as indicated in Figure 7) are the changes that were least likely to occur.

The following categories of data are dealt with:

- Functional: these questions look at the functional aspect of the sample organisations and indicate the tendency of the organisations to change in relation to functional requirements.
- Process: these questions look at the process aspect of the sample organisations and indicate the tendency of the organisations to change in relation to process requirements.
- Optimisation: these questions look at the aspect of the optimisation of the system in the sample organisations and indicate the tendency of the organisations to optimise.
- Structural: these questions look at the structural aspect of the sample organisations and indicate the tendency of the organisations to change their structures. This aspect is the main aim of the study, but is also to some extent related to the other aspects that were measured and that are described above. The relation between the functional requirements, the processes and the issue of optimisation has been discussed in the theoretical background of this paper and forms the basis for evaluating the impact of systems on the organisational structure.

In order to form a picture of the impact on organisations, these aspects were taken from the sample data and combined in a graph to give a more complete picture. The values in the graph comprised the average values of the responses to the questions that address the same aspect and are shown in Figure 7. The findings indicate that most of the organisations in the sample made functional changes in order to use the systems that were implemented. The sample value is lower than the midpoint of the scale and indicates therefore that organisations readily made changes in this category in order to obtain system fit. Process changes were not made readily, however. The value for this category of the sample is above the midpoint of the scale and indicates that the organisations in the sample did not regularly make changes in this category. Optimisation of systems is a category that shows an even smaller degree of change in the sample of organisations. Structural changes, as indicated in Figure 7, are the changes that the organisations in this sample were least likely to make.

In summary, it can be stated that the organisations in the sample did not make structural changes but did to some extent make functional and process changes. The question that arises is whether the organisational functions, processes and structure are synchronised and to what extent they serve the organisation's strategy effectively.

Conclusion

The findings of this study show clearly that, for the sample of organisations that responded, changes in the categories are not related. Some aspects of the organisations change faster than other aspects. These changes must be managed, coordinated and controlled to ensure the maximum utilisation of systems by organisations.

In the modern development environment, in which organisations have to cope with increasingly rapid technological change, it is vital to make the information requirement planning (IRP) process part of the strategic planning of the organisation. This will enable the organisation to base strategy on capability and on the development of capability. It is also important to note that, in an environment where change is continuous, the change in the organisation should not only be synchronised with the technology but also with the different aspects of the organisation. If this is done, the full capability of the organisation will be unleashed and will enable the organisational structure to be developed fully.

The sample of organisations responding to the questionnaire indicates clearly that although changes were made in certain business aspects, these changes were not synchronised and followed up to include all aspects of the organisation. The organisational structure was the aspect that, according to the respondents, experienced the least change.

The effect of IT on the organisational structure is the topic of this research project. To conclude this project, it would therefore be relevant to state that organisations do not take into account the effect that IS/IT should have on the organisational structure in order to utilise the potential of the organisation-system combination to its full potential.'

This should give rise to the following question in the mind of the business executive. Will organisations in the manufac-

turing industry in South Africa today be able to cope with the even more rapidly changing technology of tomorrow if it is currently difficult even to synchronise changes within the organisation, based on technological requirements?

References

- Blau, P.M., Falbe, C.M., McKinley, W. & Tracey P.K. 1976. 'Technology and organization in manufacturing', *Administrative Science Quarterly*, 2(1): 20–40.
- Caldwell, B. & Stein, T. 1998. *New IT Agenda*. www.informationweek.com. 30 November.
- Davis, G.B. & Hamilton S. 1993. *Managing Information: How Information Systems Impact Organisational Strategy*. Homewood, IL: Irwin.
- Deloitte Consulting. 1998. *ERP's Second Wave: Maximising the Value of ERP Enabled Processes*. New York: Deloitte Consulting.
- Gartner Group. 1998. *Strategic Analysis Report: Technology Trends: 1998–2008*.
- Gartner Group. 1999. 'The future of IT: planning for the business focused IT organisation beyond the millennium', *Africa*.
- Grant, R.M. 1995. *Contemporary Strategy Analysis* (2nd edition). Cambridge, MA: Blackwell.
- Haag, S. Cummings, M. & Dawkins, J. 1998. *Management Information Systems for the Information Age*. Boston, MA: McGraw-Hill.
- Hammer, M. & Champy, J. 1993. *Reengineering the Corporation*. New York: Harper Business.
- Laudon K.C. & Laudon J.P. 1998. *Management Information Systems*. London: Prentice Hall.
- Laudon, K.C. & Turner, J. 1989. *Information Technology and Management Strategy*. London: Prentice Hall.
- Mallach, E.G. 1994. *Understanding Decision Support Systems and Expert Systems*. Burr Ridge, IL: McGraw-Hill.
- McLeod, R. 1993. *Information Systems Concepts*. New York: Macmillan.
- Melnik, S.A. & Denzler D.R. 1996. *Operations Management*. Chicago: Irwin.
- Pellissier, R. 1999. The impact of information technology on business organizations of the future. PhD thesis, University of Pretoria.
- Pellissier, R. & Kleynhans, A. 1999. 'BPR and ERP: The chicken or the egg', *South African Journal of Industrial Engineering*, 10(1): 31–41.
- Porter, M. 1985. *Competitive Advantage*. New York: Free Press.
- Rob, P. & Coronel, C. 1997. *Database Systems, Design, Implementation, and Management* (3rd edition). [Sl.]: Course Technology, International Thompson.
- Robbins, S.P. 1996. *Organisational Behaviour* (7th edition). Englewood Cliffs, NJ: Prentice Hall.
- Robbins, S.P. & DeCenzo, D.A. 1995. *Fundamentals of Management*. Englewood Cliffs, NJ: Prentice Hall.
- Sanders, G.L., Cerveney, R.P. & Pegels C. 1993. *Strategic Information Systems for Strategic Manufacturing Operations, Marketing, Sales, Financial, and Human Resources Management*. Greenwich, CT: JAI Press.
- Thompson, A.A. & Strickland, A.J. 1996. *Strategic Management, Concepts & Cases* (9th edition). Homewood, IL: Irwin.
- United States Department of Commerce. 1999. *E-Commerce*.
- Ward, K. 1993. *Corporate Financial Strategy*. Oxford: Butterworth-Heinemann.
- Wiseman, C. 1988. *Strategic Information Systems*. Homewood, IL: Irwin.

Economic value added (EVA): Uses, benefits and limitations – A South African perspective

Nicholas A. Wood*

EVA¹ is a single-period measure of a firm's ability to create wealth for its shareholders. Firms that consistently achieve positive EVA should see this translated into increased market capitalisation, the improvement in which can be measured by market value added (MVA). While readers may be familiar with the basic concepts of EVA and MVA, they may be less aware of the adjustments and preliminary calculations necessary to compute these performance measures. The first part of this paper briefly explains these concepts and presents an illustrative example of their calculation. Thereafter, the results of two case studies of companies in South Africa and New Zealand are summarised to highlight their experiences during and after the implementation of EVA. This is followed by an exploratory review of the use of EVA in South Africa for share selection purposes. The limitations of EVA are then considered, and, finally, the implications for EVA of some recent developments in South Africa are discussed.

Introduction and objectives

Economic value added (EVA) and market value added (MVA) are measures of company performance that are designed to encourage managers to focus on shareholder wealth creation.

Stern Stewart and Co-popularised the EVA methodology in the USA, where companies began implementing this performance measurement approach in the early to mid 1980s. By the early to mid 1990s, a number of South African companies were adopting this approach, including Murray and Roberts, Nissan and Sentrachem (Curtin 1993).

Presentations by Joel Stern in South Africa's major cities in 1994, *Finance Week's* listed company rating by MVA, and articles in both academic and professional journals have heightened the interest in these concepts.

The aim of this paper is to assist companies that are considering implementing EVA to make a more informed decision. This will be achieved by:

- Explaining the EVA and MVA concepts and illustrating their computation
- Summarising the experiences of some companies in South Africa and New Zealand that have implemented EVA
- Reviewing the use of EVA for share selection purposes
- Considering EVA's limitations
- Discussing the implications of some recent developments in South Africa for the use of EVA.

EVA and MVA: The basics

The concepts and calculations

Dierks & Patel (1997) define EVA as "a measure of financial performance that combines the familiar concept of residual income with principles of modern corporate finance". In *Southern African Business Review* 4(1):46–53

Economic value added (EVA): Uses, benefits and limitations – a South African perspective

terms of this definition, the essential elements used to calculate EVA are net operating profit after tax (NOPAT), the firm's capital employed and its cost of capital (C). These variables can be presented in the following formula:

$$EVA = NOPAT - (C \times \text{total capital})$$

NOPAT (the firm's net operating profit after tax) and its total capital employed (at book value) are adjusted to more accurately reflect the cash return earned and the true capital base from which the return was generated. Examples of these adjustments (described as equity equivalents) are shown in Table 1.

Table 1. Equity equivalents

Add to capital	Add to NOPAT
Deferred tax reserve	Increase in deferred tax reserve
Cumulative goodwill written off	Goodwill written off in the period
Net capitalised research & development (R+D) costs	Increase in (net) capitalised R&D

Source: Stewart (1991)

C is the firm's weighted average cost of capital, which combines the costs of the various forms of permanent capital employed into a composite measure. C thus represents the minimum rate of return that the firm must earn to avoid a reduction in shareholder wealth. Consequently, a positive EVA occurs when NOPAT exceeds the minimum capital charge,

*Nicholas A. Wood is a senior lecturer at the School of Accounting and Finance, University of Natal. This article is based on the working paper that the author submitted in partial fulfilment of the requirements of the Masters in Business Leadership degree. The supervisor of the working paper was Professor Marius Maritz of the Graduate School of Business Leadership, University of South Africa.

1 EVA is a trademark of the Stern Stewart Consulting Group.

and this excess represents the value added to shareholder wealth during the period in question. Conversely, a negative EVA represents a decline in shareholder wealth, as the firm has not been able to achieve the minimum rate of return required by its financiers.

MVA is a cumulative measure of wealth created by the firm for its investors. It is calculated by comparing the market value of a firm's total capital with its book value (adjusted for equity equivalents) and can be formulated as follows:

$$\text{MVA} = [(\text{ordinary shares outstanding} \times \text{share price}) + (\text{market value of preference shares}) + (\text{market value of debt})] - \text{book value of total capital}$$

Another way of interpreting MVA is to regard it as representing the difference between 'cash out' (what investors could take out of a firm) and 'cash in' (the total capital provided by shareholders and lenders), and it is thus a measure of management's success in adding value to the cash provided by the firm's investors (Stern & Hahn 1994).

Firms whose EVA is regularly positive should see this translated into growing MVA, as investors' confidence grows in the firm's ability to consistently deliver a return in excess of the required risk-adjusted rate.

Calculating EVA and MVA: An example

As explained above, two of the key variables required to calculate EVA are NOPAT and total capital. The latter is also used in the calculation of MVA. Stewart (1991: 87-110) suggests two approaches – the financing and the operating approaches – to calculate NOPAT and total capital. Although both methods arrive at the same values, each adopts a different perspective. Table 2 highlights these differences.

These different approaches are illustrated in Appendices 1 and 2. The example has been adapted from Dierks & Patel (1997).

Thus, MVA would be calculated as follows:

$$\begin{aligned} \text{Market value of equity} &= 50\,000 \text{ shares} \times \text{R}25 = \text{R}1\,250\,000 \\ \text{Book value of equity}^* &= \text{R}\,555\,000 \\ \text{Market value added} &= \text{R}\,695\,000 \end{aligned}$$

*Adjusted shareholders' interest per Appendix 1

This example assumes that there are no preference shares and that the market and book values of debt are equal. Thus, only the market and book values of equity are relevant, and the cumulative value added by the firm to equity investors' capital is R695 000. This could be compared to the previous year's MVA to ascertain the change in value for the current year.

Table 2. Approaches to calculating NOPAT

Variable	Financing Approach	Operating Approach
Total Capital	Focus: Capital employed adjusted for equity equivalents	Focus: Employed of capital adjusted for equity equivalents
NOPAT	Bottom-up approach: Attributable income Add: Equity adjustments Add: Interest after tax = NOPAT	Top-down approach: Gross profit Less: Operating costs Add: Equity adjustment = NOPAT

EVA would be calculated as follows:

$$\begin{aligned} \text{NOPAT} &= \text{R}68\,000 \quad (\text{Appendices 1 \& 2}) \\ \text{Total capital (net assets)} &= \text{R}975\,000 \quad (\text{Appendices 1 \& 2}) \\ \text{C = weighted cost of capital} &= 10.7\% \quad (\text{Appendix 3}) \\ \text{Thus EVA} &= \text{R}\,68\,000 - (0.107 \times \text{R}975\,000) \\ &= \text{R}68\,000 - \text{R}104\,000 \\ &= (\text{R}36\,000) \end{aligned}$$

This negative result suggests that shareholder wealth has been reduced for the period in question.

EVA and MVA in action

The experience of EVA users

Two case studies, one conducted among South African companies (Mullane 1995) and the other more recently among New Zealand companies (McLaren 1999), were compared, together with comments from a consultant of Stern Stewart and Co. (Klynsmith 1999, pers. comm.), in order to consider the reasons for implementing EVA, the implementation processes adopted, the problems encountered and the benefits realised.

The key findings are summarised below:

- EVA was implemented primarily to measure business performance and as the basis for establishing a performance related pay scheme, the overall goal of which was to encourage managers to focus on creating wealth for shareholders.
- Guidelines for successful implementation:
 - The implementation should be viewed as a project within the firm, with a budget allocated and a project leader (preferably a senior executive) appointed.
 - A willingness to decentralise decision-making is essential so that lower level managers are empowered to take whatever steps are necessary to increase their EVA performance measure.
 - A phased approach to implementation is recommended, using EVA initially to measure business performance and then, once there is adequate understanding of the EVA concepts and goals, as the basis for an incentive scheme. Unless an incentive scheme is also introduced, managers are unlikely to have the necessary commitment to ensure successful implementation.
- Problems experienced when using EVA:
 - Unrealistic expectations that EVA would in itself transform the business
 - Demotivation in not being able to improve EVA as a result of uncontrollable external factors
 - Difficulties in calculating the cost of capital and making capital allocations
 - Communication and comprehension difficulties, especially if EVA was implemented throughout the organisation
 - The administrative requirements for EVA need careful attention to avoid the creation of an EVA bureaucracy.
 - EVA, like any other financial measure, is inadequate on its own for monitoring the achievement of a company's strategic goals.

- Benefits from using EVA:
 - The motivation to increase EVA made managers more aware of the costs of using capital and the need to manage assets more efficiently and effectively. Thus, EVA acted as a useful guide for both strategic and operational decisions. This link to planning is highlighted by McLaren's (1999) findings that all the companies surveyed used EVA (in conjunction with other methods, such as net present value and payback period) for capital budgeting.
 - Dierks & Patel (1997) point out a further benefit of using EVA, namely that "it creates a common language for decision-making, especially long-term decisions". Thus, there can be no doubt that EVA, through its focus on issues that drive value creation, is a powerful decision-making tool.
 - Linking performance-related pay to EVA made it easier to distinguish better performers from weaker ones, encouraged empowerment and a longer term decision perspective, all of which resulted in the right performance being rewarded in an objective way. Thus, EVA effectively integrates the planning and control functions within an organisation.

Using EVA for selecting shares

According to Topkis (1996), more and more Wall Street stock brokers (for example, C.S. First Boston and Goldman Sachs) are using EVA to judge share performance and to make share selection decisions. In South Africa, however, the use of EVA for share selection purposes appears to be more limited than in the USA. An exploratory review in this regard is summarised below:

EVA value ratio and spread measures

Initially, E.W. Balderson was the only stockbroking firm on the Johannesburg Stock Exchange (JSE) to make EVA an integral part of its analysis process (Clarke 1994). Subsequently, the firm's former director, Arthur Thompson (1998), reported that EVA had received renewed impetus with the arrival of international stockbrokers in South Africa and the increased adoption of the EVA performance management system by international and local companies. In his article, he explains how an EVA framework can be used to analyse company performance and hence provide useful information for share selection decisions. The following methods were adopted.

Industrial shares on the JSE are ranked according to a value ratio, and this, together with their 'spread', is used to guide the investor in buy and sell decisions. The value ratio is determined as follows:

$$\frac{\text{Present value of forecast EVAs} + \text{Economic net asset value}}{\text{Current share price}}$$

The value ratio thus compares the analyst's intrinsic valuation of the share (namely, the numerator) with its current market value to assess whether the share is under- or over-priced. A ratio in excess of 1 suggests that the share is under-priced; less than 1, that it is over-priced. The higher the ratio, the potentially more attractive the share. However, the magnitude of the ratio itself is not the critical factor, but rather its value relative to those of other shares (Clarke 1994).

The 'spread' is the difference between return on capital employed (ROCE) and weighted average cost of capital (WACC), averaged over a representative period of, for example, three years, with greater weighting being given to more recent years. Companies with a positive spread are earning a positive EVA, indicating that they are creating wealth for their shareholders. The higher the spread, the better the quality of the company.

In making share selection decisions, the value ratio should be considered first in assessing if a share is currently over- or under-priced. Thereafter, the spread suggests whether the share should be regarded as a long-term investment or merely a short-term speculative buy. For example, if the value ratio exceeds 1 and the spread is positive, this suggests that the share is under-priced and is consistently creating shareholder wealth. Such a share would be well worth considering as a long-term investment. On the other hand, a share with a value ratio in excess of 1, but with a negative spread, may be worth considering as a short-term buy only, given that an upward price correction is expected.

Economic performance analysis

Further evidence of the use of EVA in share valuation by some analysts in South Africa is apparent from a company report on Sasol Ltd conducted by Parry of HSBC Simpson McKie (1998). The report contains a section on Economic Performance Analysis that considers whether Sasol can be expected to create value for its shareholders in future. In addition, an intrinsic value per share is estimated, based on economic profit concepts.

Shareholder value creation is determined by calculating the spread, initially between ROCE and WACC, and then on a more rigorous basis between return on invested capital (ROIC) and WACC. The return and invested capital amounts are essentially the same as NOPAT and Total Capital described in the section on concepts and calculations. In the case of Sasol, although the ROCE-WACC spread was consistently positive, suggesting a positive EVA, this was not the case historically using the ROIC-WACC spread, although this was expected to become positive in future.

The market's expectation of future performance is established by calculating what is termed the rating to economic profit (REP), which compares the market's rating of the company with the company's current performance, and is expressed as follows:

$$\begin{aligned} \text{REP} &= \text{market rating} / \text{current performance} \\ &= (\text{enterprise value} / \text{invested capital}) / (\text{economic profit}) \\ &= (\text{EV} / \text{IC}) / (\text{ROIC} / \text{WACC}) \end{aligned}$$

where enterprise value represents equity market capitalisation plus net debt (or minus net cash).

The following points bear noting:

- If (EV / IC) is greater than 1 (in other words, MVA is positive), the market is valuing the company as a value creator (by giving it a positive market rating)
- If (ROIC / WACC) is greater than 1 (in other words, EVA is positive), the company is currently creating value (namely, positive performance)
- "The balance between the rating and the performance gives us a feel of how the market is pricing future compared to current performance" (Parry 1998).

