

Southern African Business Review – July 2001

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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.

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Note from the editor

"The big challenge in creating the future is not predicting the future. It is not as if there is one future out there that is going to happen, and that the only challenge is trying to predict which of the potential futures will actually be the right one. Instead, the goal is to try to imagine a future that we can create."

Gary Hamel

The quotation from Gary Hamel signifies to me the vastly complex platform on which the business and management sciences are based. And the enormous task that falls to academia in our endeavours to create a sustaining theory. Moreover, Gary elegantly warns that whatever we propose can serve only to produce a snapshot at some moment in time within the multiple cases and scenarios one may build for current and future business situations. The solution must be viable and, really, it must be simple enough for us to be able to create.

Modern management theory is globalised, and one might rightly question its applicability and value (apart from a generic one) to Southern Africa. It has always been the aim of the *Southern African Business Review* to partner in applications and theories that are unique to our specific problems and customs. Moreover, the Southern African business arena is in a state of ferment, waiting to be nurtured in order to grow. We can make that change happen.

This issue represents collaboration among a broad spectrum of academics and consultants in Southern Africa and abroad, in order to imagine that right future that Gary says we should be able to create. The issue covers aspects of risk management and volatile markets in contributions by Steven Briers & Gawie du Toit and Petrus Potgieter respectively. There are two contributions on information technology and the Web from international authors (Marguerite Cronk & Graham Fry and Dan Remenyi). From the University of Pretoria comes an alternative mechanism to the systems approach in management, and Okker Jordaan provides a consultant's perspective in his research on supply chain models. Arien Strasheim shares her research on the business school industry.

In the previous issue (December 2000), we introduced a section for 'invited papers'. In this issue, we include an 'article for the specialist' – 'Emulating the Black & Scholes model with a neural network', by L.J. le Roux & G.S. du Toit. The continuous time lognormal approach to European option pricing was first developed by Black & Scholes in 1973. In 1983, Garman and Kohlage extended the model to currencies. Scholes formed a company called Long-term Capital Management in the US based on his ideas. The focus was on leveraged spread and convergence trades. However, with the Russian and Latin American crises triggering flight to quality in 1998, spreads widened and the liquidity dried up. The company lost about \$4 billion. Readers may be interested to know that Scholes won a Nobel prize for his view of continuous pricing and the model he developed. In his acceptance speech, he honoured his deceased former colleague, Black, whom he believed had contributed enormously to the success of the model. One of the main shortcomings mentioned in literature of the Black & Scholes model is its assumption that domestic and foreign rates are constant over the option's life – a very suspicious assumption indeed, since exchange rates are often closely connected to interest rate movements, and even more so in the case of options on interest rate futures. If interest rates were constant, there would be little need for a product to hedge interest rate risks.

The issue concludes with the first of a two-part series on the work of the South African Essential Services Committee, by former committee chairperson, Dhaya Pillay.

We are glad to report that the *Southern African Business Review* has now joined the vast world of the web, and you may find us at www.sabusinessreview.co.za

My appreciation to everyone who contributed to this issue. I conclude with T.S. Eliot's repeated warning in the *Wasteland* (1922):

"Hurry up, it is time."

Enjoy reading.

René Pellissier
Editor

July 2001, Midrand

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Assessing recent rand volatility

P.H. Potgieter*

Weakness of the rand with respect to the United States (US) dollar is compared with the position of other currencies, with special focus on the Australian dollar. The general perception that the rand is losing its purchasing power abroad is addressed by using the inflation rate differential to recompute the historical exchange rate time series for the US and Australian dollars. The effect of socio-political change in South Africa is also considered briefly.

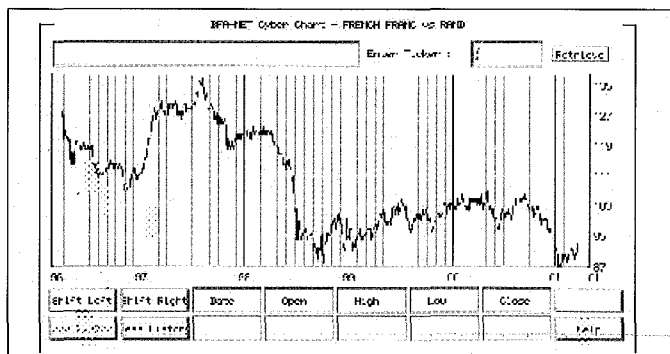
Introduction

The South African rand has lost some 19% of its value in terms of the US currency over the year to mid-March 2001, declining from a value of \$0.153 to \$0.125 and causing considerable despondency among members of the newspaper-reading and investing public. This paper will attempt to assess whether there are valid grounds for this negative response. The general perception that the rand is losing its purchasing power abroad will also be addressed by factoring the inflation rate differential into an exchange rate time series for the US and Australian dollars.

Context and comparison

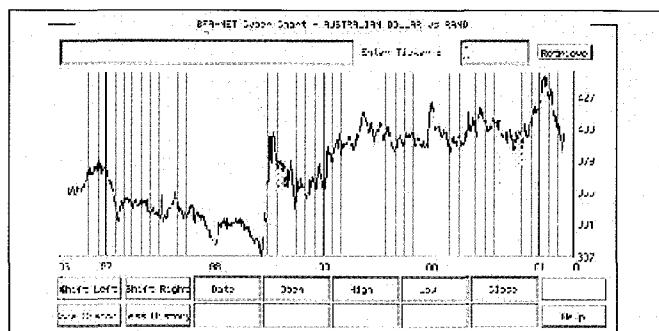
The rand has not been the only currency to have received a battering since late 2000. In the week ending 23 March 2001, the following currencies all reached a new record low against the US dollar (Bloomberg 2001; *Business Day* 2001): the South African rand, Brazilian real, Swedish krona and South Korean won (for the won, 29-month low only). Figure 1 shows the rand in French franc (FF) terms, the y-axis being in centimes, (hundredths of a FF) (McGregor-BFA 2001a). Since the start of 1999, the FF has been a proxy for the euro (at 6.559198FF to the euro), and the figure shows that the rand had been fairly stable against the euro since the emerging market crisis of 1998. Considering the inflation differential of more than 5% between South Africa and the euro zone, this indicates a moderately strong appreciation of the rand over this period with respect to the euro and its proxy currencies (including the Deutschmark).

South Africa's traditional rival in the sporting arena, Australia, has also seen its currency sink to all-time lows against the US dollar during the first quarter of 2001. Figure 2 shows the value of the Australian dollar (A\$) in terms of South African cents (McGregor-BFA 2001b). Again, there has been reasonable stability since the 1998 crisis, and even a modest



Source: McGregor-BFA 2001a
Figure 1. French franc (x 100) per South African rand

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Assessing recent rand volatility



Source: McGregor-BFA 2001b
Figure 2. South African rand (x 100) per Australian dollar

appreciation of the rand during the first quarter of 2001 – the Australian dollar fared even worse than the rand during this period. Moreover, over the past four years, the depreciation of the rand against the Australian dollar has been only around 10%, much less than would be accounted for by the inflation rate differential of just more than 5% per annum (Table 1). The Australian dollar has therefore lost significant ground even against the much-maligned rand. The New Zealand dollar has been similarly affected.