Applying the above formula to Sasol, based on its published results for 1998, the following emerged:

$$\text{REP} = (13\,969 / 18\,419) / (10.8\% / 21.1\%)$$

$$\text{REP} = 0.76 / 0.51$$

$$\text{REP} = 1.49$$

This indicates that, although MVA and EVA were negative in 1998, the REP exceeded 1, “implying an expectation of increased value creation going forward” (Parry 1998).

The analyst’s approach to estimating the share’s intrinsic value is similar to the method used by Thompson (explained above).

Conclusion

Although the use of EVA for share analysis purposes in South Africa appears to be growing, it still seems to be quite limited, given that its application is more complex and time-consuming than traditional methods based on earnings per share (EPS) and forecast price/earnings (P/E) ratios. Further research into the extent of its use for these purposes would be worthwhile.

The limitations of EVA

Despite the many benefits that can be derived from implementing EVA, it is important to be aware of the criticisms and limitations that have been raised.

EVA: An incomplete performance measure

As is the case with other financial performance measures, such as return on investment or divisional net income, EVA, on its own, is inadequate both for assessing a company’s progress in achieving its strategic goals and in measuring divisional performance.

Achieving strategic goals

Kaplan & Norton (1996) make the point that, whereas financial measures show the results of operations, other more forward looking measures, often non-financial in nature, should also be included in regular performance reports to provide early warning signals of problem areas. In this way a “balanced scorecard” can be designed to more effectively monitor a company’s activities.

Measuring divisional performance

A major challenge in a divisionalised company is to design performance measures that encourage entrepreneurial behaviour while at the same time promoting goal congruence. EVA, with its emphasis on value creation, certainly achieves the former goal, but is no better or worse than other financial measures in reflecting interdependencies among divisions (Zimmerman 1997). As a consequence of this limitation, an EVA incentive scheme should be complemented by other means to discourage managers from engaging in dysfunctional behaviour. For example, this could be achieved by tying a portion of the bonus to firm-wide EVA and instituting a share incentive scheme. Klynsmith (1999, pers. comm.) confirmed this practice among South African companies that have implemented EVA, explaining that typically at the divisional level, a weighting of 70/30 per cent is given to divisional/group EVA respectively.

Inappropriateness of EVA to certain industries

Dierks & Patel (1997) raise the point that using EVA alone to evaluate financial performance may be inappropriate for some firms. For example, for new, high growth companies, such as those in the technology and biotechnology sectors, year-on-year

changes in EVA (which may well be negative at times) are unlikely to explain changes in a firm’s value, given that value is dependent on future expected cash flows. For these firms, then, it is suggested that performance be assessed with reference to both EVA and MVA, since the latter measure, being market-value based, takes into account future expected cash flows. Thus, using EVA alone to analyse a firm’s performance is more suitable for mature companies with substantial assets in place.

EVA and share price correlation

Strong positive correlation between EVA and share price movements increases the attractiveness of using EVA as an internal performance measure. In this way, by consistently improving EVA, share price gains should follow. However, empirical tests of this relationship internationally have produced conflicting results. For example, a study of 241 firms during the period 1987 to 1993 found that “EVA and MVA are significantly positively correlated with stock price performance, attesting to their effectiveness as performance measures” (Lehn & Makhija 1996). However, other studies have shown that basic income before extraordinary items (Myers 1996) and residual income (Dodd & Chon 1996) are as strongly correlated with changes in share prices as is EVA. The latter researchers thus conclude that the benefits of using EVA as a performance measure may not justify the implementation costs. However, Zimmerman (1997) points out that, in choosing among alternative performance measures, managers are misled if they use as their key criterion the degree of correlation that each measure has with year-to-year changes in stock prices. Share prices are not only a function of single period performance but also of future expected performance and market risk factors. He thus concludes: “The quest for a performance measure that provides the best operating proxy for stock returns is both futile and potentially misleading.”

In South Africa, De Villiers & Auret (1998) conducted research into the comparative explanatory power of EPS and EVA on share prices. The research revealed that EPS better explained share price changes than did EVA, and hence the benefit of using EVA in preference to EPS in share price analysis was not evident. Thus the researchers conclude: “It is clear that in explaining or predicting share prices, EVA does not impart a simple advantage in share analysis. If it has an advantage, it has to be applied in a more subtle or complicated way than simply substituting EVA for EPS in share evaluation.” As explained in the section on using EVA for selecting shares, this is exactly what Thompson (1998) and Parry (1998) are doing in using EVA as a basis for share analysis.

Failure of EVA to account for inflation

De Villiers (1997) indicates how inflation distorts EVA and shows that it cannot be used during times of inflation to estimate actual profitability. He then devises a superior measure, called adjusted EVA, which corrects for inflationary distortions. While there is no doubt that EVA, based on historic cost accounting, is distorted by inflation, this criticism applies equally to any accounting-based measure that is not adjusted for inflation. Moreover, given the recent ongoing reduction in South Africa’s inflation rate, this problem is less severe than it was when the research was conducted in 1997.

The costs of using a performance measure that deviates from generally accepted accounting practice (GAAP)

As discussed in the section on concepts and calculations, equity adjustments to GAAP-determined capital and earnings are designed to provide more realistic values of these amounts.

However, this benefit comes at a price, with some of the costs being more obvious than others. For example, the costs of management time in deciding which adjustments to make, the accounting staff costs in making the adjustments, and the costs of educating and training employees in EVA methodologies are the more obvious ones. Less obvious costs, such as additional auditing fees and potential litigation costs, should not be overlooked when considering the merits of implementing an EVA system (Zimmerman 1997).

Additional auditing fees

If shareholders require that the basis for awarding directors' bonuses be audited, this may result in additional auditing fees, depending on how the bonuses are calculated. For example, if the calculations are based on EVA, which is derived from GAAP-adjusted earnings, the auditors would have to confirm the economic soundness of the adjustments and hence charge a higher fee than if the bonuses were based directly on GAAP earnings.

Litigation costs

The potential for litigation by shareholder groups increases when management is rewarded on a basis that deviates from GAAP earnings. This could arise if bonuses were declared, based on EVA gains, despite a fall in GAAP earnings. Zimmerman (1997) compares the treatment of research and development costs under conventional accounting with its treatment for EVA purposes, to demonstrate how this situation could arise.

Recent developments in South Africa – implications for EVA

Equity equivalent adjustments

Goodwill

The 1998 amendments to the Companies Act, which include provisions regulating share buyback schemes, became effective on 30 June 1999. Because some companies interpreted these proposed changes as limiting the reduction of capital to share buyback arrangements only, they hastily sought high court and shareholder approval for writing off goodwill against shareholders' funds. Adding to their haste was the release in June 1999 of an accounting standard (AC131) which requires, with effect from 1 January 2000, that goodwill arising from business combinations be written off through the income statement (over the period of its useful life, not exceeding 20 years). This requirement would clearly have resulted in reduced earnings for the affected companies, and hence their desire instead to write off goodwill against shareholders' funds before the accounting standard became effective. Primedia is a case in point. In the same month that AC131 was released, it obtained shareholder approval to write off its goodwill of R2.3 billion (approximately two-thirds of its net asset value) against shareholders' funds (Crotty 1999a). If this action had not been taken, the company would have faced a goodwill write-off against earnings of about R100 million a year for 20 years (assuming the maximum permissible period was used). Against this background, if Primedia, and other companies like it, were to recapitalise goodwill for EVA purposes, their shareholders might well consider this action to be inconsistent with their directors' earlier recommendations for writing it off.

Research and development (R&D) costs

In broad terms, the accounting standard (AC122), which recommends how R&D should be treated in company accounts, adopts a similar approach to the method recommended by Stewart (1991: 115–116). That is, that development costs should be capitalised and then amortised through the income statement over the period that the related economic benefits are recognised, normally not exceeding five years. The two approaches differ, however, in that AC122 sets five rigorous criteria that have to be met before development costs may be capitalised. De Waal & Everingham (1998) speculate that, because these conditions cannot be met or because of practical difficulties in applying the standard, none of the 30 JSE-listed industrial companies that De Waal (1997) surveyed had capitalised their development costs. In view of this, it appears that many companies in South Africa that adopt the EVA framework would have to make an equity adjustment for R&D costs.

Directors' remuneration

The Nail debacle, concerning the planned payment of exorbitant amounts to directors, followed more recently by Alexander Forbes' and Tourvest's plans to make generous payments to their senior executives, have all led to renewed calls for better disclosure of directors' remuneration and of the basis upon which these amounts are calculated (Crotty 1999b). While the question of disclosure is beyond the scope of this article, the issue of how remuneration is determined is most relevant. Hasenfuss (1999) believes that the developments in Nail and Tourvest are helping to advance the whole issue of performance-related pay. In this regard, Hunter (1999) believes that shareholders and other stakeholders should be more concerned about *how* senior executives are compensated, rather than *how much* they are actually paid. He goes on to say that "when a material portion of a senior executive's total wealth is variable and dictated by objective shareholder value-based criterion, the debate about how much is enough becomes unnecessary". The point is that, if remuneration is tied to the value that has been created for shareholders, then it is justifiable. If, however, it is largely fixed, then it is not. Clearly, then, EVA, as is a verifiable, internal measure of shareholder wealth creation, is ideally suited as a basis for performance-related pay.

Conclusion

EVA is more than just an internal business performance measure or a basis for determining incentive pay. If implemented fully, it represents a comprehensive financial management system that integrates planning and control activities and provides a common language for decision-making. With its emphasis on value creation, it closely aligns the goals of management and shareholders and provides an objective means for instituting performance-related pay. In the South African context, this latter benefit will assume greater importance as the call for transparency in directors' remuneration increases.

It is important to bear in mind, however, that EVA, like all financial measures, has its limitations. On its own, it is not a complete performance measure and will not prevent managers from engaging in dysfunctional behaviour. However, steps can be taken to minimise these shortcomings by supplementing EVA with other measures, typically non-financial,

and by tying incentive pay to group performance. In addition, companies considering implementing EVA must also realise that it is not a cheap, short-term initiative, but one that requires total commitment from top management and a willingness on their part to empower lower level managers and employees.

Given that more than 400 South African organisations have already implemented EVA (Klynsmith 1999, pers. comm.), and that there is a growing awareness of its usefulness for share analysis purposes, it seems likely that it will gain increasing prominence in South Africa in the years ahead.

APPENDIX 1

Total Capital and NOPAT: Financing Approach

Total Capital		R'000
Long-term debt		270
Short-term debt		100
Present value of operating leases		50
Total debt and leases		<u>420</u>
Ordinary shareholders' interest		425
<u>Add Equity equivalents:</u>		
Accumulated goodwill written off	50	
LIFO reserve	10	
Deferred tax reserve	<u>70</u>	
Total equity equivalents		130
Adjusted shareholders' interest		<u>555</u>
Total capital		<u><u>975</u></u>
NOPAT		R' 000
Income attributable to equity		30
<u>Add Equity adjustments:</u>		
Deferred tax increase	5	
Goodwill written off	15	
Increase in LIFO reserve	<u>2</u>	
Total equity adjustments		22
Adjusted attributable income		<u>52</u>
<u>Add Interest expense</u>	26	
<u>Less Tax on interest</u>	<u>(10)</u>	
Net interest expense		<u>16</u>
NOPAT		<u><u>68</u></u>

Net Assets (Employment of capital) and NOPAT: Operating Approach

Net Assets R' 000			
Cash		35	
Debtors		190	
Inventory		190	
LIFO reserve		10	
Other current assets		95	
Total current assets		520	
Accounts payable		150	
Receiver of revenue		20	
Other current liabilities		200	
NIBCLs*		370	
Net working capital		150	
Fixed assets (net)		530	
Present value of operating leases		50	
Adjusted fixed assets		580	
Goodwill		75	
Accumulated goodwill written off		50	
Adjusted goodwill		125	
Other long-term assets		120	
Net Assets		975	
NOPAT		R' 000	
Gross profit		330	
<u>Less</u> Relevant operating expenses:			
Depreciation	(20)		
Selling, general and admin	(185)		
Other	(46)		
<u>Add</u> Equity adjustment for LIFO	2		
<u>Add</u> Investment income	12		
NOPBT		93	
<u>Less</u> Cash operating taxes:			
Current provision	(20)		
Deferred tax increase reversed	5		
Tax saving on interest reversed	(10)	(25)	
NOPAT		68	

* Non-interest-bearing current liabilities

Calculation of C = Weighted Average Cost of Capital

	Component	Weighted	Market Value Cost	Weighting Cost
Long-term debt (Appendix 1) Equity: 50 000 shares x R25	R 270 000	17.80%	4.8% *	0.8%
	R1 250 000	82.20%	12.0% †	9.9%
Total	R1 520 000	100.00%		10.7%

* K_D = cost of long-term debt = current market return after tax

$K_D = 8\% \times (1 - t)$ where t = current tax rate

$K_D = 8\% \times (1 - 0.40)$

$K_D = 4.8\%$

† K_E = cost of equity which is assumed to be 12.0%

References

- Clarke, K. 1994. 'EVA on the JSE', *Finance Week* 200, 24-30 March.
- Crotty, A. 1999a. 'Restating balance sheets fools no one', *Business Report*, 23 June.
- Crotty, A. 1999b. 'If we want US-type executive pay, we need US-type disclosure', *Business Report*, 7 July.
- Curtin, M. 1993. 'Performance system EVA takes off in SA', *Business Day*, 18 November.
- De Villiers, J.U. & Auret, C.J. 1998. 'A comparison of EPS and EVA as explanatory variables for share price', *Journal for Studies in Economics and Econometrics*, 22(2): 47-63.
- De Villiers, J.U. 1997. 'The distortions in economic value added (EVA) caused by inflation', *Journal of Economics and Business*, 49: 285-300.
- De Waal, M.S. 1997. 'AC122 - Are you compliant?' *Accountancy SA*, November/December: 33.
- De Waal, M.S. & Everingham, G. 1998. 'The application of AC122, accounting for research and development costs: An investigation of the conceptual issues and implementation concerns', Paper delivered at the South African Association of Accountants conference, July.
- Dierks, P.A. & Patel, A. 1997. 'What is EVA, and how can it help your company?' *Management Accounting*, 79(5), 52-58.
- Dodd J.L. & Chon S. 1996. 'EVA a new panacea?' *B & E Review*, July/September: 26-29.
- Hasenfuss, M. 1999. 'Here's a novel idea for South Africa: Performance-related remuneration', *Business Report*, 2 July.
- Hunter, P. 1999. 'Executive compensation: Don't ask how much, ask how', *Business Report*, 31 March.
- Kaplan, R. & Norton, D. 1996. *The Balanced Scorecard: Translating Strategy into Action*. Boston, MA: Harvard Business School Press.
- Klynsmith, E. 1999. Consultant for Stern Stewart and Co., Telephonic interview, 23 September.
- Lehn K. & Makhija A.K. 1996. 'EVA and MVA as performance measures and signals for strategic change', *Strategy and Leadership Magazine*, May/June: 34-36.
- McLaren, J. 1999. 'A strategic perspective on economic value added', *Management Accounting (UK)*, 77(4): 30-32.
- Mullane, C. 1995. EVA the new standard in performance measurement?, MBA research report, University of the Witwatersrand, Johannesburg.
- Myers, R. 1996. 'Metric wars', *CFO*, October: 44.
- Parry, C. 1998. Company report, Sasol: Balance and opportunity, HSBC Simpson McKie, South Africa, October.
- Stern J. & Hahn T. 1994. 'True worth - MVA and EVA prove that qualitative measures of business performance can be measured', *Finance Week*, 24-30 March.
- Stewart, G.B. 1991. *The Quest for Value*. [S.I]: HarperCollins.
- Thompson, A. 1998. 'Identifiseer aandele met EVA', *Finansies en Tegniek*, 50(1): 39-40.
- Topkis, M. 1996. 'A new way to find bargains (earnings value added ratings of stocks)', *Fortune*, 134(11): 265-266.
- Zimmerman, J.L. 1997. 'EVA and divisional performance measurement: Capturing synergies and other issues', *Journal of Applied Corporate Finance*, 10(2): 98-109.)

New service development: A literature survey

D.N.E. Smit* & P.J. du Plessis†

The multifaceted, complex process of new product development could be regarded as the single most important factor driving firm success or failure in the maturing telecommunications industry. The speedy introduction of innovative new services with a customer quality orientation is needed to excel in this extremely competitive environment. Approaches proposed to a service marketing strategy include the exploitation of similarities with product development, relating, or even transforming, the service to a product or something tangible, management of temporary supply/demand imbalances and service flowcharting/blueprinting. Sensitivity towards ethical issues is important to avoid a negative reputation and to get a name for being honest, fair and accepting of responsibility for the consequences of the service developed. Globalisation, deregulation (which causes increased competition) and the shifting of patent law in favour of the inventor drive the increased importance of intellectual property protection, to prevent competitors stealing inventions and new service concepts. To qualify for patent protection, a concept must be new, useful and not obvious to someone with knowledge in the field. In the case of new service development, one cannot apply all the principles and practices to protect intellectual property. However, it is surmised that an organisation can maintain a competitive advantage with new services by encapsulating and integrating such services in internal expert systems, software and firewalls to entry. Internal safeguards and the confidentiality of systems are obvious policies. Potential research topics are offered.

Introduction

Brown & Eisenhardt (1995) mention that the literature on product development continues to grow. This research is varied and vibrant, yet large and fragmented. The burgeoning product development literature is categorised into three streams of research, namely, product development as rational plan, as communication web and as disciplined problem solving. It is derived from this citation that there are still many new research opportunities in the study field of product development. Referring to the fragmented character of the literature in this field, it is concluded that the integration of knowledge in the field could contribute to a better understanding of interrelating aspects and provide a useful approach to a successful product development strategy.

Lovelock (1996) comments that the study field of services management evolved much later than that of management in manufacturing organisations. Fisk, Brown & Bitner (1993) record the most-researched areas in services marketing as service quality, service encounters/experiences, service design, relationship marketing, customer retention and internal marketing. However, most contributions in service design were in service blueprinting/mapping. Compared to the engineering and production emphasis associated with the development and manufacturing of tangible products, research on the parallel activities for services was, according to the authors, meagre.

From the citations above on services marketing it is concluded that the study field of service development is young in

comparison with that of product development and only selectively researched. This opens the avenue for further value-adding studies to improve the understanding of aspects interrelating with new service development and provide a useful approach to a successful new service development strategy.

Objective

The objective of this article is to explore mainly marketing literature to identify commonalities between different authors on the subject area. Special attention is given to critical success factors and aspects proposed as an approach for a service development strategy.

This literature study represents an attempt to integrate aspects relating to new service development in order to provide a useful approach on which strategies for successful new service development can be based. The telecommunications industry is used as an example because of the innovative strategies it uses in developing new services, especially in mobile telecommunications.

New service development

Service versus product development

Differences between product and service development are identified by Storey & Easingwood (1998), who argue that, unlike companies that produce tangible goods, service firms typically cannot rely on product advantage as a means of

*D.N.E. Smith is Senior Process Engineer with Sasol Technology.

†P.J. du Plessis is a Professor in the Department of Marketing and Communication Management at the University of Pretoria.

ensuring the success of a new service. The fundamental difference between new products and new services implies that managers that strive to find the keys to the success of new services must look at factors other than sustainable product advantage. It is suggested that managers need to understand the totality of the service offering from the customer's perspective. It is explained that the purchase of a service is influenced not only by the service itself, but also by such factors as the service firm's reputation and the quality of the customer's interaction with the firm's systems and staff – in other words, by the augmented service offering.

Bitran & Pedrosa (1998) identify similarities in the creation and evolution of products and services in a literature review on product development from a services perspective. Three types of knowledge that are commonly required in the development process are discussed:

1. The sequence of steps or procedural plan that must be followed
2. The understanding of the components that integrate the design and how they interact
3. The principles and models that describe physical or human behaviour in the system that is being designed.

Butler & Abernethy (1994) suggest that there is "purchase specific" information which consumers prefer for services and goods respectively. However, there is little difference in the general categories of information consumers seek in advertisements. The general categories of value, availability and contact personnel are important in advertisements for both services and goods.

Palmer (1998) postulates that the intangible nature of services makes it relatively easy to introduce slight variants to an existing service.

Kasper, Van Helsing & De Vries (1999) contend that new services can be market-driven or technology-driven (market pull versus technology push). Market-driven innovations may result from better serving the needs of customers (for example, Businessman's McDonalds in the USA) or more technology in the service delivery process (for example, computer help desk by telephone).

Peters (1999) identifies quality and the diversity that it brings as critical to service innovation and improvement, and suggests that dynamic questioning (that provokes change) should lead the organisation to answering to the needs of the customer, but also enabling them to see the future.

Critical success factors and checklists

Each year, entrepreneurs introduce thousands of new products and services to the public. Only a small percentage of new ideas and inventions survive beyond the first year. Critical success factors and checklists for successful introduction of products and services in the market have been discussed in several papers.

In her article on the role of new product development and competitive performance in the marketplace, Foreman (1998) identifies two fundamental strategies, which are considered as the foundations of marketing to deliver value to customers, namely, a commitment to customer orientation and innovation. Foreman further suggests that managers need to balance enthusiasm for innovation with thorough processes in order to reduce the potential for product failure. Indeed, it is suggest-

ed that organisations should look beyond the tactical focus on the product and emphasise the strategic and organisational issues that help to create a culture for innovation. After the launch comes the transition from existing to new products, with renewed marketing emphasis on the future of the new product.

Schilling & Hill (1998) maintain that, for many industries, new product development is now the single most important factor driving an organisation's success or failure. The emphasis on new products has spurred researchers from fields such as strategic management, engineering, marketing and other disciplines to study the new product development process. Most conclude that in order to be successful at new product development, a firm must simultaneously meet two critical objectives: maximising the fit with customer needs and minimising time to market. According to Schilling & Hill, successful firms are those that articulate their strategic intent and map their R&D portfolio to find a fit between their new product development goals and their current resources and competencies. Other imperatives include using a parallel development process, both to reduce cycle time and better incorporate customer and supplier requirements in the product and process design, and to use executive champions to ensure that projects gain the resources and organisational commitment necessary to their completion.

Service organisations cannot continue to rely on their existing product mix for ongoing success. With increasing globalisation and increased competition, organisations will increasingly find it difficult to survive just on their past successes, but will need to continually innovate and strive for the creation of new ideas and new services (Kelly & Storey 2000).

Terrill (1992) emphasises that service companies need to cultivate and utilise appropriate principles of leadership, communication and feedback in order to develop successful new offerings. He suggests ten basic commandments that can truly drive the new service development process towards successful results:

1. Thou shalt know and define thy service offerings.
2. Thou shalt worship only new service strategies tied to business strategies.
3. Thou shalt love thy formal, yet flexible, development process.
4. Thou shalt covet thy multifunctional team members.
5. Thou shalt commit thy new ideas to tangible communication vehicles.
6. Thou shalt not allow competitors to easily steal thy new service concepts.
7. Thou shalt honour the role and sanctity of market feedback.
8. Thou shalt not bear false quality at time of launch.
9. Thou shalt measure quality through customer satisfaction.
10. Thou shalt witness the coming of a new service paradigm and it shall be called value delivery.

According to Bell (1992), the essence of service distinction is a human feeling. When the delivery of a service is over, the receiver is left, not with an object, but with a memory of dazzlement, pleasure, satisfaction, disappointment or victimisation. The initial step in creating a new or improved way to deliver service is to clearly identify the feelings that the customer is to experience when doing business with an organisation. The actions required to evoke a given set of feelings in

one customer may be slightly different from those required for another. The following questions were proposed to provide insights into how to create new ways to get service to customers:

- What emotions and feelings are likely to entice the customer back?
- What other service provider has produced those emotions and feelings?
- What is a specific customer service need that requires a service delivery system that can be improved or invented?
- How would the designer of the great service memory model design such a service delivery system?

The flowchart in Figure 1 shows the planning, creation and delivery of new services.

A checklist for product development published by B&G Marketing Services Inc. (*American Salesman* 1993) includes:

- Define the ultimate geographic market for the product
- Identify the product's strengths, weaknesses, costs and quality issues
- Analyse and learn from the successes and failures of other product introductions
- Check which market segment is available for the product or service
- Examine the opportunity to achieve quality through less expensive production processes
- Develop a monthly operating budget for the first year and provide three years' worth of projected quarterly balance sheets and profit or loss statements
- Consider various advertising options.

Lester (1998) identifies 16 critical factors in the following five areas on which the success of new product development effort hinges:

1. Senior management commitment, which is a key prerequisite for success
2. Organisational structure and processes that support the venture
3. Attractive new product concepts being available for development
4. Venture teams with appropriate staffing and resources, able to communicate effectively with management and markets
5. Project management able to focus on reducing uncertainties as early as possible.

Lester maintains that attention to these factors during the early stages of new product development allows managers to save significant time and money while reducing delays and risks.

According to Khazanet (1997), product development planning is often based on managerial intuition and experience and that all too often, time saving and cost-effective solutions – such as finding and hiring alternative designers, sub-designers, researchers and suppliers from other countries, and leasing other facilities equipped with state-of-the-art equipment – are simply overlooked. The author comments that planning and balancing of product development phases are becoming more valuable as developers try to keep up with new technology, stay ahead of the competition, retain customers and

attract new customers. The main steps in product development include:

- Preparing feasibility analyses
- Preparing detailed drawings, plans, specifications and cost estimates
- Approving the product
- Advertising the product
- Requesting bids
- Awarding prime manufacturing contracts
- Manufacturing the product
- Implementing quality control measures.

Cooper & Kleinschmidt (1995) refer to the management of new product development as a process of separating the winners from the losers. They suggest that benchmarking is helpful for identifying the critical success factors that set the most successful firms apart from their competitors. They propose that the following elements influence a company's overall new product performance:

- The new product development process and the specific activities within that process
- The organisation of the new product development programme
- The firm's new product development strategy
- The firm's culture and climate for innovation
- Senior management commitment to new product development.

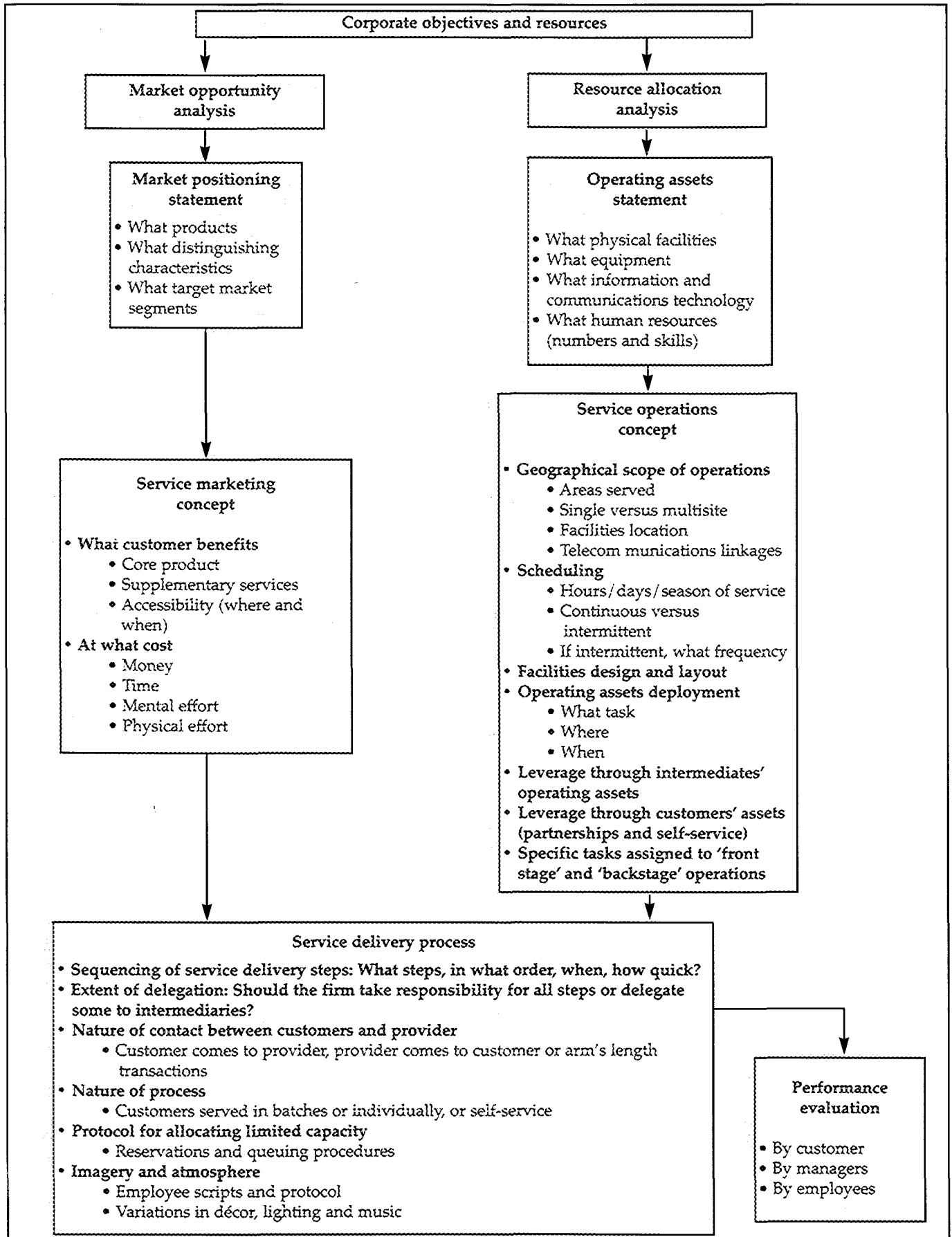
They identify nine constructs that drive performance:

1. A high quality new product process
2. A clear, well-communicated new product strategy
3. Adequate resources for new products
4. Senior management commitment to new products
5. An entrepreneurial climate for product innovation
6. Senior management accountability
7. Strategic focus and synergy
8. High-quality development teams
9. Cross-functional teams.

Cooper (1994) identifies key success factors that distinguish successful projects from commercial failures: product superiority, quality of marketing, detailed up-front homework, picking attractive markets, right product definition, proper planning and resourcing of the launch and the better performance of synergistic products. Although the study focuses specifically on the chemical industry, the results appear to be generally applicable to moderate to high-tech industries.

Dimanescu & Dwenger (1996) refer to product development as a minefield in which there are five times as many failures as successes. They suggest six widely shared problems that can inhibit the success of even the best product-development teams: customer needs not well defined or understood, errors found too late, management by interference, too many projects, burnout and poor communications.

Jenkins, Forbes, Duranni & Bannerjee (1997) indicate that a company's chance of success in launching new products is



Source: Lovelock (1996)

Figure 1. The planning, creation and delivery of new services

dependent upon the management of the new product development process. Methodologies for new product development are investigated, including phased development, stage/gate models, product and cycle-time excellence, and total design.

Customer orientation and service quality

Foreman (1998) regards customer orientation as one of two key fundamentals to deliver value to customers and as a key success factor to new service development. Schilling & Hill (1998) also regard maximising the fit with customer needs as one of the two critical objectives that must be met in product development. Cermak, File & Prince (1994) argue that customer participation in the specification and delivery of the services they seek represents an important point of potential leverage for service providers, as the nature and intensity of customer participation is within their ability to manage. Their study results confirm that participation is strongly associated with repurchase and referrals in some service settings. Martin & Horne (1995) find significant differences in the innovation level of success within the same firm. Inputs from customer contact personnel are considered as superior to those of non-contact personnel.

Quality issues feature twice in the ten commandments for service development by Terrill (1992) and can indeed be regarded as crucial to the process. Quality can also be considered as the most common denominator in the checklists on product development success factors.

Empirical studies in Sweden by Edvardsson & Olsson (1996) suggest that the goal is to build in the right quality from the start. It is argued that the main task of service development is to create the right generic prerequisites for the service. This means an efficient customer process, which must be adapted to the logic of the customer's behaviour and a good customer outcome (in other words, the service is associated with quality). In a later paper, Edvardsson (1997) again focuses on designed-in quality. The outcome of the service development process constitutes the prerequisites for the service by the service concept, the service process and the service system and resource structure. The service is produced in a customer process in which customer, company and subcontractors are actors. The quality of the process is controlled by the prerequisites each actor takes into the customer process. Service development must coordinate the development of concept, process and system where each aspect requires special treatment.

Edgett (1994) reports that the development activities are more rigorous and comprehensive for successful new services than for failures. Many companies attempt to develop too many projects simultaneously and spread their resources too thinly. The alternative is to develop and launch fewer, better-developed new services with sufficient resources allocated to execute the project effectively. Organisations that use a systematic process of well-defined development stages tend to have a higher probability of successful outcomes. Gaining a firm understanding of the needs and wants of the targeted consumer group is also well accepted as critical to success.

Service innovation, creation and improvisation

As mentioned before, innovation is regarded as fundamental to delivering value to customers and a key success factor to new service development (Foreman 1998). According to Lynn, Morone & Paulson (1996), companies that compete effectively

over the long run in technology-intensive fields exhibit ability for both continuous and discontinuous innovations. Discontinuous innovations, which lead to the creation of entirely new businesses and product lines, pose a unique set of challenges for management. They typically require a long, investment-intensive process, marked by pervasive uncertainty, unpleasant surprises and no guarantee of success.

Lovelock (1996) adapts the following categories of product innovation, running from major innovations to simple style changes, for use in the service context:

- Major innovations are new products for markets as yet undefined and undimensioned, for example, FedEx's introduction of nation-wide, overnight package delivery.
- Start-up businesses consist of new products for a market already served by products that meet the same generic need, for example, outpatient surgical centres for same-day surgery as an alternative to overnight hospitalisation.
- New products for the currently served market represent an attempt to offer existing customers a product that the firm did not previously offer, although it was available elsewhere, for example, retail banks that add insurance services.
- Product line extensions are additions to the current product line or distinctive new ways of delivering existing products, for example, new menu items in a restaurant.
- Product improvements are the commonest type of innovation, involving changes in the features of current products, for example, improvements to the core service, such as faster execution.
- Style changes represent the most modest type of innovation, although they are often highly visible, for example, repainting aircraft or new uniforms for personnel.

Moorman & Miner (1998) discuss the common assumption that marketing strategy should occur by first composing a plan on the basis of a careful review of environmental and organisational information and then executing that plan. However, there are cases when the composition and execution of an action converge in time so that they occur simultaneously. Moorman & Miner define such a convergence as improvisation. They develop hypotheses to investigate the conditions in which improvisation is likely to occur and be effective. These hypotheses are tested in a longitudinal study of new product development activities. Results show that: organisational improvisation occurs moderately in organisations, organisational memory level decreases, and environmental turbulence level increases the incidence of improvisation.

Wyner (1998) argues that the conventional wisdom about new product development suggests a well-defined process in which marketing research methods are applied in an orderly way at specific points in time. When the rules are followed, successful new products are supposed to emerge from the end of the process. He suggests an alternative view of this process as not very orderly or fast and notes that the use of traditional methodologies has not proven especially effective.

The view of Edvardsson, Haglund & Mattsson (1995) is that creativity and innovation cannot rely only on planning and control. They believe that there must be some elements of improvisation, anarchy and internal competition in the development of new services.

Research on how new ideas are generated, quoted by Kelly & Storey (2000) indicates that approximately 80% of banks view their competitors as the main source of new ideas.

Development speed

Minimising time to market is one of the two most critical product development objectives defined by Schilling & Hill (1998). In the race to get to market first, Towner (1994) suggests that old product development models must be discarded. Sequential development and hand-over-the-wall practices are too slow. Time must be cut out of the process. An accelerated product development programme must be established to streamline and undertake activities in parallel, to launch the product simultaneously in world markets, and to release enhanced supporting services and business processes after launch.

Adler, Mandelbaum, Nguyen & Schwerer (1996) suggest that managers think of product development as a production process in which projects move through the knowledge-work equivalent of a job shop. According to the authors, companies that have applied process management to product development have made three important discoveries:

1. Projects get done faster if the organisation takes on fewer at a time.
2. Investments to relieve bottlenecks yield large time-to-market benefits.
3. Standardisation does not kill creativity. The authors maintain that companies that have embraced this approach have cut average development times by between 30% and 50%.

Roche (1999) reports that sequential engineering for product development has been largely replaced by concurrent engineering, in which teams of engineers work simultaneously to design the various components of a product. With concurrent engineering, companies can get products to market much faster than they could before. However, the disadvantage of concurrent engineering is that it introduces considerable uncertainty into the development process. In observing concurrent engineering, researchers found that engineers intuitively use two different strategies for communicating information, namely, an iterative strategy and a set-based strategy.

Service analysis

Service analysis is regarded as crucial to successful new service development, as illustrated by the first commandment of Terrill (1992): "Thou shalt know and define thy service offerings".

While innovation is considered as risky and complex, involving major resource investments and a high rate of failure, studies by De Brentani (1995) show that managers reduce the complexity surrounding individual decisions by viewing these in a gestalt or situation-specific mode. Hence, knowing the types of new service development situations, or scenarios that typically lead to success and failure, is an important requisite for making superior decisions.

A study by Langford & Cosenza (1998) shows that a service product can be analysed using knowledge of the product and application marketing literature to determine which of a service product's marketing characteristics are more like a good than a service. It is suggested that such determination allows researchers and strategists to more effectively use secondary research on both goods and services in developing projects and tasks, even for service products that are considered pure services.

Lovelock (1996) proposes a step-by-step flowcharting (also called mapping or blueprinting) of the constituent service processes. This could ensure that the service provider understands the full extent of the relationships with the customers and prevent customers from getting 'lost' and feeling that nobody knows who they are and what they need. The following key steps are proposed:

- Define the purpose of the flowchart clearly, especially the expected learning points.
- Identify each interaction that a particular type of customer has when using a specific service. The core product must be distinguished from the supplementary service elements.
- Chart the interactions in sequence to flow like a river. At each step, the following questions should be asked: (a) What does the customer really want? (b) Where is the potential failure at this step?
- For every front-stage activity, chart back-stage supporting activities.
- Validate the description with inputs from customers and service personnel.
- Supplement the flowchart with a brief narrative describing the activities and their interrelationships.