The position of the rand *vis-à-vis* several other major currencies is similar. The correct way of looking at the headline-grabbing rand/dollar exchange rate is therefore not in terms of rand weakness but as a complex picture involving dollar (and sterling, it must be added) strength as driving factors. Since much of South Africa's trade is denominated in dollars, and the United Kingdom (UK) is an important trading partner, dollar and sterling strength should not be ignored. However, South Africa has a trade surplus with the rest of the world (South African Revenue Service 2001), and a stronger dollar therefore translates into more rands earned from South Africa's total import and export activity.

South Africa and Australia

Since the technology-fuelled equities boom in the US and elsewhere during the 1990s, South Africa and Australia have been dismissed as 'old economy' countries – exporters of commodities and little else. The downturn of late 2000 and 2001 has also not been favourable to these two offshoots of the British Empire. A worldwide economic downturn is expected to lower demand for the commodities in which South Africa and Australia trade. There is even worse news, however; according to Claudio Piron, treasury economist at Standard Chartered in London, South Africa and Australia are likely to suffer as a result of acting as proxy currencies for less tradable currencies in their respective regions (Reuters 2001). The dismal tango of the two currencies is illustrated in Figure 2.

P.H. Potgieter is a professor in the Department of Quantitative Management, University of South Africa (e-mail potgiph@unisa.ac.za).

Table 1. Real (CPI adjusted, base March 2001) rand value of A\$1

Date	Rand/A\$	Austalian CPI *	South Africa CPI*	CPI factor	Real Rand/A\$ rate
1996-08-30	3.54	120.0	79.2	1	4.25
1996-09-30	3.58	120.1	79.9	0.991789	4.26
1996-10-31	3.72	120.2	80.2	0.988629	4.41
1996-11-29	3.73	120.2	81.0	0.979407	4.38
1996-12-31	3.72	120.3	77.7	1.021569	4.56
1997-01-31	3.47	120.7	82.0	0.971221	4.04
1997-02-28	3.47	120.6	82.5	0.964533	4.02
1997-03-27	3.45	120.5	83.0	0.957926	3.96
1997-04-30	3.47	120.5	83.7	0.950187	3.96
1997-05-30	3.40	120.4	84.0	0.945479	3.86
1997-06-30	3.42	120.2	84.2	0.941923	3.86
1997-07-31	3.43	119.5	85.1	0.926537	3.81
1997-08-29	3.50	119.6	85.2	0.926222	3.89
1997-09-30	3.38	119.7	85.6	0.922664	3.74
1997-10-31	3.40	119.8	86.0	0.919143	3.75
1997-11-28	3.29	119.9	85.7	0.923128	3.64
1997-12-31	3.18	120.0	86.0	0.920674	3.51
1998-01-30	3.31	119.8	86.7	0.911989	3.62
1998-02-27	3.32	120.1	86.9	0.911652	3.63
1998-03-31	3.32	120.3	87.5	0.907153	3.61
1998-04-30	3.27	120.8	87.9	0.906781	3.56
1998-05-29	3.21	120.9	88.3	0.903419	3.48
1998-06-30	3.61	121.0	88.6	0.901104	3.90
1998-07-31	3.78	120.9	90.7	0.879525	3.99
1998-08-31	3.65	121.1	91.7	0.871365	3.82
1998-09-30	3.48	121.3	93.3	0.857832	3.58
1998-10-30	3.54	122.0	93.7	0.858865	3.65
1998-11-30	3.63	121.9	93.7	0.85863	3.74
1998-12-31	3.60	121.9	93.7	0.858395	3.71
1999-01-29	3.78	121.5	94.4	0.849009	3.85
1999-02-26	3.91	121.6	94.4	0.850169	3.99
1999-03-31	3.95	121.8	94.4	0.851331	4.03
1999-04-30	3.98	121.6	94.6	0.847942	4.05
1999-05-31	4.09	121.9	94.5	0.851376	4.18
1999-06-30	3.97	122.3	95.0	0.849427	4.05
1999-07-30	4.00	122.9	95.1	0.852943	4.09
1999-08-31	3.86	123.2	94.7	0.858162	3.97
1999-09-30	3.92	123.4	95.1	0.856165	4.03
1999-10-29	3.96	123.4	95.3	0.854175	4.06
1999-11-30	3.92	123.7	95.5	0.854897	4.02
1999-12-30	4.23	124.1	95.8	0.854731	4.34
2000-01-31	4.08	124.5	96.9	0.848009	4.15
2000-02-29	3.89	124.9	96.6	0.852901	3.98
2000-03-31	3.97	125.2	97.6	0.846404	4.03
2000-04-28	3.97	123.2	98.9	0.821673	3.91
2000-05-31	4.09	124.7	99.3	0.828399	4.06
2000-06-30	4.09	126.2	100.8	0.82608	4.05

Date	Rand/A\$	Australian CPI *	South Africa CPI*	CPI factor	Real Rand/A\$ rate
2000-07-31	4.09	130.6	101.2	0.851724	4.18
2000-08-31	3.97	130.8	101.7	0.848399	4.04
2000-09-29	3.99	130.9	102.0	0.846764	4.05
2000-10-31	4.00	131.0	102.2	0.84596	4.06
2000-11-30	4.08	131.2	102.5	0.844349	4.13
2000-12-29	4.22	131.3	103.8	0.834623	4.23
2001-01-31	4.30	131.5	104.1	0.833736	4.30
2001-02-28	4.05	131.8	104.3	0.833656	4.05
2001-03-30	3.97	132.0	104.5	0.833575	3.97
Average annual CPI increase: A\$ – 2.21%; Rand – 7.51%					

* Interpolated between quarter endings for Australia and for March 2001 for both countries

Source: Statistics South Africa 2001; US Bureau of Labor Statistics 2001; McGregor-BFA 2001b

The question, however, is why the rand has been doing slightly better than the Australian dollar. Using macroeconomic arguments to explain even medium-term exchange rate tendencies is an act of bravery, but one fact at least stands out in a macroeconomic comparison of South Africa and Australia: South Africa appears to have been more successful in shifting its exports from commodities to manufactured goods. According to the World Bank (2001), in 1998 only 29% of Australia's exports (by value) were of manufactured goods; the comparable figure for South Africa was 54%. Even more striking is the fact that South Africa has managed to achieve this from a base of 18% in 1980, compared to 22% for Australia in that year. While these conditions prevail, it is reasonable to expect South Africa's currency to continue performing somewhat better than Australia's, although at this stage what is good for the one will probably still be good for the other of these two Indian Ocean nations, and both might benefit from a future upturn in the world economy that increases the demand for their commodity exports.