Service marketing strategies and tactics

Because services cannot be stored, temporary imbalances between supply and demand present a difficult challenge for managers of service firms. Shemwell & Cronin (1994) discuss two categories of strategies: foreseeing the unforeseen by improving market intelligence, and lessening the intensity of the negative consequences of supply/demand non-equilibriums by increasing flexibility and sharing risks.

Reddy, Buskirk & Kaicker (1993) suggest that a key to success in services marketing is to 'tangibilise' the intangible. Each firm differs from others in the manner it chooses to 'tangibilise' its service mix. Some firms try to portray a physical object. Despite the method selected, consistency in maintaining quality is very important. Once 'tangibilised', that image must be consistently maintained.

To successfully sell a service, Baker (1996) suggests that the service should be 'productised' rather than defined. The idea behind 'productising' a service is to actually make a service into a tangible product. For a large portion of services, the deliverable is a report. After the specifications are developed for a service, all efforts should be put into creating a professionally designed report template, coloured whenever possible, graphically representing the data in charts and tables.

Kotler (2000) reports that value for a customer is about the resulting experience customers will have from the provider's offering.

According to Lovelock (1996), technology allows the benefits that formerly had to be delivered by service staff in a real-time environment to be captured in a physical product. Services that are transformed into goods, allowing customers to unlock the value through self-service, are referred to as 'frozen services', for example, videotapes of live performances.

According to Karlgaard (1998), a sure sign that a technology company is mature is when service income grows faster than product income. The author maintains that this would be the wrong time to pursue service-income growth.

By focusing on the benefits to the consumer, Duncan (1992) maintains that a new product or service becomes market-driven rather than entrepreneur-driven. Once the businessperson has an understanding of the need that is being addressed by the product or service, he or she can define a target market group. The businessperson should determine what target group would most value the benefits of the product in economic terms and be able to give a detailed profile of this group, including age, abode, gender and economic status. Market research may be either primary or secondary.

Ethical issues

Perreault & McCarthy (1996) report that members of the American Marketing Association (AMA) subscribe to a code of ethics containing the following elements to uphold and advance the integrity, honour and dignity of the marketing profession:

- To accept responsibility for the consequences of their activities, not knowingly to do harm and to adhere to all applicable laws and regulations
- To give accurate representation of their education, training and experience
- To be honest in serving consumers, clients, employees, suppliers, distributors and the public and not knowingly participate in conflict of interest without prior notice to all parties involved
- To be fair by establishing equitable fee schedules, including the payment or receipt of usual, customary and/or legal compensation for marketing exchanges.

In the area of product development, the following topics are embraced in the AMA code of ethics:

- Disclosure of all substantial risks associated with product or service usage
- Identification of any product component substitution that might materially change the product or impact on the buyer's purchase decision
- Identification of extra-cost added features.

Perreault & McCarthy (1996) further report on the following ethical issues revolving around new product decisions or decisions to abandon old products. Being insensitive to these factors might lead to a negative backlash that affects the firm's strategy or reputation:

- Holding back important new innovations until patents run out – or sales slow down – on existing products
- 'Planned obsolescence' – releasing of products that the company plans to replace soon with improved new versions
- Keeping new-product introduction plans secret, leaving wholesalers and middlemen with dated inventory that they can sell only at a loss
- Leaving consumers unable to get replacement parts for abandoned products
- Constantly releasing minor variations of products in already saturated markets, which could be perceived as a ploy for more shelf space
- Making it impossible for some consumers to make an informed choice among the bewildering array of product choices.

Telecommunications industry

The telecommunications industry is used as an example because of the innovative strategies used in developing new services – especially in mobile telecommunications. A similar structure is used to the previous section.

Customer orientation and quality

Oringer (1993) states that the successes of the cellular industry have been impressive, but that users are demanding more, including business system-type services, timely and accurate billing and lower costs. The cellular wireless communications industry is ready to make the transition from simply getting networks up and running to managing operations that are more responsive, competitive and profitable.

According to Lannon (1995), it is absolutely essential for cellular service providers to start learning about customer care. Cellular customers do not change carriers arbitrarily. Soon the day will come when all network services will have to know as much about consumer preferences as retailers or entertainment companies do today.

O Shea (1997) suggests that wireless network operators, for all their work, are not yet masters of their domains. They must still work to extend coverage where it does not yet exist. They also have to make sure that enhanced services are consistently available and well supported by customer service provision.

According to Drummond (1998), the world of the telecommunications industry is changing from one in which its services and network capabilities took centre-stage to one in which the full focus of attention is on customers and their needs and wishes. The hub of this new world is no longer the network, but rather the customer interface. In this new customer-centric telecommunications world, pricing and packaging of services is just as important as their technical capabilities. Customers want prices that are aligned with the benefits they get from a product or service.

Potter (1999) contends that the frenetic pace of cellular growth today exacts its toll on all levels of the network. For cellular operators, the most pressing issue is optimising the network to deliver both performance and quality of service that will ensure customer satisfaction and prevent their turning to a competitor's network. Industry predictions forecast more than 530 million cellular network subscribers worldwide by the year 2001. There is no magic formula to ensure that a network design delivers optimised performance. The winners in the competitive mobile telecommunications industry will, first and foremost, be operators that can ensure the kind of quality and network performance that customers appreciate and demand.

Ogawa & Ketner (1997) report on the 1996 World-wide Telecommunications Product Development Benchmarking Study, launched by Pittiglio, Rabin, Todd & McGrath, who investigated three key areas of product development excellence: time-based performance, development effectiveness and cross-project management. The results show that service providers that achieve best-in-class performance can gain a significant competitive edge in a number of areas, such as delivering products to market more swiftly, generating greater revenue from new products, and minimising lost product development costs. An important factor in achieving a competitive edge is the efficient use of funds to develop new prod-

ucts. Each company must decide the areas in which it wants to be above average and the areas in which being merely competitive is sufficient.

In South Africa, the mobile telecommunications industry has, since its inception six years ago, primarily focused its strategies on customer acquisition in order to grow its customer base. However, as the South African customer becomes increasingly demanding, the industry will have to shift its strategic focus to encompass a retention strategy, particularly for its most valuable and profitable customers, in order to prevent them from turning to the competition (Slongo 1999).

Bolton (1998) models the duration of the customer relationship with an organisation that delivers a continuously provided service such as telecommunications. In the model, it is hypothesised that cumulative satisfaction serves as an anchor that is updated with new information obtained during service experiences. The model describes cellular customers' perceptions and behaviour over a 22-month period.

The results indicate that customers' satisfaction ratings elicited prior to any decision to cancel or stay loyal to the provider are positively related to the duration of the relationship. The strength of the relationship between duration times and satisfaction levels depends on the length of the customer's experience with the organisation. Customers with many months' experience with the organisation weigh prior cumulative satisfaction more heavily and new information relatively less heavily. The duration of the relationship between the service provider and customer also depends on whether customers have experienced service transactions or failures. The effects of perceived losses arising from transactions or service failures on duration times are directly weighed by prior satisfaction, creating contrast and assimilation effects.

It is a misconception that organisations that focus on customer satisfaction are failing to manage customer retention. Bolton (1998) suggests that service organisations should be proactive and learn from customers before they defect by understanding their current satisfaction levels.

In the South African situation, one can surmise that the introduction of new service packages, especially in the cellular telecommunications industry, has been part of a strategy to attract new segments of the market as well as to provide a broader product range to existing customers.

Market segmentation

According to Brown (1993), the mobile telephone industry is in transition in the United Kingdom. The big question is whether the transition is evolutionary or revolutionary. Vodafone, the largest cellular radio operator, believes in evolution, while Cellnet and newcomer Mercury One-2-One are revolutionaries. Vodafone believes that the lion's share of demand for some years ahead will continue to come from business. In contrast, Cellnet believes there is a pent-up demand in the domestic sector, waiting to be released by lower prices. Cellnet, along with Mercury One-2-One and Hutchison, are convinced that a breakthrough into the mass market is not only possible but imminent. Stafford Taylor, managing director of Cellnet, predicts that demand for the mobile phone will follow the pattern set by video recorders. Richard Goswell, managing director of Mercury One-2-One, thinks that the fall in fixed costs may come sooner than anyone had previously thought possible.

Cairncross (1997) maintains that the mobile telephone has been the mainstay of the telecommunications revolution over the past five years. A decade ago, the market hardly existed. Now, more than half of all new telephones worldwide are mobile. The growth in some developing countries has been even more remarkable. For telephone companies, the shift to mobility has changed the composition of their revenues. They make money in two ways: through their own mobile subsidiaries and by charging for access to their networks. The mobile segment is the fastest growing one in the telecommunications industry. One market that has done less well than expected is the USA. Overall, competitive pressures will cause a number of changes in the industry.

According to Marbach (1998), a global technology transformation is being driven by the interaction of two forces, namely, improvements in computing power, and the expansion of global communications networks. In the software markets, some of the most important trends involve communications and the growth of the small office and home office market. Use of the Internet for commerce, financial transactions, news and information is still in the earliest stages, but it is already clear that having a first-rate site is a key asset in the newly developing digital economy.

The South African situation in the cellular telephone market is characterised by fierce competition over entry into new segments of the market that are not currently serviced by fixed line products. Products such as Vodago and Companion entered a segment where it was not required to have up-front proof of financial credibility.

Competition

Fisher (1992) maintains that, once the industry gains momentum, wireless voice, data and imaging services such as pocket telephones, portable telefax machines and hand-held computers or personal organisers will start to compete with, as well as complement, existing wire-based and cellular telephone services.

Oskarsson & Sjoberg (1994) examine the validity of the strategic implications drawn from the typology of generic strategies presented by Michael Porter. It is argued that the existence of technologies that simultaneously drive cost and performance make it possible to combine cost leadership and differentiation strategies, yet be extremely competitive. The mobile telephone industry provides an illustration, exhibiting a 'luck in the middle' strategy, rather than a 'stuck in the middle' strategy.

Bridge (1998) refers to the South African cellular network as a white-owned duopoly, which has been smashed by a government decision to open the \$2.1-billion-a-year industry to competition by awarding more licenses, most likely to black-controlled groups. While most accept that the awarding of the licenses must be distorted deliberately to achieve social and political goals, there are still deep-seated concerns over unfair advantages that the new operators could enjoy.

The South African cellular telecommunications industry has for the past six years been heavily focused on acquisition as the incumbent networks are strategising for position, and this is still the case. However, this is changing as customers are become more informed and more demanding. In addition, a third network operator will be entering the industry this year, which means increasing competition and in turn results in increased choice for customers. The fixed-line operator will also

face competition in the medium term when the current licence of operation changes and new competitors enter the market.

International services marketing

Exported services are, according to Fugate & Zimmerman (1996), the fastest growing sector of global exchanges, not only for the industrialised leaders but for many newly industrialising countries and lesser developed countries as well. Ironically, regulation of this important international trade sector has been a virtually ad hoc effort as nations have negotiated, measured and controlled the international economic arena almost exclusively in terms of manufactured goods.

Interest in services marketing continues to grow around the world, but Hayes (1994) comments that the relative rate of growth is higher outside the USA as other industrial or industrialising countries move to catch up. Where consumer services are concerned, culture may shape not only the expectations of how service should be delivered, but also traditions governing relationships between providers and customers.

Protecting intellectual property

The protection of intellectual property is a burning issue during the development of a new service, as illustrated in the sixth of Terrill's (1992) ten commandments for new service development: "Thou shalt not allow competitors to easily steal thy new service concepts."

Requirements for patent protection

McKeefry (1998) suggests that there are two requirements for protecting a patent: the invention must be new and the invention must be useful. There is no requirement that the idea be economically or commercially viable. Although major corporations such as Microsoft Corporation and Intel Corporation account for the lion's share of patents granted each year, the United States Patent Office helps and encourages individuals to protect their work. Small entities – which include individuals, small companies, non-profit organisations and universities – are charged only half the usual patent filing fee. Before filing a patent, individuals should decide whether a patent is really needed, since a patented invention may never generate enough income to pay for the patent process itself, much less garner huge revenue streams. Sometimes the technology will be obsolete before the patent process is complete. In these instances, inventors have other invention-guarding options, such as keeping it a trade secret or obtaining a trademark or copyright. Inventors may have to patent their ideas in several countries to ensure that no-one will be able to use their technology.

Udpike (1998) reports on a recent court appeal in the USA in which it was held that a business method that uses a mathematical formula could be patented as long as it meets the three traditional criteria for legal protection:

1. That it is new
2. That it is useful
3. That it is not obvious to someone with knowledge in the field.

The court noted that Congress intended the Patent Act to extend to anything under the sun that is made by man. The ruling has generated a whirlwind of controversy. Critics fear that the decision will give some patent holders huge windfall profits, while at the same time slowing the spread of valuable commercial innovations.

To patent or not?

Mazzoleni & Nelson (1998) propose that there are several broad theories about the principal purposes patents serve:

- The anticipation of patents provides motivation for useful invention (termed the "invention motivation" theory).
- Patents induce inventors to disclose their inventions when otherwise they would rely on secrecy, and in this and other ways facilitate wide knowledge about and use of inventions (termed the "invention dissemination" theory).
- Patents enable the orderly exploration of broad prospects (termed the "exploration control" theory).

Millonzi & Passannante (1996) suggest that there are several things a company can do to protect its intellectual property. Some methods require legal support; others can be handled by strong company policies. Registering trademarks, trade dress and copyrights with the Patent and Trademark Office or US Copyright Office provides valuable protection, such as the right to sue in the federal court and a number of other remedies, including statutory damages, attorney fees and constructive notice of ownership. In addition, US protection provides a basis for foreign registrations. Other methods for protecting intellectual property include implementing a controlled process for reviewing the proposed (and unauthorised) use of one's marks by others.

According to Brown (1998), entrepreneurs can increase their chances of successfully commercialising their inventions by arming themselves with knowledge by following the following procedures:

- Safeguarding the invention from the start
- Protecting oneself with a nondisclosure agreement as well as a patent
- Considering allowing the company to oversee the patent process
- Considering licensing the invention rather than assigning (selling) it.

Retsky (1997) postulates that many people do not understand the difference between trademarks, patents and copyrights. The three terms are often used incorrectly or even interchangeably. The most important distinction among patents, trademarks and copyrights is the basis for and the scope of the protection. Another difference is the length of time that legal protection lasts.

Mann & Canary (1993) propose that three kinds of patents exist: utility, design and plant. To determine if an idea should be patented, they suggest that the owner should consult a patent attorney.

Horwitz (1993) recommends that a company register its intellectual property trademark or patent in three types of jurisdictions: significant markets, manufacturing locations and counterfeiting locations. A trademark owner must be vigilant in identifying others that have registered or are using similar marks. Patent enforcement need not be as vigilant.

The simple truth of innovation, according to Hsu (1998), is that any effort to make an invention can almost always be done more cheaply and more easily by someone else. As a result, a scheme of unrestricted copying would lead to a situation in which inventors could not recover the cost of their invention and the financial incentive to invest in any research would cease. However, the importance of having a strong

patent system goes beyond encouraging and protecting innovation; it is directly related to the standard of living.

Today's conventional wisdom, according to Mazzoleni & Nelson (1998) is that strong patent rights are conducive to economic progress. Yet not long ago, students of the patent system took a more nuanced position, arguing that often, strong patents are not necessary to induce invention, and entail significant economic costs. Several empirical studies have supported this position. There is reason for concern that the present movement towards stronger patent protection may hinder rather than stimulate technological and economic progress.

Trends in intellectual property

According to Edson (1997), several developments in today's fast-moving technological world have defined new roles for patents. Firstly, globalisation, the shaper of the American economy during the 1980s, has made patents more valuable on an international basis as companies scramble for market presence in scores of developed and developing countries. Secondly, the booming expansion in deregulation in South Africa has lifted competition to a way of life virtually everywhere, automatically giving an edge to a company that can milk the largesse of its patents at every stage in their life, from birth to expiration. Thirdly, patent law has shifted in favour of the inventor.

Protection of intellectual property is crucial to prevent competitors from stealing inventions and new service concepts.

Conclusion

The literature survey indicates that new services cannot depend for their success on sustainable advantage. The totality of the service offering (the augmented service offering including, for example, interaction with the firm's systems and staff) must be understood from the customer's perspective.

The types of knowledge that are commonly required in the development of a service are similar to those needed for product development. General categories of value, availability and contact personnel are important in both services and goods advertisements.

Critical success factors for product development are a commitment to customer orientation (maximising the fit with customer needs); innovation and minimising time to the market.

The literature review reveals only a few common denominators between new product and new service development, namely: quality issues, feasibility analyses, senior management commitment, planning issues, market segmenting and high quality venture teams.

It is concluded that:

- Customer orientation is a fundamental key success factor in service development.
- Customer participation in the specification of services provides potential leverage for a service provider.
- Participation can be strongly associated with repurchase and referrals in service settings.
- Customer contact during the service development process can enhance the innovation level.
- Service quality is to adapt the process to the logic of the customer's behaviour and to achieve a satisfied customer experience.
- Designed-in quality right from the start is crucial to the success of service development.

- Fewer, well-developed services can be far more successful than many less fully developed services.

Innovation is a fundamental key success factor in service development. Six categories have been defined for product innovation in the service context:

1. Major innovations
2. Start-up businesses
3. New products
4. Product line extensions
5. Product improvements (the commonest type of innovation)
6. Style changes.

From the citations on innovation, it can be concluded that chaos theory could provide a better understanding of innovation in service development because the process is marked by pervasive uncertainty, the increasing incidence of improvisation caused by the level of environmental turbulence, the fact that the process is not very orderly, and the presence of elements of anarchy.

Subscription to a code of ethics for the marketing profession is important to uphold and advance the integrity, honour and dignity of the profession and to gain a name for being honest, fair and accepting of responsibility for the consequences of the service developed. During the new product planning phase, sensitivity towards ethical issues is important so as not to gain a reputation for holding back important new innovations.

In the case of new service development, it is not possible to apply all the principles and practices to protect intellectual property, but it is surmised that the organisation can maintain a competitive advantage with new services by encapsulating and integrating them in internal expert systems, software and firewalls to entry. Internal safeguarding and confidentiality of systems are obvious policies.

Future research

Future research is necessary to explore the following:

- The methods that service organisations use to protect intellectual property
- The effectiveness of such measures
- Whether the process for the development of tangible new products development differs from the development process for new services
- Whether there are differences between service industries regarding new service development
- How multifunctional teams are used in new service development
- How research is used in identifying new customers needs in the service industry.

References

- Adler, P.S., Mandelbaum, A., Nguyen, V. & Schwerer, E. 1996. 'Getting the most out of your product development process', *Harvard Business Review*, 74(2): 134-152.
- American Salesman 1993. 'Checklist: This little product goes to market', 38(4): 20-21.
- Baker, J. 1996. 'Productizing a service: Make the service into a product', *Computer Reseller News*, 145-146.
- Bell, C.R. 1992. 'How to invent service', *Journal of Services Marketing*, 6: 37-39.