Purchasing power parity

It is clear, even to the casual observer, that foreign exchange rates in the short term are largely news-driven. Purchasing power parity (PPP) must be the oldest theory addressing exchange rate values in the medium to longer term. The idea behind PPP is that similar goods should, short-term fluctuations aside, have similar prices all over the world. A revised version of the PPP hypothesis, relative PPP (RPPP), hypothesises that a currency exchange rate will in the medium to long term adjust itself so as to maintain the real (inflation-adjusted for both currency areas) exchange rate.

Having a coffee

Large variations from the PPP exchange rate values are observed in the world, however, not least by the South African tourist ordering a coffee in London. *The Economist* publishes a popular comparison of purchasing power of the local currency all over the world (Table 2) using a McDonalds BigMac hamburger as a proxy for an identical basket of goods. The premise is that the BigMac is a highly uniform product, the production of which requires inputs from a broad range of industries (such as agriculture, building, power, paper, manufacturing) and services. The January 2001 BigMac index values shown here paints an unflattering picture of the rand's purchasing power, but it is again worth noting that many countries (including well-developed ones like Malaysia,

Hungary and the Special Administrative Region of Hong Kong) are in a comparable position.

There is one rather obvious explanation for the large deviations from PPP values in the medium term, which is simply that commonly traded goods in different currency areas are really not comparable. By the time that a product is bought or consumed, it has already acquired an invisible layer of socioeconomic values pertaining in the country where the consumption takes place. When you consume a coffee in London, for example, you are not paying only for a hot beverage. You are also paying for such expenses as the relatively decent salary of the waiters, for their unemployment benefit should they lose their position, for an extensive public transport system, for the UK public health system, for membership of the European Community and its associated costs. A coffee in Johannesburg, Budapest or Bangkok is a much more simple affair. Expressed differently, the social benefits of the Johannesburg, Budapest or Bangkok coffee are a fraction of the social benefits of a London coffee, and these are incorporated in the price. The social benefits impact mostly via employee salaries and taxes but there is a compounding effect since the same is true for all non-imported products and services associated with the London coffee.

One further remark about PPP is in order. It often does not hold even within a single country, and this does not cause much concern. Neither should it be cause for alarm when PPP does not hold between different countries. *The Economist's* BigMac index tacitly acknowledges this by taking the US price of the BigMac as an average of the price in four different cities. As anyone even slightly familiar with the US knows, a range of products and services are much more expensive in New York City than elsewhere. The reasons for this are understood and reflect the argument above.

Socio-political change

South African society has experienced immense changes since the 1960s, and especially since 1994. The political changes of the 1990s have been the most obvious and have been followed by the world media with great interest, but the real change from an economic point of view has been taking place at a gradual (although accelerated since 1994) pace over the second half of the 20th century, and, if seen dispassionately, the political changes also lie in this context. The fundamental change has been the large-scale entry of black people, mainly, (but also women and poor Afrikaners) into the workforce of

Table 2. BigMac index

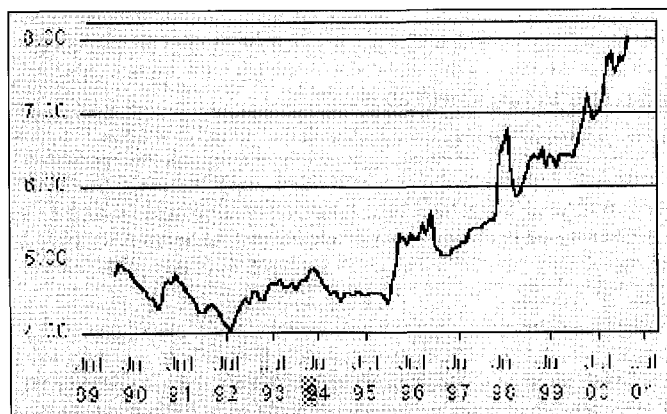
Country	BigMac price (US\$) 8 January 2001	Currency under (-) or over (+) valuation
Israel	3.52	+ 38%
Britain	2.99	+ 17%
US (average of 4 cities)	2.55	0%
Japan	2.53	-1%
Argentina	2.50	-2%
Euro area	2.44	-4%
South Korea	2.37	-7%
Chile	2.19	-14%
Mexico	2.15	-16%
Taiwan	2.14	-16%
Singapore	1.85	-27%
Egypt	1.63	-36%
Indonesia	1.53	-40%
Brazil	1.51	-41%
Poland	1.34	-47%
Hong Kong	1.31	-49%
Thailand	1.28	-50%
Hungary	1.25	-51%
China	1.20	-53%
Malaysia	1.19	-53%
South Africa	1.19	-53%
Philippines	1.06	-58%

Source: Economist 2001

the formal economy, which has enabled South Africa to expand its economy significantly through the greater and more efficient mobilisation of labour. Black workers' wages started increasing faster than those of white workers in 1970 (Bundy 1992), and this date should be considered a milestone in South African economic history.

A snapshot of the South Africa economy in the 1960s and even 1970s would have revealed a system where almost all the wealth generated accrued to a group of about 3.5 million people enjoying a range of excellent social benefits: good free schools and cheap universities, guaranteed employment in the state sector at middle-class salaries, an excellent urban

Figure 3. Inflation adjusted South African rands per US dollar, baseline March 2001



Source: Tables 3 and 4

infrastructure and access to recreational facilities better than almost anywhere in the world. All this was paid for by high taxes on the rich – in 1975 the top income tax rate was 66% (Fraser Institute 2000) – and on companies and by the high levels of state violence needed to suppress the disadvantaged majority. In other words, a Sweden with a kink.

Looking at South Africa again in the early years of the 21st century, we find a society where roughly 20 million people (including workers and their dependents) are engaged in and competing on a more or less equal footing in the formal economy, with modest wages and quite modest levels of social benefits from the state. General public education is inadequate, health services are not particularly good, poverty relief is virtually non-existent and large parts of the infrastructure and recreational facilities have been privatised. Of course, in most areas, services are better for the majority than they were before 1994, but the social services and benefits available to the citizens of this 21st century nation are vastly inferior to those enjoyed by the 3.5 million inhabitants of the pseudo-Sweden of the 1960s and 1970s.

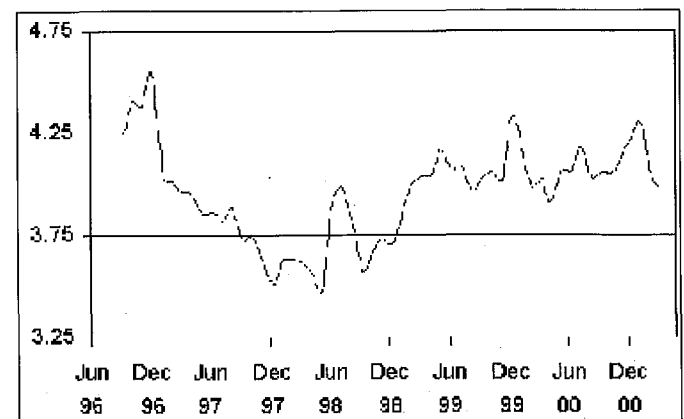
It should not therefore come as much of a surprise that South Africa in the 1960s and 1970s enjoyed a Scandinavian exchange rate, on a par with developed countries, which declined during the 1980s and 1990s up until the present to an exchange rate characteristic of a developing nation and comparable with that of countries like Malaysia or Thailand. It is a logical consequence of the continuing development of South African society and should not be seen as a negative reflection on the state of the nation.

Relative purchasing power

While we have discussed the transition of the rand from a currency characteristic of a small 'developed' nation (really an archipelago of privilege) to that of a much larger emerging economy, it is worth looking at the variant of the PPP hypothesis that takes inflation rate differences into account – relative purchasing power parity.

Time value of money is a generally well-understood idea, but is not very often brought into a discussion of exchange rate time series, even though a comparison of the 1995 rand price of one US dollar to the 2001 price is nonsensical due to the fact that a 1995 rand is not the same as a 2001 rand, and a 1995 greenback is different from its counterpart in 2001. (It is

Figure 4. Inflation adjusted SA rands per Australian dollar, baseline March 2001



Source: Table 1

tantamount to comparing apples and pears.) What one should really do is to compare the purchasing power of the 1995 equivalent of R1 today to the purchasing in the US of R1 in today's money.

This can be done in a fairly straightforward way. If L_t is the consumer price index (CPI) in South Africa at time t and L_t the foreign CPI, and we are at time T considering the exchange rate of the foreign currency in terms of rand back to time $t = 0$, let us define a CPI factor K_t at time t by

$$K_t = \frac{F_t}{F_0} \cdot \frac{L_0}{L_t}$$

which is the ratio needed to convert the nominal exchange rate at time T to a real exchange rate at time t . If the nominal exchange rate at time t is X_t rand per unit of foreign currency, then the real exchange rate Y_t (relative to time T) is given by

$$Y_t = \left(K_t \cdot \frac{1}{K_T} \right) X_t.$$

Table 3. Real (CPI adjusted, base March 2001) rand value of US\$1 (1990 – 1995)

Date	Rand/US\$	US CPI	South African CPI	CPI factor	Real Rand/US\$ rate
1990-02-28	2.55	128.0	40.3	1.0000	4.81
1990-03-30	2.65	128.7	40.9	0.9907	4.95
1990-04-30	2.66	128.9	41.3	0.9826	4.93
1990-05-30	2.65	129.2	41.7	0.9755	4.87
1990-06-29	2.65	129.9	42.0	0.9738	4.87
1990-07-31	2.59	130.4	42.3	0.9706	4.74
1990-08-31	2.57	131.6	43.0	0.9636	4.67
1990-09-28	2.56	132.7	43.7	0.9561	4.61
1990-10-31	2.54	133.5	44.0	0.9553	4.58
1990-11-30	2.52	133.8	44.9	0.9382	4.46
1990-12-28	2.56	133.8	45.2	0.9320	4.50
1991-01-31	2.54	130.7	45.7	0.9004	4.31
1991-02-28	2.56	134.6	46.3	0.9153	4.42
1991-03-28	2.73	135.0	46.7	0.9101	4.69
1991-04-30	2.78	135.2	47.4	0.8980	4.71
1991-05-30	2.8	135.6	48.1	0.8876	4.69
1991-06-28	2.88	136.0	48.4	0.8847	4.80
1991-07-31	2.86	136.2	49.0	0.8751	4.72
1991-08-30	2.87	136.6	49.7	0.8653	4.68
1991-09-30	2.8	137.2	50.4	0.8571	4.52
1991-10-31	2.83	137.4	51.3	0.8433	4.50
1991-11-29	2.79	137.8	51.8	0.8376	4.41
1991-12-31	2.74	137.9	52.6	0.8254	4.26
1992-01-31	2.8	136.2	53.1	0.8076	4.26
1992-02-28	2.84	138.1	53.6	0.8112	4.34
1992-03-31	2.87	139.3	54.0	0.8122	4.40
1992-04-30	2.87	139.5	54.7	0.8029	4.35
1992-05-29	2.83	139.7	55.1	0.7983	4.26
1992-06-30	2.77	140.2	55.7	0.7925	4.14
1992-07-31	2.76	140.5	56.2	0.7871	4.10
1992-08-31	2.73	140.9	56.8	0.7810	4.02
1992-09-30	2.81	141.3	57.2	0.7778	4.12
1992-10-30	2.95	141.8	57.3	0.7791	4.33
1992-11-30	3.02	142.0	57.6	0.7762	4.42
1992-12-31	3.05	141.9	57.6	0.7756	4.46
1993-01-29	3.07	140.3	58.2	0.7590	4.39
1993-02-26	3.14	142.6	58.4	0.7688	4.55
1993-03-31	3.17	143.6	59.2	0.7637	4.56
1993-04-30	3.16	144.0	60.8	0.7457	4.44
1993-05-28	3.17	144.2	61.0	0.7443	4.45
1993-06-30	3.32	144.4	61.3	0.7417	4.64
1993-07-30	3.37	144.4	61.8	0.7357	4.67
1993-08-31	3.37	144.8	62.1	0.7341	4.66
1993-09-30	3.43	145.1	62.3	0.7333	4.74
1993-10-29	3.35	145.7	62.8	0.7305	4.61
1993-11-30	3.36	145.8	62.9	0.7298	4.62
1993-12-31	3.39	145.8	63.1	0.7275	4.65

Date	Rand/US\$	US CPI	South African CPI	CPI factor	Real Rand/US\$ rate
1994-01-31	3.42	144.5	64.0	0.7109	4.58
1994-02-28	3.47	146.2	64.2	0.7170	4.69
1994-03-31	3.48	147.2	64.6	0.7174	4.71
1994-04-29	3.52	147.4	65.0	0.7140	4.74
1994-05-30	3.63	147.5	65.4	0.7101	4.86
1994-06-30	3.65	148.0	65.8	0.7082	4.87
1994-07-29	3.67	148.4	66.8	0.6994	4.84
1994-08-31	3.58	149.0	67.8	0.6919	4.67
1994-09-30	3.56	149.4	68.6	0.6857	4.60
1994-10-31	3.5	149.5	68.9	0.6832	4.51
1994-11-30	3.55	149.7	69.1	0.6821	4.57
1994-12-30	3.54	149.7	69.3	0.6801	4.54
1995-01-31	3.53	148.2	70.2	0.6647	4.42
1995-02-28	3.59	150.3	70.5	0.6712	4.54
1995-03-31	3.59	151.4	71.3	0.6685	4.53
1995-04-28	3.61	151.9	72.2	0.6624	4.51
1995-05-31	3.67	152.2	72.5	0.6610	4.57
1995-06-30	3.63	152.5	72.4	0.6632	4.54
1995-07-31	3.63	152.5	72.8	0.6595	4.51
1995-08-31	3.65	152.9	73.0	0.6594	4.54
1995-09-29	3.64	153.2	73.1	0.6598	4.53
1995-10-31	3.64	153.7	73.3	0.6602	4.53
1995-11-30	3.66	153.6	73.5	0.6580	4.54
1995-12-29	3.63	153.5	74.1	0.6522	4.46