- Bitran, G. & Pedrosa, L. 1998. 'A structured product development perspective for service corporations', *European Management Journal*, 16(2): 169–189.
- Bolton, R.N. 1998. 'A dynamic model of the duration of the customer's relationship with a continuous service provider: The role of satisfaction', *Marketing Science*, 41.
- Bridge, S. 1998. 'SA mobile expansion to address imbalance', *Telecommunications [International Edition]*, 32(12): 26–28.
- Brown, M. 1993. 'Slow march of the mobiles', *Management Today*: 54–57.
- Brown, M. 1998. 'From inventor to entrepreneur', *Black Enterprise*, 28(7): 54–56.
- Brown, S.L. & Eisenhardt, K.M. 1995. 'Product development: Past research, present findings, and future directions', *Academy of Management Review*, 20(2): 343–378.
- Butler, D.D. & Abernethy, A.M. 1994. 'Information consumers seek from advertisements: Are there differences between services and goods?', *Journal of Professional Services Marketing*, 10(2): 75–92.
- Cairncross, F. 1997. 'Airborne', *Economist*, 344(8034): T16–T21.
- Cermak, D.S.P., File, K.M. & Prince, R.A. 1994. 'Customer participation in service specification and delivery', *Journal of Applied Business Research*, 10: 90–97.
- Cooper, R.G. 1994. 'Debunking the myths of new product development', *Research-Technology Management*, 37(4): 40–50.
- Cooper, R.G. & Kleinschmidt, E.J. 1995. 'Benchmarking the firm's critical success factors in new product development', *Journal of Product Innovation Management*, 12(5): 374–391.
- De Brentani, U. 1995. 'New industrial service development: Scenarios for success and failure', *Journal of Business Research*, 32(2): 93–103.
- Dimancescu, D. & Dwenger, K. 1996. 'Smoothing the product development path', *Management Review* 85(1): 36–41.
- Drummond, R. 1998. 'The customer care renaissance', *Telecommunications [International Edition]*, 32(11): 83–84.
- Duncan, I.D. 1992. 'Researching the market', *CMA Magazine*, 66(7): 39.
- Edgett, S. 1994. 'The traits of successful new service development', *Journal of Services Marketing*, 8(3): 40–49.
- Edson, L. 1997. 'Nothing lasts forever', *Across the Board*, 34(6): 22–27.
- Edvardsson, B. & Olsson, J. 1996. 'Key concepts for new service development', *Service Industries Journal*, 16(2): 140–164.
- Edvardsson, B., Haglund, L. & Mattsson, J. 1995. 'Analysis, planning, improvisation and control in the development of new services', *International Journal of Service Industry Management*, 6(2): 24–35.
- Evardsson, B. 1997. 'Quality in new service development: Key concepts and a frame of reference', *International Journal of Production Economics*, 52(1,2): 31–46.
- Fisher, C. 1992. 'What's next after cellular telephones', *Advertising Age*, 63(44): 12.
- Fisk, R.P., Brown, S.W. & Bitner, M.J. 1993. 'Tracking the evolution of the services marketing literature', *Journal of Retailing*, 69(1): 61–103.
- Foreman, S. 1998. 'Marketing: Product development performance and competition', *Manager Update*, 9(4): 12–22.
- Fugate, D.L. & Zimmerman, A. 1996. 'International services marketing: A review of structural barriers, regulatory limitations, and marketing responses', *Journal of Professional Services Marketing*, 13(2): 33–58.
- Hayes, T. 1994. 'Services go international', *Marketing News*, 28(6): 14–15.
- Horwitz, E. 1993. 'Intellectual property in a global marketplace', *Directors and Boards*, 17(2): 51–52.
- Hsu, R. 1998. 'Maintaining high living standards through innovation, strong patents', *Communications of the ACM*, 41(10): 27–28.
- Jenkins, S., Forbes, S., Durrani, T.S. & Banerjee, S.K. 1997. 'Managing the product development process (Part I: An assessment)', *International Journal of Technology Management*, 13(4): 359–378.
- Karlgard, R. 1999. 'The road to ruin – Services', *Forbes*, 162(8): 39.
- Kasper, H., Van Helsdingen, P. & De Vries, W. 1999. *Services Marketing Management*. New York: John Wiley & Sons.
- Khazanet, V.L. 1997. 'Improving the product development process', *Industrial Management*, 39(2): 16–18.
- Kelly, D. & Storey, C. 2000. 'New service development: Initiation strategies', *International Journal of Service Industry Management*, 11(1):45–62.
- Kotler, P. 2000. *Marketing Management* (millennium edition). New Jersey: Prentice Hall.
- Langford, B.E. & Cosenza, R.M. 'What is service/good analysis?', *Journal of Marketing Theory and Practice*, 6(1): 16–26.
- Lannon, L. 1995. 'Customer care', *Telephony*, 229(4): 64.
- Lester, D.H. 1998. 'Critical success factors for new product development', *Research-Technology Management*, 41(1): 36–43.
- Lovelock, C H. 1996. *Services Marketing*, [SI.]: Prentice Hall International Editions.
- Lynn, G.S., Morone, J.G. & Paulson, A.S. 1996. 'Marketing and discontinuous innovation: The probe and learn process', *California Management Review*, 38(3): 8–37.
- Mann, M.A. & Canary, P. 1993. 'Protecting innovation through patents', *Business and Economic Review*, 39(2): 25–27.
- Marbach, B. 1998. 'Going digital', *Fortune*, Technology Buyer's Guide Supplement: 18–24.
- Martin, C.R. Jr & Horne, D.A. 1995. 'Level of success inputs for service innovations in the same firm', *International Journal of Service Industry Management*, 6(4): 40–56.
- Mazzoleni, R. & Nelson, R. 1998. 'Economic theories about the benefits and costs of patents', *Journal of Economic Issues*, 32(4): 1031–1052.
- McKeefry, H.L. 1998. 'Protecting intellectual property', *Computer Reseller News*, 802: 84–86.
- Millonzi, K. & Passannante, W.G. 1996. 'Beware of the pirates: How to protect intellectual property', *Risk Management*, 43(8): 39–42.
- Moorman, C. & Miner, A. 1998. 'The convergence of planning and execution: Improvisation in new product development', *Journal of Marketing*, 62(3): 1–20.
- O Shea, D. 1997. 'Great expectations', *Telephony*, 233(1): 5.
- Ogawa, D. & Ketner, L. 1997. 'Benchmarking product development', *Telephony*, 232(4): 34–38.
- Oringer, H. 1993, 'The cellular industry comes of age', *Telephony*, 224(9): 26–32.
- Oskarsson, C. & Sjoberg, N. 1994. 'Technology analysis and competitive strategy: The case of mobile telephones', *Technology Analysis and Strategic Management*, 6(1): 3–19.
- Palmer, A. 1998. *Principles of Services Marketing* (2nd edition). New York: McGraw-Hill.
- Perreault, W.D. & McCarthy, E. J. 1996. *Basic Marketing*, A

- Global-Managerial Approach* (12th edition). Boston, MA: Irwin.
- Peters, V.J. 1999. 'Total service quality management', *Managing Service Quality*, 29(1):6-12.
- Potter, R. 1999. 'Squeezing the cellular network', *Telecommunications [Americas Edition]*, 33(2): 63-66.
- Reddy, A.C., Buskirk, B.D. & Kaicker, A. 1993. 'Tangibilizing the intangibles: Some strategies for services marketing', *Journal of Services*, 7(3): 13-17.
- Retsky, M.L. 1997. 'Making sense of intellectual property laws', *Marketing News*, 31(19): 25.
- Roche, E. 1999. 'Product development', *Harvard Business Review*, 77(1): 21-24.
- Schilling, M.A. & Hill, C.W.L. 1998. 'Managing the new product development process: Strategic imperatives', *Academy of Management Executive*, 12(3): 67-81.
- Shemwell, D.J. Jr & Cronin, J.J. 1994. 'Services marketing strategies for coping with demand/supply imbalances', *Journal of Services Marketing*, 8(4): 14-24.
- Slongo, C. N. 1999. Viability of a retention strategy in the mobile telecommunications industry in South Africa, Unpublished MBL working paper, Unisa Graduate School of Business Leadership.
- Storey, C. & Easingwood, C.J. 1998. 'The augmented service offering: A conceptualization and study of its impact on new service success', *Journal of Product Innovation Management*, 15(4): 335-351.
- Terrill, C.A. 1992. 'The ten commandments of new service development', *Management Review*, 81(2): 24-27.
- Towner, S.J. 1994. 'Four ways to accelerate new product development', *Long Range Planning*, 27(2): 57-65.
- Updike, E. 1998. 'What's next - A patent for the 401(k)?', *Business Week*, 104-111.
- Wyner, G. 1998. 'Rethinking product development', *Marketing Research: A Magazine of Management*, 10(4): 49-51.

Information technology – Future perfect?

René Pellissier*

This paper explores the Digital Economy of Toffler's so-called Third (Information Age) and Fourth Waves (Bio-Technological Wave).¹ It studies the evolution of information technology (IT) and explores its growth from back-room, cost-cutting and efficiency measure to its becoming a strategic imperative, especially through IT's reengineering of the ways of doing business. In this, it also becomes the most significant driver of radical change. IT's influence on and relevance to reengineering are discussed, especially in terms of the failures of reengineering to deliver. In this paper, the evolution of IT and its two dimensions are specifically addressed in this regard.

An information delivery matrix is developed, highlighting the evolutionary IT needs of business, from office automation to business intelligence and data mining. A value chain of data/information is proposed. The paper also addresses the differences between the demand (information systems or IS) and supply (information technology or IT) sides of information, the resultant leadership roles of each, as well as the difference between strategic and operational informational issues.

A collision of waves

In 1970, Toffler conceived the rate of change of society to be exponential. He argued that there is an inherent reproductive principle in technology in that it is possible for technology to create more technology. He continued beyond that notion and subsequently (1980) demonstrated that the economic world, as we know it, has evolved through waves, each with its own specialisations (see Table 1). The economic world has thus moved through the Agricultural Revolution, the Industrial Revolution and the Information Revolution, also known as the Third Wave. Each wave of change was accompanied by an era of discontinuity or dissatisfaction with the existing realities of the time. Each wave thus constructed the force and gap for the next one.

Each wave is represented by an S curve that shows an early period of dislocation, followed by a long spell of maturity and its eventual demise as new technologies replace the old and societal and business structures become obsolete (see Figure 1). The transition periods and the era of discontent that pave the way for the introduction of the new wave constitute a period of chaos and turbulence, during which there is an unfreezing from the current state, transformation, and a refreezing into the new state with the attainment of some measure of equilibrium. This introduces the notion of change and transformation. The duration of the periods of equilibrium is uncertain. However, it is evident that the periods of discontent occur at shorter and shorter intervals of time.

The Digital Economy is dominated by service organisations, with the line between manufacturing and services blurred and fuzzy. Service activities, such as design, marketing and customer support, provide significant value – even in manufacturing organisations. The knowledge (or intellect) of the workers is deemed the primary resource, thus introducing the emerging notion of knowledge workers. The old paradigm that services are intangible, ephemeral and not capital-intensive, and that

they generally play a minor role in economic activity, is something of the past (Hope & Hope 1997).

The real engine that drives the Digital Era is technology (Hope & Hope 1997). However, a number of factors change the competitive landscape of organisations – even South African ones:

- The evolution and impact of technology
- The change in the global market (mainly through new technology)
- Government-driven changes (mainly deregulation and privatisation in the South African context)
- The changing face of the competition (to some extent through new technology)
- The changing pattern of employment (to some extent through technology)
- The rise of knowledge as the key economic resource (mainly through technology).

Table 1: Summary of Toffler's waves of economic discontent

	APPROXIMATE DURATION	DRIVING FORCE
AGRICULTURAL WAVE	8000 BC – mid 18th century AD	Physical labour
INDUSTRIAL WAVE	18th century – late 20th century	Machines and blue collar workers
INFORMATION WAVE	1960s – 2000	IT and knowledge workers
BIO-TECHNOLOGICAL WAVE	1999 –	Technology and information

Source: Adapted from Toffler (1980)

¹ For the purposes of this paper, the Third and Fourth Waves will be denoted the Digital Era, Economy or Wave, since technology and information are the drivers for both.

*René Pellissier is an Associate Professor at the Graduate School of Business Leadership, University of South Africa.

Oliver (1998) points out that the twentieth century has witnessed the ascendancy of physics, with the splitting of the atom, the exploration of relativity and quantum theory and the harnessing of the power of silicon chips. The article predicts medical, environmental and agricultural advances, and even the expanded potential of bio-technology to include the application of gene splicing and genetic engineering to the creation of more powerful computing. Indeed, bio-materials (biological materials) represent the next logical step in the evolution of science and technology, and the production of such materials is predicted to 'flip' the world from the current economic era of information. The real 'high tech' is represented by bio-technology and new materials, rather than information management (Oliver 1998). The origins of bio-technology go back to 1665, when British scientist Robert Hooke coined the word 'cell'. Notwithstanding several centuries' worth of progress in biology, the next relevant event was in 1953, when scientists James Watson and Francis Crick described the anatomy of DNA as the 'double helix'. Scientists worldwide are now working on the basis of this discovery, which in many ways forms the basis of new scientific discoveries.

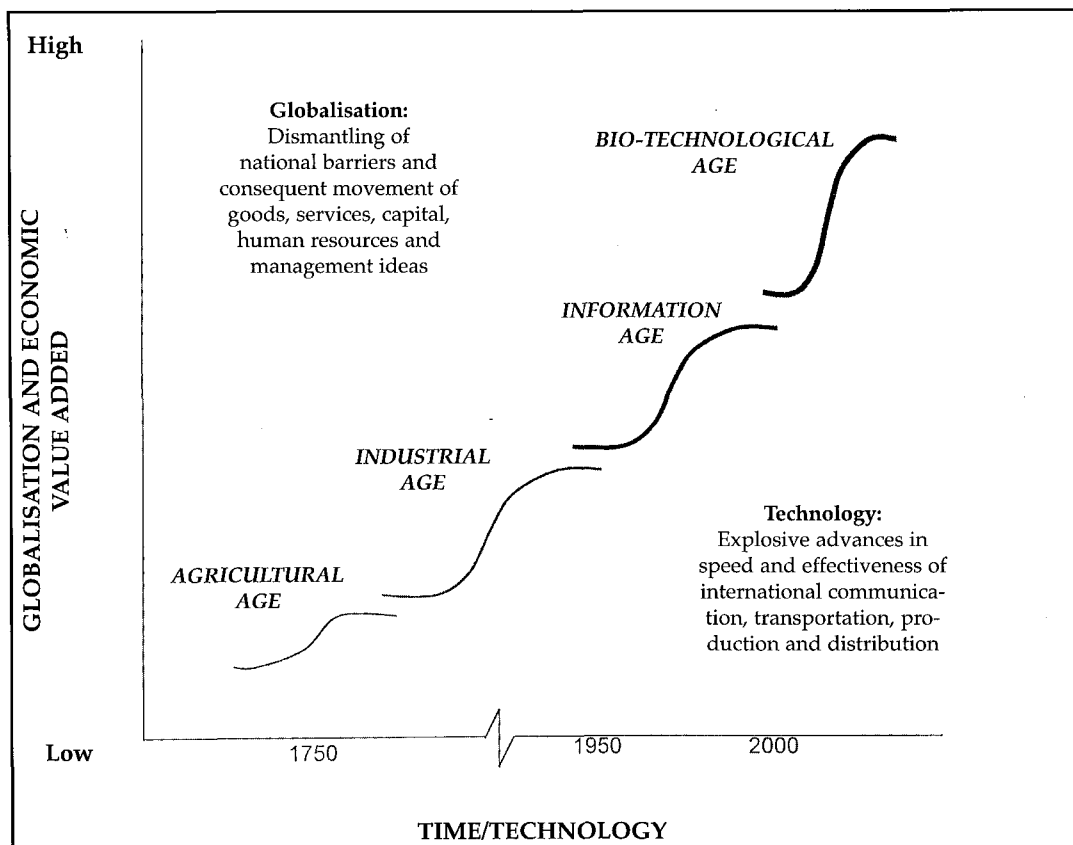
While the early importance of bio-technology will be in agriculture and medical applications, the long-range impact will be in the production of commercial goods. The commercialisation of bio-materials (biological technology) amounts to companies manipulating the biological structure of matter, such as DNA and cell culture, for commercial human use. Universities and organisations throughout the world are investing in research and development on bio-technology products. Large chemical and pharmaceutical companies are rapidly acquiring or forming partnerships with bio-technology startup organisa-

tions, which are small in size but high in innovation. Bio-technology organisations appear to be at an approximately equivalent stage in the development of bio-materials to that of IBM and other computer technology developers in the development of information technology in the 1950s.

The potential for bio-technology and bio-materials to transform our notions of products, services, materials and even life itself is phenomenal, and as scientists and others point out, we have scarcely scratched the surface. Oliver (1998: 231) predicts that bio-technology will "soon become just as important to a wide range of industry as the steam engine or the micro-processor", with applications in the engineering, food, chemicals, metal, textiles, paper and environmental industries. How the bio-technology age will change the world is unknown today. What is certain is that it will not remain the same.

The grand metaphor, according to Toffler (1980), is that of the collision of waves (see Figure 1), resulting in social tensions, conflict and the collapse of polarisations – as can be witnessed in the current build-up of tensions around the globe. This situation is also true for organisations around the world. The metaphor merely switches to the platform of knowledge – who owns it and how it is extracted, assimilated and implemented for quick decision making in the complexities that confront leadership in organisations and nations alike.

The way business is organised today has its origins with the Second Wave. Workers in Second Wave ideologies generally bemoan the break-up of mass society, which they regard as fragmentation. Two hundred years after the Industrial Revolution dramatically changed the established world order, the world is again in a period of sharp transformation – the



Source: Oliver (1998)

Figure 1: Toffler's collision of economic waves

duration of which is uncertain as is its eventual outcome. There is no doubt that this gives rise to the same types of fear and uncertainty felt by eighteenth-century agricultural workers when they migrated from the fields to the factories. Job security has vanished as organisations reengineering and downsize (Hope & Hope 1997) in an endeavour to remain competitive in an increasingly unstable environment. These methodologies have their own sets of rules – and, arguably, at least as many failures as successes.

A reengineering of reengineering through IT

In 1990, Hammer & Champy introduced the concept of “reengineering the business processes”, which forever changed the scene for companies that were trying to reinvent themselves because the environment and their customers said that they should.

Hammer & Champy’s proposition for replacing a lacklustre diamond with a sparkling one suggests that IT forms an integral part of the new way of working. They believe “state of the art IT” to be “an essential enabler” for corporations that are reinventing themselves and they cite examples of the misuse of IT in the organisation of work.

Geisler (1997) contends that the reengineering proposed by Hammer & Champy cites IT as the enabling mechanism for organisations to reinvent themselves. The redesign of the work processes, the elimination of processes with little or no value added and the resultant overall redesign of the organisation depend on the existence and support provided by ubiquitous IT (after Geisler 1997). She believes that the fallacy in this contention rests on the following dimensions and that these help to explain the failure of reengineering:

1. The information dimension
 - Even the best, most complete, timely, correct and clear information is not enough to fuel re-engineering.
 - If reengineering is already flawed as a concept and major change programme, IT and the ubiquity of information cannot overcome these flaws.
2. The technology dimension
 - This is the pattern IT has taken through its evolution from its use for back-room, cost-cutting efficiency purposes to its front-end, strategic use for overall organisational performance, enabling organisations to advance on the learning curve.