Source: US Bureau of Labor Statistics 2001; Statistics South Africa 2001; McGregor – BFA 2001c

Table 4. Real (CPI adjusted, base March 2001) rand value of US\$1 (1996–2001)

Date	Rand/US\$	US CPI*	South African CPI*	CPI factor	Real Rand/US\$ rate
1996-01-31	3.65	152.4	75.0	0.6398	4.40
1996-02-29	3.85	154.4	75.1	0.6473	4.70
1996-03-29	3.98	155.7	75.7	0.6476	4.86
1996-04-30	4.39	156.3	76.2	0.6458	5.35
1996-05-31	4.36	156.6	76.7	0.6428	5.28
1996-06-28	4.32	156.7	77.4	0.6374	5.19
1996-07-31	4.47	157.0	78.0	0.6337	5.34
1996-08-30	4.47	157.3	79.2	0.6253	5.27
1996-09-30	4.52	157.8	79.9	0.6218	5.30
1996-10-31	4.69	158.3	80.2	0.6214	5.50
1996-11-29	4.6	158.6	81.0	0.6165	5.35
1996-12-31	4.67	158.6	77.7	0.6427	5.66
1997-01-31	4.56	156.9	82.0	0.6024	5.18
1997-02-28	4.48	159.1	82.5	0.6072	5.13
1997-03-27	4.42	160.0	83.0	0.6069	5.06
1997-04-30	4.44	160.2	83.7	0.6026	5.04
1997-05-30	4.47	160.1	84.0	0.6001	5.06
1997-06-30	4.53	160.3	84.2	0.5994	5.12
1997-07-31	4.61	160.5	85.1	0.5938	5.16
1997-08-29	4.69	160.8	85.2	0.5942	5.25
1997-09-30	4.67	161.2	85.6	0.5929	5.22
1997-10-31	4.84	161.6	86.0	0.5916	5.40
1997-11-28	4.85	161.5	85.7	0.5933	5.43
1997-12-31	4.86	161.3	86.0	0.5905	5.41
1998-01-30	4.94	160.5	86.7	0.5828	5.43
1998-02-27	4.94	161.6	86.9	0.5855	5.45
1998-03-31	5.03	162.2	87.5	0.5836	5.54
1998-04-30	5.05	162.5	87.9	0.5820	5.54
1998-05-29	5.15	162.8	88.3	0.5805	5.64
1998-06-30	5.89	163.0	88.6	0.5792	6.43
1998-07-31	6.15	163.2	90.7	0.5665	6.57
1998-08-31	6.41	163.4	91.7	0.5610	6.78

Date	Rand/US\$	US CPI	South African CPI*	CPI factor	Real Rand/US\$ rate
1998-09-30	5.86	163.6	93.3	0.5521	6.10
1998-10-30	5.64	164.0	93.7	0.5511	5.86
1998-11-30	5.69	164.0	93.7	0.5511	5.91
1998-12-31	5.86	163.9	93.7	0.5507	6.08
1999-01-29	6.07	163.0	94.4	0.5436	6.22
1999-02-26	6.17	164.3	94.4	0.5480	6.38
1999-03-31	6.18	165.0	94.4	0.5503	6.41
1999-04-30	6.10	166.2	94.6	0.5531	6.36
1999-05-31	6.25	166.2	94.5	0.5537	6.52
1999-06-30	6.03	166.2	95.0	0.5508	6.27
1999-07-30	6.17	166.7	95.1	0.5519	6.42
1999-08-31	6.10	167.1	94.7	0.5555	6.39
1999-09-30	5.99	167.9	95.1	0.5559	6.28
1999-10-29	6.14	168.2	95.3	0.5557	6.43
1999-11-30	6.14	168.3	95.5	0.5549	6.42
1999-12-30	6.15	168.3	95.8	0.5531	6.41
2000-01-31	6.27	166.6	96.9	0.5413	6.40
2000-02-29	6.32	168.8	96.6	0.5502	6.56
2000-03-31	6.5	171.2	97.6	0.5523	6.77
2000-04-28	6.74	171.3	98.9	0.5453	6.93
2000-05-31	7.08	171.5	99.3	0.5438	7.26
2000-06-30	6.81	172.4	100.8	0.5385	6.91
2000-07-31	6.94	172.8	101.2	0.5376	7.03
2000-08-31	6.97	172.8	101.7	0.5350	7.03
2000-09-29	7.24	173.7	102.0	0.5362	7.32
2000-10-31	7.63	174.0	102.2	0.5360	7.71
2000-11-30	7.78	174.1	102.5	0.5348	7.84
2000-12-29	7.58	174.0	103.8	0.5278	7.55
2001-01-31	7.91	172.2	104.1	0.5208	7.77
2001-02-28	7.74	175.1	104.3	0.5286	7.71
2001-03-30	8.03	176.2	104.6	0.5304	8.03

* Estimated for March 2001

Source: US Bureau of Labor Statistics 2001; Statistics South Africa 2001; McGregor-BFA 2001c

The calculation of Y_t has been done for the US dollar from February 1990 to March 2001 using South African CPI (Statistics South Africa 2001) and US urban CPI (US Bureau of Labor Statistics 2001), and the results are displayed in Tables 3 and 4. As the graph of Y_t (Figure 3) shows, there has indeed been a real decline of the value of the rand against the US currency since 1990 of about 40%. Most of this decline has taken place since the emerging market crisis of mid-1998; bearing in mind that the rand is at the same time both a commodity currency (like the Australian dollar) and an emerging market currency (like the Brazilian real or Thai baht), both of which categories are out of favour at the moment, it may well recover much of the real ground it has lost against the dollar since 1998. It should be noted that the loss in US dollar purchasing power of the rand, illustrated in Figure 3, is of a much smaller magnitude than the author believes to be the perception of the general investing public.

The calculation of a time series Y_t was also effected for the Australian dollar from August 1996 to March 2001 (Table 1). Over this period a decline in the real value of the rand *vis-à-vis* the Australian dollar has been non-existent. If anything, the trend is of a slightly strengthening rand (Figure 4).

Conclusion

There are a number of factors other than headline news impacting on the rand/dollar exchange rate level. Some

factors are global, such as the commodity exporter's dilemma that South Africa shares with Australia, and others are local, such as the positive changes that have taken place in the South African society and economy over the past decades, especially since the early 1990s. The real purchasing power of the rand in US dollar terms has indeed declined since 1990 in terms of the US and South African consumer price indices, but this decline has been to a much smaller extent than is generally believed. Compared to the Australian dollar in terms of relative purchasing power, the rand has actually strengthened since 1996.

Time will tell whether South Africa succeeds in fully exploiting the opportunities offered to it in the global marketplace as it adjusts to its new place in the world, but fretting over the level of the currency with respect to the US dollar is unproductive and unnecessary.

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The DNA of risk: the development of an integrated model of risk

Steven Briers* & G.S. du Toit†

The idea of integrating risk precepts is fundamental to the development of enterprise-wide risk management. It is argued that integration is necessary in order to deal with the richness and complexity of risks in the modern business environment. A lack of integration will perpetuate an incomplete approach to managing risk.

A new model of risk is developed that spans all four schools of risk management: pure risk, financial risk, corporate failure and risk-taking. The fundamental difference between the new model and other existing approaches is its ability to generate integrated risk management processes. The integration process does not begin at an organisational level (although this is a probable by-product and is to be encouraged), but rather in the technicalities of identifying, interpreting and intervening in risk.

The evolution of risk management

Every so often, an idea emerges in the business world that seems so logical that it sets in motion an indisputable momentum towards its fulfilment. The concept of 'enterprise-wide risk management' is one such idea. Building the capability to confront all types of risk within every part of an enterprise seems such a sensible goal that it is difficult to challenge its logic.

Many companies are struggling to understand the concept of enterprise-wide risk management, however, let alone implement it. Even risk professionals are engaged in rigorous debate about how to build frames of reference for this concept of 'one balance sheet, one risk management strategy'. Some of the reasons for these difficulties are evident in the different perspectives of risk, the functional silos that prevail in the risk management field, and corporate culture differences between different kinds of risk practitioner. These factors often make the idea of enterprise-wide risk management a noble but elusive ambition.

Despite the difficulties involved, there is no doubt that there is considerable momentum within business to develop a common approach to risk management. Business is frustrated with the fragmentation and duplication that prevails in risk management programmes and is looking for a common risk management process that can confront every kind of risk facing the enterprise, whether it is currency exchange rate volatility, an e-commerce liability or brand name sabotage, to name but a few examples.

The business world desires a holistic, consistent and integrated model of risk management that will satisfy the modern enterprise's total need to respond to risk. It looks for consistent methodologies and measurement parameters for the identification, assessment and management of risk across the complete spectrum of the enterprise's activity. It may be asked, however, why this concept of enterprise-wide risk management has emerged as an important dimension of modern business.

In the first instance, the increasing sophistication of business has changed the risk profile of most corporate enterprises. The patterns of vulnerability, dependency and

criticality have changed in business and have become more complex. Twenty years ago, for example, most of a company's computing power was to be found in a main-frame computer suite in a head-office building. Nowadays, most of a company's computing power is contained in networks, so the risks are more widespread and diverse. Facets of modern business that we now take for granted – such as e-commerce, an increasing component of foreign trade in the sales portfolio, more competitors, shorter product life cycles, greater reliance upon intellectual capital, and numerous other variables – have created more complex risk profiles in most modern business enterprises. Risk management strategies have not always kept pace with these changes in business. Every node of change in business brings with it new dimensions of uncertainty that need to be managed.

A second driver behind the enterprise-wide movement, and one that is related to the previous idea of changing risk profiles, is the 'interconnectedness' of risks. In previous times, there was no great need for various types of risk manager to work together on risk problems. Indeed, they were probably hardly aware of one another in most cases. There is a growing realisation now that the risks in one part of an enterprise are very likely to impact on other parts of the enterprise. Risks do not, in most cases, behave in isolation. For example, a negative impact on cash flow can change the machinery breakdown risk profile. An environmental liability can change investor confidence. Fluctuations in equity markets can change the demand patterns for the products of the business. Currency exchange rate volatility can impact upon the cost of manufacturing and influence operating cost efficiency risk. A risk manager in one function – whether treasury, internal audit, insurance or loss prevention – can no longer act in isolation from his or her counterparts. The growing recognition that risk management must be aligned with the business strategy has also shifted much of the accountability for managing risk from risk professionals to board directors.

The changes taking place in the field of corporate governance provide a third driver towards the process of integrating disparate risk strategies into a single enterprise-wide system. The much-publicised Turnbull Report of 1999

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(Institute of Chartered Accountants in England and Wales 1999), which has now become the combined code of internal control required of companies listed on the London Stock Exchange, has done much to further the cause of enterprise-wide risk management. The fundamental shift that the Turnbull code makes is to require that companies report to shareholders on their key risks in addition to reporting on the adequacy of internal controls. Moreover, the code requires a company to carry out an annual review of key risks that it faces. The code does not specify the types of risks that should be noted, but it does not confine itself to financial risk. There is an implicit assumption that the types of risk that would be of interest to shareholders are without boundaries. The intention of the combined code on risk is to provide assurance to shareholders that embedded internal controls and risk management measures have been put in place to safeguard and enhance shareholder value.

A fourth impetus to the enterprise-wide risk movement is the convergence of risk finance instruments on a number of fronts. Within corporate enterprises, for instance, insurance officers are collaborating more regularly with treasury officers. As they explore how insurance facilities (such as captive insurance companies) and treasury facilities (such as hedging arrangements) can be combined to address business problems, so the process of enterprise-wide risk management grows.

Commercial insurance is a mature commodity; however, the field is being rejuvenated by integrating insurance and capital market instruments. New forms of risk finance protection (such as catastrophe bonds; multiple hedge portfolios and back-to-back pledges) are applied to a wider range of business risks than conventional insurance would allow. This widening of the risk spectrum has the dual effect of bringing diverse solution providers together and of creating new solutions to business risks.

Despite these developments, corporate enterprises are still puzzled by the dazzling array of disparate risk management techniques on offer, each purporting to be an enterprise-wide

solution but actually operating only within a narrow band of the risk spectrum.

Is the solution to developing an enterprise-wide risk management system an organisational one? If a business were to combine or integrate its various risk managers and programmes into a single organisational entity, would this constitute 'enterprise-wide risk management'? In a word – no. At the core of the problem are the frames of reference for the concept of risk.

Large enterprises typically employ a number of risk practitioners with different perspectives on risk. To the pure risk or insurance risk practitioner, risk management is focused on sudden and unforeseen events. To the financial risk manager, risk management is a matter of responding to volatility, correlation and aggregation. To the strategic planner, risk has to do with management decisions under conditions of uncertainty. Internal and external auditors, who are increasingly adopting a risk-based approach to their work, view risk predominantly in the control environment, with an emphasis on compliance and non-conformance issues. There are many other viewpoints on risk, from corporate failure to risk-taking strategies.

This organisational fragmentation results in an inconsistency in the reporting and measurement of risk. There is the problem, too, that certain risks (especially emerging ones, such as e-commerce liabilities) are overlooked or underestimated by formalised risk management processes. Risk management systems and risk finance solutions are also often applied in a manner that lacks awareness of the enterprise's complete risk profile.

Could a process of organisational development correct these anomalies? It seems unlikely. Although better quality information about risk, the integration of risk treatment measures and better communication might bring about some improvements in managing risk, the underlying causes of fragmentation would remain.