It is thus possible that IT is not the catalyst and cannot act as such for reengineering. It is suffering its own evolution. It certainly has brought about many changes in culture and the way work is performed, but it brings about its own form of change in the organisation, which does not necessarily correlate with the intentions of reengineering. In view of this, Hammer & Champy’s contention that IT is an essential enabler for corporations that are reinventing themselves could be seriously flawed.

In the Digital Era, basic economics is turned on its head (Drucker 1998). The new basic resource – namely, information – differs radically from most other commodities in that it does not follow the scarcity theorem. On the contrary, it follows an abundance theorem, leading Drucker (1998: 168) to write: “If I impart information, I still have it and can sell it again and again. ... it is clear that it will force us radically to revise basic economic theory.”

Drucker (1983) was the first to refer to the Knowledge Society, which distinguishes itself from the past by the key role it plays within society. He argues that, in the new economy, knowledge is not simply another resource alongside the traditional factors of production (namely, land, labour and capital) but the only meaningful resource. The fact that knowledge has become *the* resource, rather than *a* resource, is what makes the new society unique.

Toffler (1980) echoes Drucker’s contention, proclaiming that knowledge is the source of the highest quality power and the key to the power shift that lies ahead. He argues that knowledge has shifted from being an adjunct of money power to being its very essence. He sees knowledge as the ultimate replacement for other resources.

Quinn (1992) shares their opinions and adds that the value of most products and services depends significantly upon knowledge-based intangibles (such as technological know-how, product design, marketing presentation, understanding of the customer and innovation). In this society, knowledge workers constitute the most important asset, since they know how to allocate knowledge to productive use (in a similar way that the capitalist would allocate capital to productive use). The capacity to manage the knowledge-based intellect is fast becoming the critical executive skill for coping with the Digital Economy.

Hope & Hope (1997) contend that the only true competitive advantage will belong to those equipped with the knowledge to identify, solve and broker complex business problems.

The value of information

Information does not generally belong to a specific industry or business. It does not have any end use, nor does any particular end-user require a particular kind of information. One implication is that non-customers are as important as customers. Another is that non-customers are more important than customers. It is believed that they generally constitute at least 70% of the market potential (Drucker 1998: 169). They are the possessors of information on why they are not customers of that particular business. Drucker (1998) contends that changes generally start with these non-customers – who they are, where they are and the reasons they are. Information, and the subsequent information systems (IS), are generally obtained, stored, assimilated and retrieved through IT. Thus, both focus on information – IS on the demand side of information and IT on the supply side of information. This link (and subtle difference) between IT and IS can best be summarised in the matrix illustrated in Figure 2, according to which the two sides are both deployed to create value from data – in this instance, information and business intelligence.

The value of information is difficult to determine. Information may be deemed highly valuable or it may be deemed worthless – especially given the growing notion of information as an essential product and valuable resource. This idea of value through information is difficult to describe; sometimes it is calculable and other times not. Broadly, it is contended that the calculable value of information has two dimensions:

- There is value in the *exchange* of information: Essentially, value in exchange is calculated (or known) by the amount of money for which the commodity information exchanges hands.

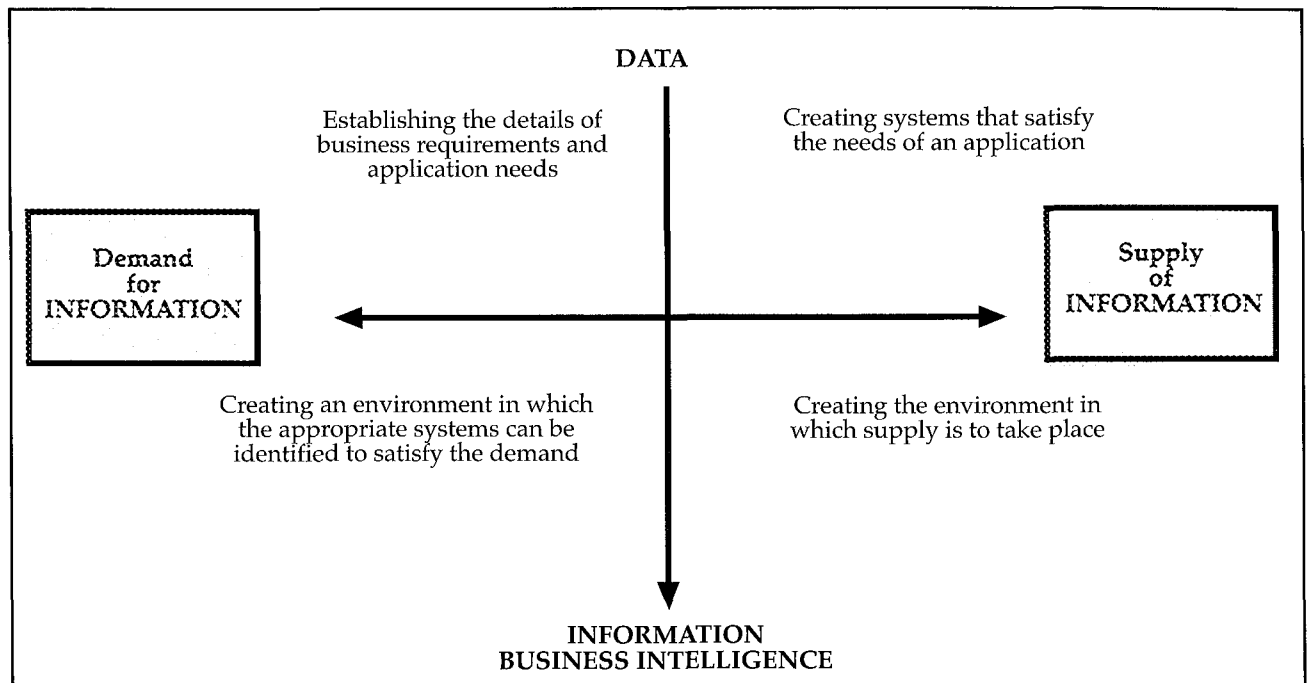


Figure 2: The proposed link (and difference) between the supply and demand sides of information

- There is value in the use of information: The value of information, in this instance, lies in the difference between tangible expenses and less tangible costs incurred in extracting or producing the information. Unlike value in exchange, value in use is difficult to calculate because it has to be calculated by other means than the amount of money for which it actually changes hands.

It would therefore seem that the cost of information lies more in the cost the prospective buyer may incur in not buying from a specific vendor or, more to the point, not having access to the information (or business intelligence). In putting a monetary value on information, the approach suggested by Haag, Cummings & Dawkins (1998) is recommended – information needs are identified according to three dimensions of needs, termed dimensions of information, which are time, content and form.

1. The time dimension of information. This deals with the 'when' aspect of information – in other words, a timeliness issue. It is not possible to make the correct decision at the correct time without the correct information at hand. It also includes a currency characteristic in that the information has to be up to date, otherwise it is of no strategic value to leadership and of no use to the knowledge worker.
2. The content dimension of information. This is generally considered the most critical dimension of information. It deals with the 'what' aspect of information, and characteristics include accuracy, relevance and completeness. The modern IT environment can easily lead to an information overload if the information that is available is not relevant or is impossible to assimilate. The latter is addressed in terms of the information delivery matrix, with particular reference to the context of business intelligence and information warehousing.

3. The form dimension of information. This dimension deals with the 'how' aspect of information and includes detail (in other words, information granularity or resolution) and presentation (using graphics, video or special technology).

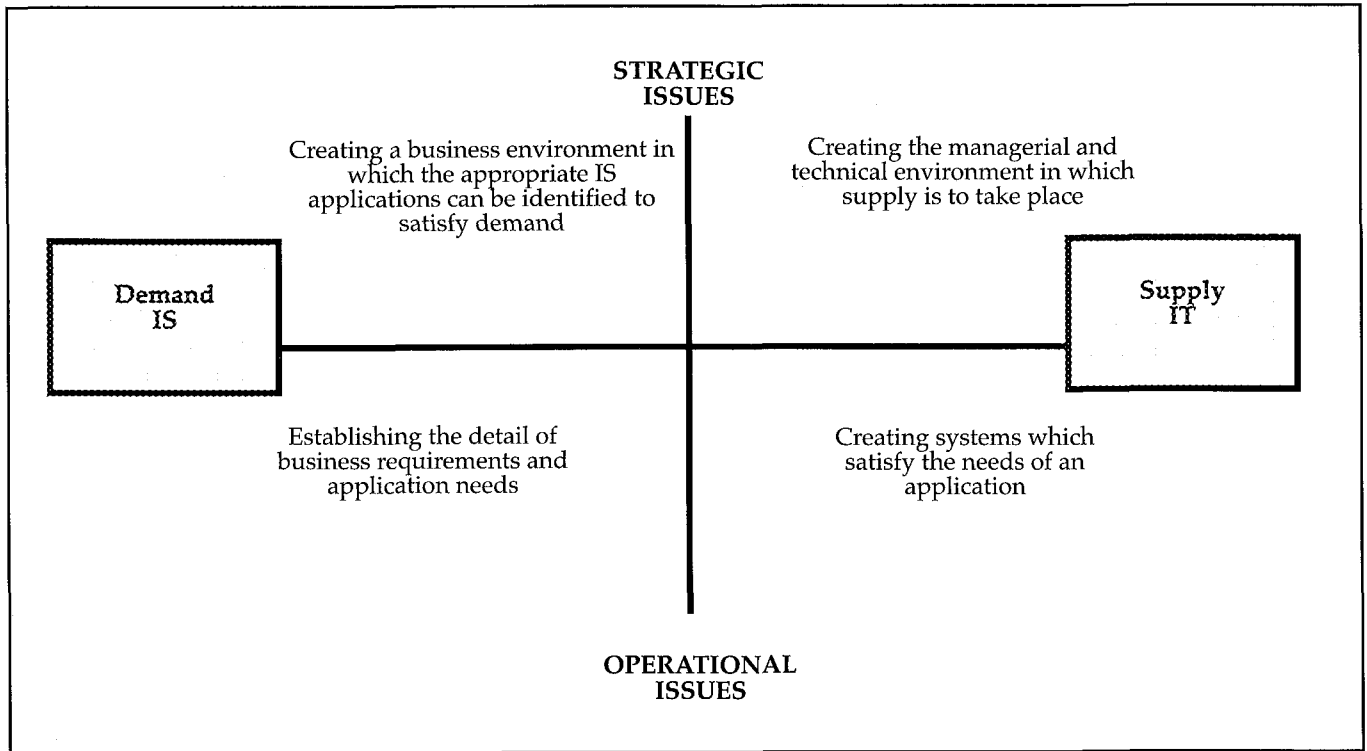
Through the above dimensions, it is possible to define and identify the characteristics of information that are of specific value to an organisation. In conclusion, it is strategically important, using the above dimensions of information, to ensure that an organisation has the right information (content), when it wants it (time) and how it wants it (form). These are driven by the two sides of information, illustrated in Figures 2 and 3.

In the schematic presentation (see Figure 3), the two sides of information are differentiated, firstly, as that which pertains to the strategic importance of the business and, secondly, that which is of greater operational value. As a consequence, both present different leadership (or decision-making) roles in the business.

This scheme leads to differing leadership and managerial roles through the use of IT and IS as strategic and operational tools. Traditionally, these two related sides of information generate different decision roles and structure roles within the organisation, as summarised in Figure 4.

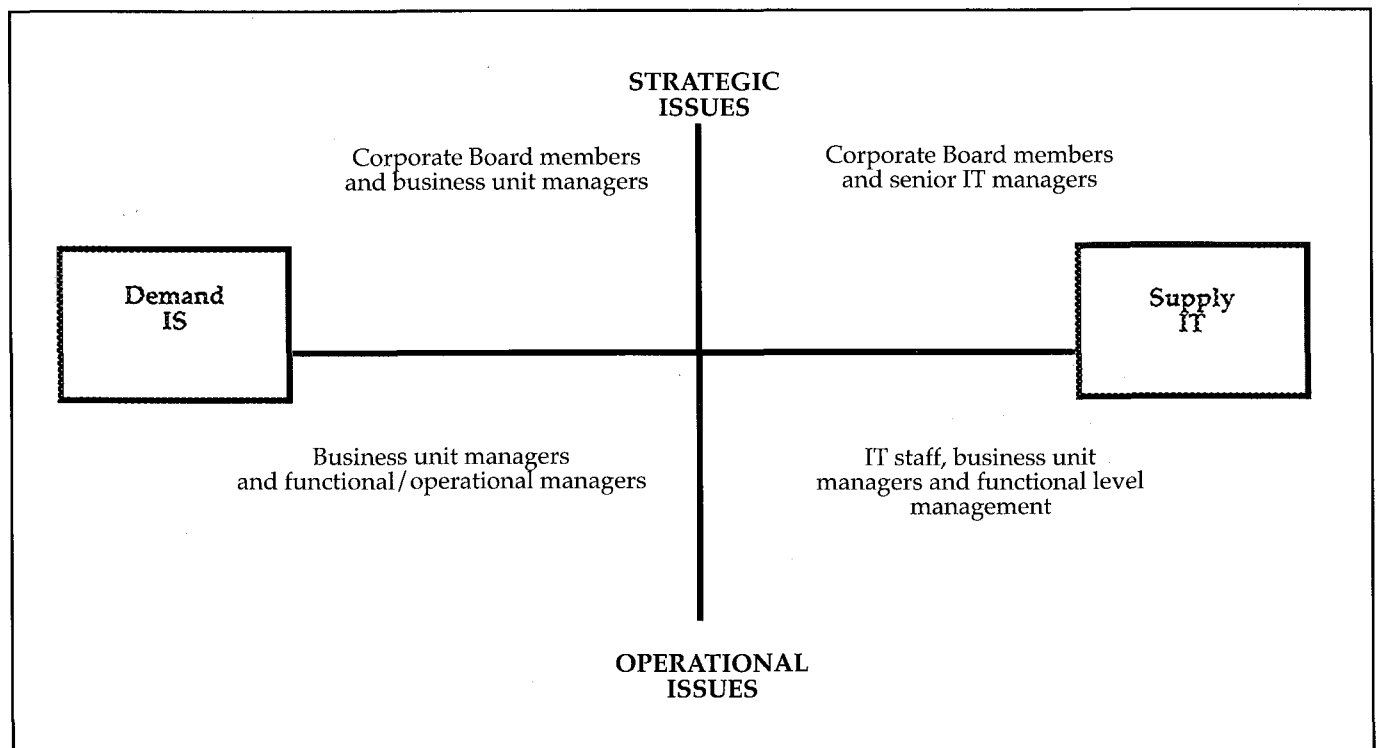
The new age of business intelligence

The study of human knowledge is as old as human history itself. It has been the central subject matter of philosophy and epistemology since the period of the Greek philosophers. Drucker and Toffler are two business theorists that call attention to the importance of knowledge as a business resource and a source of power. Using knowledge as the new competitive advantage calls for a fundamental shift in thinking about



Source: Adapted from Edwards, Ward & Bytheway (1996)

Figure 3: Differentiation between strategic and operational information issues



Source: Adapted from Edwards, Ward & Bytheway (1996)

Figure 4: Different roles pertaining to the two sides to information

the business organisation. The focus is not only on the process of knowledge, but also on creation of that knowledge.

There is strong evidence to support the belief that Japanese companies' understanding and use of 'knowledge creating' companies is the most important reason for their successes. In other words, in the Japanese culture, the organisation acts as the medium for knowledge creation. In Western culture, however, the individual is the principal agent for possessing and processing knowledge. However, it is suggested that the individual interacts with the organisation through knowledge. Thus, knowledge creation takes place at three distinct levels – individual, group and organisation (Nonaka & Takeuchi 1995).

In order for an organisation to qualify as a knowledge-creating company, it must possess the organisational capability to acquire, accumulate, exploit and create new knowledge continuously and dynamically. It must also have the ability to recategorise and recontextualise such knowledge strategically for use by others in the organisation. This goes beyond organisational learning (Nonaka & Takeuchi 1995). It touches on the links between the conventional business systems and structures, and IT.

Up to this point, the terms 'knowledge' and 'information' have been used interchangeably. However, most theorists agree that these concepts, although related, differ in application and level.

Table 2 tabulates the knowledge levels for decision making, each building upon the previous one. These levels are mentioned here for the purpose of comprehensiveness, and a simpler value chain is introduced later.

In contrast to knowledge levels given in Table 2, this author suggests only three knowledge levels in proposing the following value chain of data as it pertains to business:

Business data → Business information/knowledge → Business intelligence.

The acquisition of business intelligence is regarded as the ultimate form of competitive advantage.

The answer to the question 'Why the focus on knowledge?' lies in the power of knowledge as a decision-making tool. An

organisation's business intelligence base (accumulated outside the organisation and shared widely within it) can be used to develop new technologies and products. Some conversion takes place with regard to the business intelligence. This is called the 'transformation process' of business intelligence:

Business intelligence outside the organisation →

Business intelligence inside the organisation →

New products, services, systems.

This dual external/internal role of business intelligence is the key to strategic competitive advantage, as summarised in the following scheme:

Business intelligence creation → Continuous innovation → Competitive advantage.

The term (business) 'intelligence', which is the preferred term used by this author, relates to the identification and understanding of problems occurring in the organisation – why the problem, where and with what effects (Laudon & Laudon 1997) – whereas Mallach (1994: 679) notes that intelligence is "the first of Simon's four phases of decision making, which consists of finding, identifying and formulating the problem or situation that calls for a decision". And Schultheis & Sumner (1992: G-8) agree that intelligence is "the first phase in the decision making process in which the decision maker searches for conditions calling for a decision such as a problem or opportunity".

Thus, for the purposes of this paper, the term (business) 'intelligence' will denote the identification of business opportunities for change through appropriate information (technology and systems). This follows from the four stages of decision making described by Simon (in Mallach 1994) (see Table 3).

Finally, it is important to place in context the different kinds of decision making that may follow from the information delivery in a subsequent section. These are summarised in Table 4.

Table 2: Knowledge levels for decision making

Data	↓	Streams of raw facts representing events before they have been organised and arranged according to some criteria into a usable and understandable format
Information	↓	Knowledge about how things fit together statistically
Understanding	↓	Knowledge about the system's external relationships
Wisdom	↓	Knowledge about 'what' (regulation) keeps things together
Insight		Knowledge about how things fit together dynamically

Source Adapted from Laudon & Laudon (1997)

Table 3: Simon’s four stages of decision making – with feedback at any stage to the previous stage

INTELLIGENCE	Is there a problem?	Information gathering to identify problems in the organisation
DESIGN	What are the alternatives?	Conception of possible alternative solutions to the problem
CHOICE	Which should you choose?	Selection from the various alternative solutions
IMPLEMENTATION	Is the choice working?	Implementing the decision and reporting on the progress made from it

Source: Mallach (1994)

The evolution of IT

Before the strategic application of technology can be addressed, it is important to formally define IT. Definitions of IT depend largely upon the evolution of IT, since most authors agree that IT has moved from back-office applications to front-end strategic use. According to Venkatraman, Henderson & Oldach (1993), “IT has become the generally accepted term that encompasses the rapidly expanding range of equipment (computers, data storage devices, network and communications devices), applications and services (end user computing, help desk, application development) used by organisations to deliver data, information and knowledge. It provides strategic value to all parts of the business.” According to Senn (1998: 12), “IT refers to a wide variety of items and abilities used in the creation, storage and dispersal of data and information as well as the creation of knowledge.”