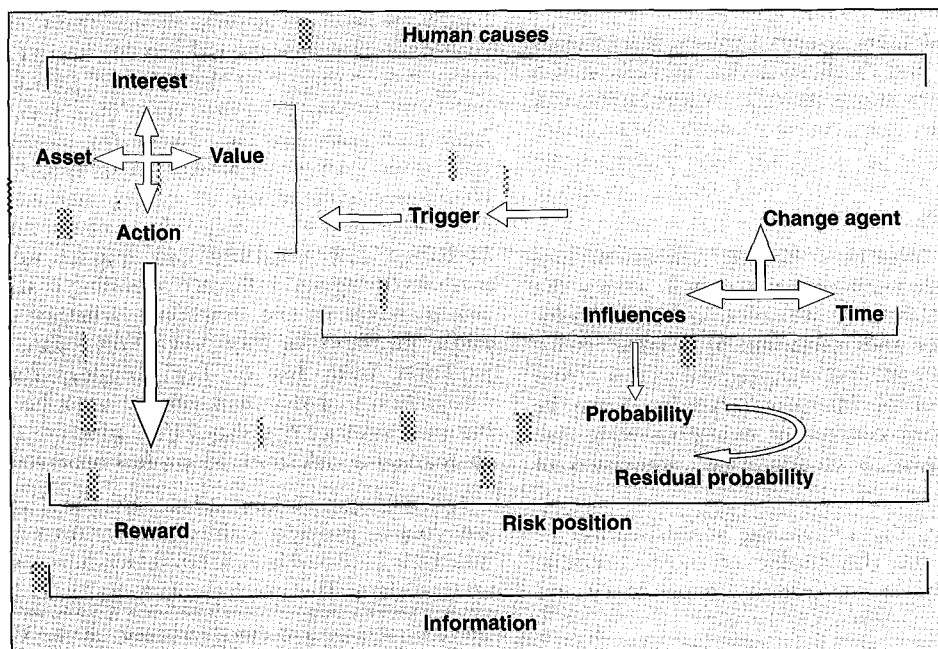


Figure 1. The universalistic model of risk: thirteen precepts

The solution is two-fold: firstly, use a model of risk that can explain all dimensions of the concept; and, secondly, use a process of risk management that adopts a holistic view of the enterprise.

The DNA of risk

The following definition and model of risk adopt a 'universalistic' viewpoint. They satisfy the tenets of existing schools of risk management thought, and offer a complete model of the precepts of risk. It is proposed that an accurate and complete model of risk is the starting point for correcting the fragmentation in managing risk.

Risk can be summarised and defined as follows: risk is human behaviour with imperfect knowledge about future outcomes that can vary intended rewards (Briers 2000).

Risk can be modelled according to Figure 1. The thirteen precepts of risk shown in Figure 1 are briefly explained in the sections that follow.

1. Reward: risk always incorporates some degree of desire for reward

The model assumes that in the context of risk, human behaviour is directed towards the achievement of some reward or benefit. This reward may be an improvement in one's condition, the successful fulfilment of a task, or the avoidance of some negative influence, for example. The reward need not be confined to conventionally positive outcomes. The main idea behind this precept is that human action is a flow of behaviour that breaks conditions of stasis for gainful purpose.

It is true, of course, that people manifest numerous actions and behaviour without a clear, conscious impetus towards some reward or benefit. Nevertheless, it seems that every conceivable human condition has some or other label that implies an objective. Although a person or enterprise may sometimes appear to be in a condition of stasis – not actively risk-taking – every action, condition and behaviour has a desired reward and carries with it a spectrum of risk exposures.

This risk precept refers to the human desire for reward, and not to the outcome or consequences of action. It is the human dimension of wanting reward that is positioned within the boundaries of the concept of risk. The desire for reward can be reflected in an anticipation of a positive change in values, or even the maintenance of existing values.

Risk finds its inherent nature only in the context of the possibility of a variance in reward. Without the pursuit of reward, in conjunction with other precepts, risk is merely a condition of uncertainty. It is the fact that a change in reward can occur as a result of change that gives risk its distinguishing characteristic.

2. Interest: risk does not exist unless it incorporates some attachment of interest in the uncertainty variables

The pursuit of reward has an infinite number of possible underlying driving forces. Human interest is a distinct component of the risk structure. Without it, the risk model is incomplete. There has to be a human interest present for risk to exist.

This interest can manifest itself in several ways:

Cognitive interest. An individual or group has intellectual attachment to an asset or set of variables.

Legal interest. An individual or group has a legal interest in, or rights to, or ownership of, an asset or set of variables.

Emotional interest. An individual or set of individuals has an emotional attachment to an asset or set of variables.

Perceived interest. An individual or group perceives that it has a valid interest or attachment to an asset or set of variables.

Political interest. An individual or group has an interest in matters of government and social authority.

Social interest. An individual or group has an interest in or attachment to social assets or variables.

Economic interest. An individual or group has financial and economic interest in an asset or set of variables.

The interest in a risk situation represents more than mere curiosity on the part of an observer. The interest is actually akin to ownership. There is participation by an individual or group in the set of risk dynamics. In this context, an interest implies involvement in the risk scenario. It assumes that there is a definable connection between a participant and the desire for a certain outcome. The dynamic of risk cannot be experienced without this bond, connection or attachment to the uncertainty variables. As the above categories of interest suggest, however, the precept is wide enough to allow for many types of possible risk experience.

3. Asset: risk always has a subject matter

Risk is never just a condition of general uncertainty. An asset is an integral part of the risk dynamic. The asset is the subject of the risk-to-person relationship. It is the dependent variable. The subject of the risk, which has been broadly labelled 'asset' here, can take many forms. Some assets do not have fluid or flexible characteristics, such as fixed plant and equipment, and could be considered as 'static assets'. Other assets are changeable in the short term. Examples of assets that are flexible in nature include some financial instruments, legal assets and intellectual assets. Such assets could be termed 'dynamic assets'. A distinction is drawn between these two types of assets because they generate different risk characteristics.

The concept of asset used allows for a broad range of variables. The criterion for inclusion is that the asset can provide an interested party with some reward, and holds the possibility of generating different values. It is suggested, too, that the asset need not be the current property of the interested party. The asset could be owned by another, or could be located elsewhere. In many instances, particularly in risk-taking cases, the asset could be something as abstract as 'success' or 'prestige'. In all cases, however, the asset has some attributed value.

4. Value: risk always incorporates an attribution of value

The presence of risk incorporates an attachment of value. The value is attributed in the present and at some future point in time.

The subject matter of a risk situation, in which a participant has an interest, always has some existing value to the interested party. Without the perception or attribution of value, there is no risk. In many cases, the value is a given matter of fact, such as the market value of fixed property. This value can be influenced by emotive and perception variables, and therefore change the risk profile. In some cases, the value can be entirely of an emotive or perceptive nature.