It seems that these generic definitions have one thing in common, namely, that they broadly define the concept of IT application, depending on its evolution. In this regard, Figure 5 is presented, showing IT’s evolution in terms of its business application.

In place of the term ‘IT’, the more descriptive acronym ITT (IT and telecommunications) may be used, as this encompasses the essential component of telecommunications (Geisler 1997). ITT has evolved from a tactical tool to rationalise and automate back-room operations of accounting payroll. In modern times, it is of strategic value to organisations in assimilating and reporting the accumulated knowledge and experi-

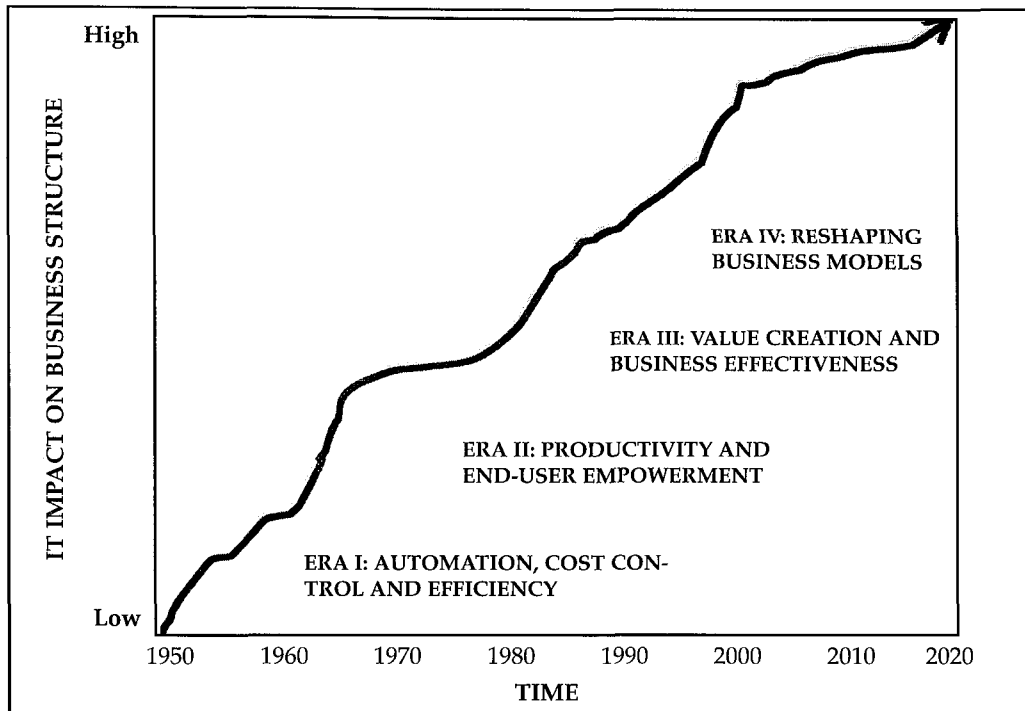
ences in the organisation. The learning curve of ITT is incremental and cumulative. Data processing and back-room operations are still practised, but organisations have mastered the intricacies of these functions as they move along the sophistication curve towards ITT as a strategic tool.

It is generally agreed that IT applications should be designed in such a way as to have an impact on the individual, the functional unit and the organisation as a whole. It is this author’s belief that this also serves as the progressive evolution of IT. The framework (and evolution) of IT application presented in Table 5 is thus proposed.

The three roles of IT depicted in Table 5 (namely, administrative, operational and competitive) form part of the IT evolution discussed. In an administrative capacity, the scope of IT embraces the automation of accounting and control functions, whereas IT’s operational role, although an extension of the first, is distinguished by the creation and deployment of a technology platform that creates the capability to automate the entire set of business processes, as opposed to just the administrative activities. However, along the same principles of viewing strategic management in terms of a hierarchy of three levels of strategies – these being corporate strategy (concerned with the portfolio of and interrelationships among businesses), business strategy (focusing on developing a strategy that maximises organisation-specific comparative advantages to best compete in the marketplace) and functional strategy (reflecting efficient allocation of resources to the particular

Table 4: Different IS pertaining to different organisational levels

	OPERATIONAL	KNOWLEDGE	MANAGEMENT	STRATEGIC
Structured	TPS (Transaction processing system)	OAS (Office automation system)	MIS (Management information system)	
Semi-structured			DSS (Decision-support system)	
Unstructured		KWS (Knowledge support system)		ESS (Executive information system)



Source: Adapted from Gartner (1999)

Figure 5: The evolution of IT in terms of investment drivers, technology cycles and change

<p>SYSTEM APPLICATIONS (OLTP, ESPECIALLY ERP)</p> <p>EXAMPLES: SAP, PEOPLESOFT, BAAN, JD EDWARDS, SSA, RUBICO</p>	<p>BUSINESS INTELLIGENCE (INFORMATION WAREHOUSING AND MINING)</p> <p>EXAMPLES: SAS, HYPERION, COGNOS, BUSINESS OBJECTS</p>
<p>DATABASE APPLICATIONS</p> <p>EXAMPLES: ORACLE, EXCEL, SYBASE, INFORMIX, MS ACCESS, LOTUS NOTES, DBASE, SOFTWARE AG</p>	<p>OFFICE AUTOMATION</p> <p>EXAMPLES: E-MAIL, DESKTOP PUBLISHING, WORD PROCESSING, FACSIMILE TRANSMISSIONS, VIDEO CONFERENCING</p>

Figure 6: Proposed classification of information delivery systems in terms of cost and ease of implementation

Table 5: Application framework for IT, highlighting its evolution

	ROLES OF IT	INDIVIDUAL	FUNCTIONAL	STRATEGIC
Efficiency	Administrative	Task mechanism	Process automation	Boundary extension
Effectiveness	Operational	Work improvement	Functional enhancement	Service enhancement
Transformation	Competitive	Role differentiation/expansion	Functional redefinition	Product/process/business innovation

function) – the existing IT strategies have generally reflected an internal efficiency focus. However, the capabilities now exist for organisations to deploy new IT applications that use the information and technological attributes as leverage to obtain differential sources of competitive advantages in the marketplace.

This framework is in agreement with Figure 6 (which may be superimposed on Figure 5), which proposes IT's evolution, over the course of four eras, in terms of investment drivers, technology cycles and change (Gartner 1999). Era III corresponds with the notions of reengineering, while Era IV corresponds with the greater notion of reengineering the business itself (see Figure 5).

The increased attention devoted to IT to influence structural characteristics in the organisation and its markets is a concern that needs to be addressed. In this, emerging IT has significant implications for organisational transformation – especially because the mere superimposition of powerful IT capabilities on existing organisational structures and processes is unlikely to yield superior competitive benefits. This contention is supported by research that found that successful organisations can be distinguished by their IT leverage capabilities to transform their businesses and obtain powerful and new sources of competitive advantage. In this context, the existing frameworks – Porter's value chain analysis, business systems planning and critical success factors (Porter 1985) – are limited because of their operational focus.

With regard to the differences in needs between the Industrial and Digital Eras, the reflections in Table 6 are of interest, showing the evolution from an organisation-as-machine (Second Wave) perspective to the organisation-as-living-entity perspective of the Digital Era.

Technological forecasting

Decisions exist only in the present. The question that faces the long-range planner is not what we should do tomorrow, it is: What do we have to do today to be ready for an uncertain tomorrow? The question is not what will happen in the future. It is what futuristics do we have to factor into our present thinking and doing; what time spans do we have to consider, and how do we converge them to a simultaneous decision in the present?

Drucker (1970)

According to Drucker's beliefs as stated above, all that is certain about the future is that it will be different from the present or the past. Since technology is responsible for many of the most important changes in society, forecasting future advances in technology, as well as their impact, will have a significant effect on the organisational strategy. The planning horizons for organisations are becoming much shorter (Burgelman & Maidique 1988), and, in this regard, it is important to note the evolution of IT and emerging trends.

A number of shifts in the nature of technology itself are driving forward the convergence of computing, communications and content technologies and industries. These shifts create the power, capabilities and price performance for new media, a new organisation, a new economy and a new society. Leadership does not have to become expert in technology in order to understand the main shifts that are under way and how these can be used for competitive advantage. The ten most important technology shifts are shown in Table 7.

It is suggested here that organisations would do well to invest in so-called technological forecasting as part of their strategic inventions. Granted, there is a degree of uncertainty in the outcome of such research. Nevertheless, an attempt should be made to utilise this costly and ever-expanding innovation. This may also take the form of an analysis of the strengths, weaknesses, opportunities and threats (SWOT analysis) of current and future technologies, scenario-building activities and statistical techniques. Technology cannot be looked at in isolation – there is strong evidence of interactions between the political, technological and social forces in the organisation (Tichy 1993). An example of this is the development of the NASA space programme, which was not based entirely on technological innovations, but also on the nature of the race between the USA and Russia.

Writing in 1993, Luftman, Lewis & Oldach state their belief that the rate of change at which new technology is introduced is increasing by between 20% and 30% annually, impacting on (i) the demand to apply state-of-the-art technology strategically and (ii) accelerated innovation. They confirm that technology will continue to increase and be magnified by new network communications opportunities.

Although there are two schools of thought, this researcher agrees with Drucker's (1970) argument that, contrary to some contentions that the evolution of technology will follow the normal life cycle approach, technology will create new technology, which makes any serious attempt at technological forecasting almost, if not entirely, impossible. It consequently increases the value of technological innovation significantly.

Classification of information delivery technologies

Introduction

It is evident that IT has given organisations competitive parity. The history of IT has essentially been that of finding more efficient ways and means of getting data into systems to perform simple tasks (see Figure 5). Greater efficiency results in less waste, fewer resources and reduced costs. Also, by standardising and integrating systems, more waste is eliminated. One possible disadvantage of this approach is that organisations all perform at the same level. Thus, standard approaches to IT may deliver short-term competitive advantages, but, in the long term, may only ensure competitive parity. Moreover, standard approaches to IT may corrode differentiating strengths. In view of this, organisations should find ways to discover, develop and accentuate their strengths. The focus of future organisations will not be on collecting data, but rather on acquiring information (and business intelligence) to support and enhance innovation. Competitive advantage comes from matching internal strengths to profitable opportunities to create and sustain advantages that competitors cannot easily copy. For this, they need information about their own businesses, their customers and the external environment. The data that organisations collect over many years could act as the source of that information. This is the notion of 'information delivery'.

Definition of information delivery

Information delivery may be defined as the end-to-end process of converting raw data, which large organisations have in abundance, into the meaningful information required

Table 6: Different IT applications between the Industrial and Digital Waves

	INDUSTRIAL AGE	DIGITAL AGE
Primary tool	Machines	Information creation, distribution and application
People	Division of labour	Connectivity of workers through: Teams Interconnectivity Shared information
Productivity	Mechanisation and automation	IT
Partnership	Partnership between man and machine	Partnership of people with people

Table 7: Technology shifts for competitive advantage

TECHNOLOGY	FROM	TO	
Signal	Analogue	Digital	Digital economies for the digital economy
Processors	Traditional semi-conductor	Microprocessor	High performance processing for the high performance organisation
System	Host-based	Client server	Network-centric computing for the Internet worked enterprise. Client/server computing for the dynamic client/customer service organisation. The network becomes the computer. The enterprise becomes the network
Network capacity	Garden path bandwidth	Information highway	Broad band communications for the networked economy
Device	Dumb access	Information appliance	Smart on- and off-ramps for the information highway
Information forms	Separate data, text, voice, image	Multimedia	Interactive multimedia for complete human communications
System	Proprietary	Open	Open systems for an open world
Networks	Dumb	Intelligent	Hypermedia and letting the agent do the walking through the Net
Software development	Craft	Object computing	Rapidly deployable software for the rapidly changing world
Interface	General user interface (GUIs)	Multi-user dimensionality (MUDs), Multi-user interface (MUIs) and multi-objects operator (MOOs)	New collaborative environments for a new economy

Source: Tapscott (1996)

to support and enhance successful decision making (after SAS Institute 1999). Such software may be categorised according to four main categories:

1. Personal productivity tools and utilities
2. Transactional databases
3. Standard operational applications
4. Business intelligence.

The first three of these categories are primarily concerned with data capturing, time saving and the achievement of day-to-day efficiencies. Personal productivity tools have automated the process of creating documents and organising personal information. Transactional databases provide an efficient means of storing substantial amounts of data that are continually changing. Standard applications enable an organisation to integrate its operational processes based on common software. The first three software categories are essential to the organisation's survival and provide an operational solution. However, the last category concerns more than survival. It is essential only to those organisations that have set themselves more ambitious goals (such as market leadership, exceptional levels of customer satisfaction, above-average return on investment (ROI) and sustainable competitive advantage), hence a more strategic focus.

Proposed classification of information delivery systems

One proposition in terms of the class of IT is presented by the matrix in Figure 6, representing the software landscape as four quadrants, each of which has a clear leader – Microsoft (office automation), Oracle (transactional databases), SAP (systems applications) and SAS (business intelligence). The most relevant of these are discussed next, using the market leader in that quadrant as an example. It should be noted, however, that there is evidence that the products in the different quadrants of the matrix are continuously improving and competing with those in other quadrants. The first and most basic level is that of office automation, which is not discussed as it is felt that most organisations have already invested in such systems. The other three quadrants are discussed in the order in which this author believes they will become pertinent to organisations and their growing need for strategic information (or business intelligence), corresponding to the evolution of IT, as illustrated in Figures 5 and 6, namely:

Office automation → Database applications → Online transaction processing → Business intelligence.

1. Database management systems (DBMS): A database is defined by Laudon & Laudon (1997: 203) as "a collection of data organised to serve several applications efficiently by centralising the data and minimising redundant data". They add: "Rather than storing data in separate files for each application, data are stored physically to appear to users as being stored in only one location." Thus, these authors maintain that DBMS can be viewed as the software that:

- Permits an organisation to centralise data
- Manages the data efficiently
- Provides access to the stored data via application programmes.

The DBMS acts as an interface between application programmes and the physical data files. A multidimensional

database model represents relationships between data in a multidimensional structure. This principle is best viewed as cubes of data and cubes within cubes of data, with each side of the cube consisting of another level of information, in contrast to spreadsheet applications, which consist of data of a flat nature. Thus, a matrix of actual sales could be stacked on top of a matrix of projected sales to form a cube with six faces. Cubes may be nested within cubes to build complex views of data. The database environment is schematically presented below with the DBMS acting as an interface between the application programmes and the data. The main advantages of DBMS are summarised in Table 8.

2. Transaction software or standard applications: This quadrant can also be classified as OLTP (or online transaction processing), comprising a wider range of systems than the popular enterprise resource planning (ERP) systems. This discussion will focus on ERP application as an example of the OLTP, with specific reference to the SAP system. The SAP system is currently the world's biggest selling ERP system. ERP entails the development and implementation of a total (online) software solution. All aspects of business information are packaged within one integrated solution. The result is faster decision making, since all information within the organisation's IT/IS structures is assimilated and summarised within one system. This enhances organisational efficiencies, since the systems contain information about such things as the organisation's customer base and inventories (including inventory build-ups). Table 9 shows issues that pertain to the implementation of ERP systems.
3. Information warehousing/mining (or business intelligence): Data/information warehousing addresses the problem of fragmented data in separate operational systems, thus not allowing decision makers to integrate complete knowledge bases. Laudon & Laudon (1997: 218) define a data warehouse (this author prefers the term information warehouse) as "a database, with tools, that stores current and historical data throughout the organisation".

The data may originate in many core operational systems and are copied into the information warehouse when needed – striving towards a pull, or just-in-time (JIT) information delivery system. The data are standardised and consolidated to be used across the organisation for strategic analysis and decision making. Thus, an information warehouse includes query and analytical tools, as well as graphical reporting facilities. These systems may perform high-level analysis of trends, but are also able to drill down into more detail if required. They seek business intelligence. Thus, information warehouse data may differ from operational data according to the platforms shown in Table 10.

Information warehousing includes important organisational strategies, such as executive IS (EIS), management IS (MIS), decision support systems (DSS) and marketing and financial strategies.

The technological framework for information delivery is the information warehouse. An information warehouse is more than a store of data; it consists of an entire process of:

- Extracting data from operational systems
- Reconciling and organising it in ways that make business sense
- Exploiting it with knowledge discovery and analytical software.

Table 8: Main advantages of DBMS

Reduction of the complexity of the IS environment	Through central management of data, access, utilisation and security
Reduction of data-redundancy and security	Through the elimination of isolated files in which the same data elements are repeated (corresponding to the reengineering principle of capturing data once, at the source)
Elimination of data confusion	Through the provision of central control of data creation and definitions
Reduction of programme-data dependence	Through the separation of the logical view of the data from its physical elements
Reduction of programme development and maintenance costs	
Higher flexibility of IS	Through rapid and ad hoc queries from large pools of information
Increased access to and availability of information	

Source: Adapted from Haag, Cummings & Dawkins (1998)

Table 9: Organisational issues in the implementation of ERP systems

Costs	ERP implementation is very costly and consumes a large part of the IT budget
IT resources	There is a substantial need for IT resources during the ERP implementation and in terms of maintenance
Functionality	The decision should be made as to whether specific modules only or the complete system will meet the organisation's requirements – general information or specific requirements have to be addressed
Data availability	Management information is generally based on multiple data sources (internal or external) – all of which have to be available
Information flows	Strategic information should be available throughout the organisation (on Intranet) – the ERP system is required to provide such an information sharing and storage facility
No transactional facility	Transaction data should be stored separately since calculations are not the main function in a reporting environment
ERP systems are not open to other systems	SAP has a so-called family of add-ons that link on to their software and provide links from other platforms
No provision for data storage or information reporting	The core functionality of ERP is not that of information warehousing, and ERPs have been found lacking in this area – although SAP is moving into the competitive field of information warehousing

Table 10: Different platforms for operational data and information warehousing

OPERATIONAL DATA	INFORMATION WAREHOUSE
Isolated data	Organisation-wide integrated data collected from legacy systems
Contains current operational data	Contains recent data as well as historical data
Original fields may be inconsistent across the organisation	A single agreed-upon definition exists for every field stored in the system
Data are organised from an operational or functional perspective	Data are organised around major business information subjects
Data are volatile to support operations within the organisation	Data are stabilised for decision making
Data are stored on multiple platforms	Data are stored on a single platform

Data mining is undoubtedly one of the fastest growing fields in the software delivery arena. Once a small interest area within computer science and statistics, it has expanded into a field of its own, providing strategic benefit from data and information for long-term decision making. In broad terms, the data mining process (from the data warehouse) tries to discover hidden patterns and trends, especially since:

- Databases become large and multi-dimensional, making access and analysis virtually impossible.
- Standard statistical methods may be impractical because of missing values.
- The large databases make it impossible for systems administrators to know what information is contained in the data or what it is relevant to ask.

Business intelligence covers a range of technologies concerned with the end-to-end process of extracting information from raw data to support meaningful decisions. However, the practicalities of such information delivery make it very difficult to implement solutions unless they are based on an 'end-to-end' approach to technology, in which approach, the same family of software solutions performs all the essential functions of information delivery. This quadrant may also be called business intelligence, or OLAP (online architecture platform), as this is what it provides to the business.

The main advantage of an end-to-end solution is the elimination of integration issues. Selecting different modules of an information delivery solution from various suppliers (called 'best-of-breed') may:

- Delay implementation
- Incur vast expense
- Cause time-consuming maintenance problems
- Build inflexibility into the system (counter to the notion of increased responsiveness and market edge).

An end-to-end solution, however, is designed for rapid ROI and sustainable competitive advantage.

It is evident that SAP is moving towards this market with the launch of its Datawarehouse module, as is Oracle. The trends in the latter's product development are depicted in Figure 7 (with software competitors given in brackets). Oracle's way of providing business intelligence takes the form of DSS applications modules (also indicated in Figure 7).

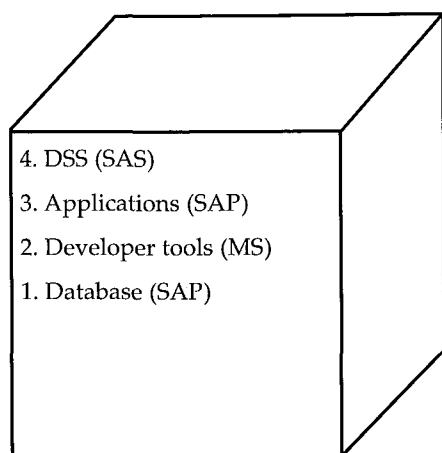


Figure 7: Oracle's stacked system as example of trends towards business intelligence

Conclusion

It is contended that the new platform of competitive advantage will be in the domain of business intelligence and information delivery and that, as indicated by the matrix in Figure 6, information warehousing will play the major role in organisations' efforts to make successful business decisions.

One of the primary concerns of reengineering is the need to design (or redesign) systems and processes that fit the organisation and its needs. Selection criteria for packaged solutions hardly consider the extent to which such a fit may be retained. The organisation therefore no longer has total control over the systems design process. Even with the most flexible and easily customised package, there are limits to the amount of tailoring allowed. Organisations that are experienced in the use of packaged software solutions have noted that even the 'best' packages cannot be expected to meet more than 70% of the organisation's requirements (Laudon & Laudon 1997). Other requirements will have to remain unmet by the organisation or be satisfied by some other means. If the package cannot adapt to the organisation, the organisation will have to adapt to the package and change its procedures – in other words, engage in secondary reengineering. One of the most far-reaching impacts of software packaging is its potential effect on organisational procedures.

The kind of information and business intelligence an organisation may store and retrieve for an application, such as accounts receivable, could largely be determined by the applicable package. This depends upon the organisation's position in the software delivery matrix illustrated in Figure 6. Leadership is urged to note that most of these software deliveries handle operational issues, whereas IT has evolved to the point where it can create strategic value for organisations. Most organisations are still engaged in using IT as efficiency/automation (operational) tool, whereas the new business landscape will demand more radical measures – getting strategic advantage from IT, which represents an effectiveness focus. The importance of business intelligence (over data and information) and its growing importance in obtaining competitive advantage in the Digital Era is one that leadership should actively explore. In this lies the new challenge.

References

- Burgelman, R.A. & Maidique, M.A. 1988. *Strategic Management of Technology and Innovation*. Homewood, IL: Irwin.
- Drucker, P.F. 1970. *Technology, Management and Society*. London: Heineman.
- Drucker, P.F. 1983. *Managing in Turbulent Times*. London: Heineman.
- Drucker, P.F. 1998. 'Management's new paradigms', *Forbes*, 162(7): 152–177.
- Edwards, C., Ward, J. & Bytheway, A. 1996. *Essence of Information Systems*. Hertfordshire: Prentice-Hall.
- Gartner Group. The Voice of IT Symposium, Cape Town, August 1999.
- Geisler, E. 1997. *Managing in the Aftermath of Radical Corporate Change: Reengineering, Restructuring and Reinvention*. Westport, CT: Quorum.
- Haag, S., Cummings, M. & Dawkins, J. 1998. *Management Information Systems for the Information Age*. Boston, MA: Irwin McGraw-Hill.
- Hammer, M. & Champy, J. 1990. *Reengineering the Corporation: A Manifesto for Revolution*. London: Nicholas Brealey.

- Hope, J. & Hope, T. 1997. *Competing in the Third Wave*. Boston: Harvard Business School.
- Laudon, K.C. & Laudon, J.P. 1997. *Essentials of Management Information Systems*. New Jersey: Prentice Hall.
- Luftman, J.N., Lewis, P.R. & Oldach, S.H. 1993. 'Transforming the enterprise: The alignment of business and information technology strategies', *IBM Systems Journal*, 32(1): 198–221.
- Mallach, E.G. 1994. *Understanding Decision Support Systems and Expert Systems*. Burr Ridge, IL: Irwin.
- Nonaka, I. & Takeuchi, H. 1995. *The Knowledge-Creating Company*. New York: Oxford University Press.
- Oliver, R.W. 1998. *The Shape of Things to Come*. New York: McGraw-Hill.
- Porter, M. 1985. *Competitive Advantage*. New York: Free Press.
- Quinn, R.E. 1992. *Beyond Rational Management, Mastering the Paradoxes and Demands of High Performance*. London: Jossey-Bass.
- SAS Institute. 1999. Information leaflet.
- Schultheis, R. & Sumner, M. 1992. *Management Information Systems: The Manager's View*. Homewood, IL: Irwin.
- Senn, J.A. 1998. 'Expanding the reach of electronic commerce: The Internet alternative', *Information Systems Management*, 15(3): 7–15.
- Tapscott, D. 1996. *The Digital Economy*. New York: McGraw-Hill.
- Tichy, N.M. 1993. 'Revolutionise your company (by following General Electric's example of restructuring). The new era', *Fortune*, 128(15):114–116.
- Toffler, A. 1970. *Future Shock*. London: Pan Books.
- Toffler, A. 1980. *The Third Wave*. London: Pan Books.
- Venkatraman, N., Henderson, J.C. & Oldach, S. 1993. 'Continuous strategic alignment: Exploiting information technology capabilities for competitive success', *European Management Journal*, June(2): 139–149.

Doctoral theses completed in 1999

The impact of information technology on business organisations of the future

René Pellissier

A thesis submitted for the PhD (Systems Engineering) degree to the Department of Industrial and Systems Engineering, Faculty of Engineering, University of Pretoria

Supervisor: Prof P.S. Kruger

Abstract

The world and society at large are experiencing profound changes that bring about their own challenges and opportunities but also demand that businesses align their business strategies and processes with their IT strategies, as the latter is probably the most significant driving force and enabler of change. Since the evolution of technology is so rapid – technology creates technology – this in itself induces and, at the same time, impedes radical change. This anomaly highlights the need for reengineering existing and past paradigms and methodologies. Moreover, several management paradigms often prevail simultaneously, some of which are completely irreconcilable with the chaotic dimensions of new business.

Newton's linear science and the clock-like machine universe are being replaced by dynamic forces so powerful as to change forever the paradigms of the past.

The focus in the thesis is Handy's age of unreason, or period of discontinuity, that is, the shift from Toffler's Second Wave (Industrial Era) to the clash of subsequent waves – between the Second Wave and the Third (Information Era) or Fourth Waves, called the Quantum Era, in which technology and information are identified as the main agents of change.

In drawing from a vast field of application and theory (mainly mathematics, mathematical statistics, physics, philosophy and the business domain), the thesis adds the following to the existing body of knowledge:

- Technology change model, whereby organisations can measure the extent of (or correlate or link) change (incremental or discontinuous) against (information) technology (existing or new)
- The proposition of deengineering the corporation, following from the principles of self-organisation, strange attractors and feedback in chaos theory to rectify reengineering's deficiencies. The term 'chaordic' (chaord = cha-os + ord-er) theory to replace chaos theory is introduced. This concept is explored in terms of the notions of chaordic enterprise structures (for example, the quantum organisation) and chaordic leadership.
- The proposition of:
 - Appropriate mathematical business models that follow the natural life cycle of any business or idea
 - The subsequent identification (mathematically and statistically) of the time (pro-active or pre-active) to institute radical change points ('cusp' or 'bifurcation' in chaotic or catastrophic systems).
- The evaluation of IT/IS projects in terms of:
 - The application of the traditional total cost of ownership (TCO) model, the development of a generic TCO-based model for its implementation and possible integration into the supply chain paradigm
 - An information delivery matrix – measuring the direct and indirect consequences.

Throughout the thesis, three phenomena become prevalent. These are:

- The self-organising, self-renewal principles of a chaotic system. Ultimately, some (new) point of equilibrium is reached, introducing the notion of a 'chaord' (chaos + order)
- The inherent cyclical nature prevalent in society and organisations, so that, though the needs of society and the environment have shifted into a new paradigm, these needs are in a way repetitive, similar to Kondratieff's waves (K waves)
- The principle of synchronicity between the differing sciences.

In conclusion, the possible effects of the chaordic organisational form on the broader society and on the macro-level are tentatively explored. Although the evolution of this field is so rapid as to render obsolete any proposition of what the future may hold, an attempt is made to identify possible future scenarios.

A decision support model for the cash replenishment process in South African retail banking

Susan Adendorff

A thesis submitted for the PhD (Industrial Engineering) degree to the Department of Industrial and Systems Engineering, Faculty of Engineering, University of Pretoria

Supervisor: Prof P.S. Kruger

Abstract

The objective of the research was to establish a scientifically based decision-making procedure for determining the amount of cash to be held at a cash point at any time without compromising the customer service level or incurring undue cost. To reach the objective, the problem was divided into the following subproblems:

- To determine the cost parameters describing the nature of the problem of cash provision in South Africa
- To investigate the characteristics unique to South African retail banking
- To determine the nature of the demand distribution for a cash point
- To develop a forecasting method appropriate for retail banking, although it was clearly stated that the methods used were specific to the branch studied
- To investigate the existing order policies used by retail banks, as well as alternative order policies, with the aim of improving the cash replenishment process.

As a result of the investigation, a generic decision model was developed which may be used to improve the process at branch level for retail banks in South Africa. Some suggestions were also made regarding the implementation and maintenance of the model.

To investigate the cash replenishment problem, the cooperation of one of the leading retail banks in South Africa was obtained. A typical branch was selected. The total withdrawal and deposit patterns and the withdrawal patterns at the automated teller machines (ATMs) were investigated for a three-month period during 1998. The cost parameters relevant to the cash replenishment process were quantified. The approach followed was based on the classical inventory theory, where the total cost of carrying inventory comprised three cost categories, namely storage cost, supply cost and shortage cost. Since the banks do not quantify the shortage cost, assumptions regarding the scope of the shortage cost had to be made.

The next step was to determine the cost of the existing order policy followed by the branch. This figure was used as a benchmark once alternative policies had been investigated. The investigation resulted in alternative policies that significantly reduced the daily cost involved in carrying inventory as well as reduced the average amount of cash carried at the branch.

It was also shown that the branch should consider using an appropriate forecasting method, since once forecasting was combined with an appropriate order policy, it was possible to reduce the cost of carrying cash inventories even further.

In conclusion, the research report suggested an implementation plan to be followed at branch level, pointing out that certain changes to information systems were required. In addition, training needs were identified to enable the branch operations manager to successfully use the decision-support model.

A comparison was drawn between the existing approach followed at the branch (which is mainly experience-based and largely of a random nature) and the proposed alternative method. It was shown that the daily cost of carrying cash inventory could be reduced by 13% per day. This represented a daily bottom line cost reduction of R358. At the time that the research was carried out, this retail bank had 75 similar branches. Should the saving at this representative branch be extrapolated, it shows a potential saving of R8 million per annum at this category of branch. It was further shown that the average cash inventory at this branch could be reduced by 52% using the proposed method.

The study was limited to an investigation at one particular branch of a leading South African retail bank. The figures used to describe cash movements at the branch were of an extremely sensitive nature and were fairly difficult to obtain due to the way in which transactions are reported. The accuracy of the data provided by the branch could not be verified, but had to be accepted at face value. Although a particular case was investigated, a concerted effort was made to point out how the methodology may be used in the generic situation.

During the period under review, the branch relocated to a complex across the street from its previous location in a busy shopping mall. This had a direct impact on the ATM withdrawal patterns at the two ATMs located at the branch. In addition, soon after the research was carried out, a number of other branches of the same retail bank were consolidated into this one particular branch. This would impact on the validity of the branch-specific factors determined as part of the research.

The study proved the applicability of industrial engineering principles in a service environment, where the added value of having the optimum cash amount available when required would impact directly on the bottom line of the bank and thereby enhance shareholder value. In the changing environment confronting retail banks, enhanced shareholder value is of the utmost importance in increasing competitiveness and ensuring long-term survival.

**CALL FOR CONTRIBUTIONS TO THE
SOUTHERN AFRICAN BUSINESS REVIEW
SPECIAL ISSUE ON INFORMATION TECHNOLOGY,
NOVEMBER 2000**

'The history of IT can be characterised as the overestimation of what can be accomplished immediately and the underestimation of long-term consequences.'
Strassman 1984: 199

Change is around us. As business executives, practitioners and consultants, we know that the engines that expedite change are run on information and technology. Now, like never before, business should act as a catalyst in embracing the powers of information technology and aligning the latter with the business strategies in order to compete in industries where the conventional rules are being shattered by these emerging forces.

We invite the business community, academics and consultants, from South Africa and abroad, to join us at the School of Business Leadership to put together a special issue on IT in which we will discuss topics on:

- Information and enterprise architecture
- IT and radical change
- Aligning business and IT strategies
- E-business, Internet strategies and issues
- Data security
- Trends in IT and/or telecommunications
- Emerging new technologies
- Knowledge management
- Data warehousing, data mining and business intelligence.

The main aim will be to provide critical perspectives on advanced information and communication technologies with an emphasis on their organisational and social implications and on management – particularly with respect to the African model. The Special Issue will be published in November 2000.

Through the material it publishes, the *Southern African Business Review* has always sought to make a significant contribution to the development of theory and practice – especially within the Southern African context. In this special issue devoted to the IT domain, we hope to present the Southern African business community with an opportunity to present and to share in the knowledge of this dynamic revolution. Issues of a more general nature will appear in a different section of the issue.

Please submit manuscripts to reach us not later than 31 August 2000 at any of the addresses below. (The normal house style is applicable and is available on request.)

Guest Editor

Professor René Pellissier

THE SOUTHERN AFRICAN BUSINESS REVIEW (SPECIAL ISSUE ON IT)

Graduate School of Business Leadership

University of South Africa

P.O. Box 392

Pretoria

0003

South Africa

Professor René Pellissier (Guest Editor and Manager: Research)

E-mail: pellir@alpha.unisa.ac.za

Tel: +27 11 652-0381 or +27 82 887-3481

AFRICA'S CENTURY: CHALLENGES FOR MANAGEMENT AND LEADERSHIP



Invitation and first call for papers

SOUTHERN AFRICA INSTITUTE FOR MANAGEMENT SCIENTISTS (SAIMS)
12th ANNUAL CONFERENCE
31 OCTOBER – 2 NOVEMBER 2000

HOSTED BY THE UNIVERSITY OF SOUTH AFRICA AND SPONSORED BY TOYOTA (SA)

SAIMS and the University of South Africa have pleasure in inviting scientists and all individuals interested in research and teaching in the Management Sciences to the 12th Annual Conference to be held from 31 October to 2 November 2000 at the Midrand Campus and Main Campus of the University of South Africa.

The theme of the conference is *Africa's Century: Challenges for Management and Leadership*. This theme is obviously linked to the idea of the 'African Renaissance', and the core objective of the conference is therefore to explore the role of management and leadership in developing the Southern African region and creating wealth on the African continent. The conveners particularly wish to emphasise the Afrocentric focus of the conference; they intend to invite as many participants as possible from countries all over Africa.

A broad theme was specifically chosen to encompass all the sciences affiliated to SAIMS and to afford participants from different fields in the Management Sciences the opportunity to present papers.

Conference Address:

The Conference Organiser
SAIMS 2000 Conference
Department of Business Management
University of South Africa
P O Box 392
Pretoria 0003
South Africa

Tel: 082 887-3494 or
082 442-5708
+27 11 652-0248
E-mail: hucon@icon.co.za
Fax: +27 11 652-0299 or
+27 12 429-3463/5/8

Conference 2000 organising committee:

Co-chairs:
Prof G.J.deJ. Cronjé
Prof M.A. Ferreira
Members:
Prof G.S. du Toit
Prof R. Pellissier
Coordinators:
Prof W.M.J. Hugo
Prof T. Brevis
Hospitality:
Helena Burger
Tel: +27 12 348-2133

Conference venue:

Registration and gala dinner:
Unisa Main Campus
Muckleneuk Hill
Pretoria

Conference activities:
Unisa Graduate School
of Business Leadership
1st Street extension
Midrand

Preliminary information

Conference fees

Category	Payment by 30 August	Payment after 30 August
SAIMS members	R700	R800
Non-members	R750	R850

Registration

Early registration will be available from 1 August 2000 by e-mail, on web site and by post. Full information and a detailed conference brochure with registration forms will be available at that date.

Presentation of papers

You are cordially invited to submit a proposal for a paper(s) to be presented at the conference. The relevant details are as follows:

- Proposals may be submitted in three categories:
 - Competitive papers
 - Poster presentations
 - Work in progress.
- The time available for a presentation is 30 minutes, including 10 minutes for questions.
- All papers will be reviewed blind. To facilitate this process, you are requested to kindly submit an abstract on the attached abstract form no later than **15 August 2000**. Please follow the procedure guidelines provided in the attached document carefully. This procedure applies to all categories.

In the competitive category, a full length paper will also have to be submitted by **15 September 2000**.

Abstract preparation

- Use single spacing on the abstract form provided and do not exceed the space provided.
- 12 point type only; Times New Roman preferred.
- Title should appear in capitals and be in bold at the top of the abstract.

- Author's surname first, followed by initials.
- Omit degrees and titles.
- Principal author to appear first.
- Underline the author(s) who will be presenting the paper.
- Name of the institution concerned, followed by the country, should be placed just below the title.
- Abbreviations must be spelt out in full at the first mention followed by the abbreviation in parenthesis.
- The abstract will appear in print exactly as it is submitted – do ensure that it is in a final format.
- Please use subtitles as indicated in the sample, (for example, Introduction, Method, Results and Conclusion).
- References to sources are not required.

Mailing instructions

Postal address:

The Conference Organiser
SAIMS 2000 CONFERENCE
Department of Business Management
University of South Africa
P.O. Box 392
Pretoria 0003
South Africa
E-mail: hucon@icon.co.za