The uncertainty of the change in value from the present to some future moment in time provides part of the dimension of risk. The attachment of value in a risk context implies the possibility of sacrifice or loss. Having attributed some importance or worth to an asset, the interested party always faces the possibility of no increase in value, or a decrease in value, in a risk situation. Equally, an increase in value that is less than desired or required is also a dimension of value at risk.

5. Actions: the condition of risk always incorporates dimensions of action

The manifestation of risk is developed by the introduction of action into the relationship between human interest in an asset and the desire for reward. Such actions could be physical (such as movement, force or energy) or financial, informational, process-oriented or managerial in nature. The actions create a new or stronger connection with a change agent.

This precept allows for the existing concepts of risk-taking and, moreover, makes provision for the infinite number of actions and behaviours that do not deliberately seek out risk but for which risk is a natural consequence.

There are many actions that deliberately seek out conditions of risk in the pursuit of reward; equally, there are many actions that do not consciously seek out risk but that nevertheless have associated conditions of risk. Actions can therefore include deliberate or non-deliberate risk-taking behaviour. The work of the risk practitioner would be to identify and interpret the dimensions of action involved in the given set of circumstances.

6. Change agents: there is always a change agent present under conditions of risk

A change agent is a force, energy or independent variable that influences the action-interest-asset-value dynamic in a way that introduces conditions of uncertainty. Different types of change agent will introduce differing categories of risk. The change agent is an influencing factor that has the ability to change the potential value of an outcome or reward. The change agents can either be generated by an action itself, or can be prevalent in an environment and then introduced into the interest relationship.

Non-linearity as a change agent

The theories of chaos and complexity, developed in the field of quantum physics and mathematics, have found their way into the conventional world of risk management. The attraction of risk management practitioners to these fields stems mainly from the association of non-linearity concepts with risk. Most of the applications of chaos theory are found in the field of financial risk, which has an intensive mathematical foundation.

The field of chaos is appealing to risk practitioners because of its apparent ability to explain conventional unpredictability. Sherden (1998) states: "Chaos refers to turbulent behaviour in a system where the behaviour is totally determined by non-linear laws, which amplify the smallest of errors in the initial conditions of the system, making the system unpredictable beyond the shortest of periods."

The tenets of chaos theory have the potential to turn the basic principles of risk analysis upside down. Stewart (1998) explains: "Fundamental events such as the decay of a radioactive atom are held to be determined by chance, not law." Chaos theory suggests that systems that obey precise

laws do not always act in predictable and regular ways. Deterministic laws can produce behaviour that appears to be random. In a similar vein, behaviour that appears to be random and without structure might, in fact, be obeying simple laws, which are able to generate behaviour that is so complex and sensitive to measurement that it appears to be random. The Royal Society of London in 1986 endorsed the definition of 'chaos' as: "Stochastic behaviour occurring in a deterministic system" (in Stewart 1997: 12).

Much of the risk practitioner's understanding of uncertainty and variability of outcomes rests on the paradigm of determinism. Society's systems and assets are naturally designed to behave in a deterministic way. These laws are assumed and understood, and even the breakdown of such systems (by loss or damage, for example) is attributed to the interplay of these laws. The known laws of error, as illustrated in the science of statistics, are also well understood and often applied by the risk practitioner. Chaos theorists, however, introduce new rationales to explain disorder. Concepts such as instability, discontinuity, reversibility, connectedness, interference, linearity and periodicity attempt to explain the dynamics underlying apparent disorder in a system.

Risk practitioners may be tempted to believe that much uncertainty could be explained by chaos principles. Stewart (1997), however, explains that "in essence chaos and chance are poles apart". The point is that chaos need not always be unpredictable, because the action might be following known laws. The challenge to the risk practitioner, when examining a particular system or sub-system, is to make an evaluation of whether the behaviour is best modelled by a deterministic or random set of dynamics. Stewart makes the distinction, which has an important bearing on risk: "A real sub-system ... looks deterministic if, ignoring unexpected outside effects, whenever you return it to what looks like the same initial state it then does much the same thing for some non-zero period of time. It is random if indistinguishable initial states can immediately lead to very different outcomes." Apparent randomness is sometimes only the result of a lack of information. The initial condition of a system will also provide the source of randomness.

The sensitivity of chaotic systems to error and small changes led to the development of 'chaotic control' theory (Stewart 1997: 309), which introduces the idea of human intervention in a chaotic system to produce a desired outcome. The alignment of this thinking with that of risk practitioners is clear. Control theory involves modifying a system towards desired behaviour, and applying monitoring and corrective measures.

The principles of chaos create new challenges in the realm of predictability for risk practitioners operating where chaotic systems apply. Chaotic events are non-repeatable, which makes prediction difficult. The closest that one can come is prediction through probabilistic means. Stewart (1997) argues that chance events occur when an influence outside the system, which is not accounted for by deterministic laws, disturbs orderly functioning.

Complexity as a change agent

The science of complexity also influences the field of risk through its bearing on predictability and uncertainty. According to Sherden (1998), complexity refers to the phenomenon of order emerging from the complex interactions among the components of a system influenced by one or more simple guiding principles. Complex systems organise

themselves without internal control (for example, an economy). They exhibit uncertainty because of a number of general principles. They have no natural laws governing their behaviour, and can therefore not be scientifically predicted. They cannot be dissected into their component parts because the systems themselves arise from the numerous interactions among the parts. Complex systems are very highly connected and exhibit numerous positive and negative feedback loops, sometimes causing contradictory effects. They exhibit periods of order and predictability, punctuated by moments of self-generated turmoil. Complex systems can evolve and adapt to their environment, exhibiting new behaviours. Complex systems have no fixed cycles, and do not replicate past behaviour.

Sherden (1998) refers to the Sante Fe Institute classification of an economy as a "complex non-linear adaptive system". Many risk managers would willingly adopt such a classification as a description of their own organisations. This idea of non-linearity contradicts a commonly held belief that economies have a natural tendency towards a state of equilibrium. Holland (in Sherden 1998) argues that "it is essentially meaningless to talk about a complex adaptive system being in equilibrium ... it is always unfolding, always in transition".

Complexity theory posits that a system exhibits a simple level of behaviour at a high level, while its component parts simultaneously behave in a series of complex interactions. A key concept of complexity is emergence, where a system transcends its components. This idea is not generally found in risk tenets, but possibly has application.

Complex systems do not allow an observer to describe or calculate the behaviour of their components in a precise manner. They are not necessarily random or ordered in behaviour, but the number of interactions negates the possibility of precise prediction. Both complexity and chaos principles negate the idea that apparent order and regularity in the universe are the result of regular laws generating predictability.

This has fundamental implications for the science of risk. Complexity is related to the principles of chaos through the theory of non-linear dynamics. It seems that the science of risk is a probable candidate for this relationship.

7. Influence: the character or profile of risk is always shaped by directly influencing variables

This precept proposes that risk does not prevail in a vacuum – other factors are always present to shape the risk profile. The degree of change brought about by the change agent is dependent on a number of factors.

The range of possible influences on risk is infinite. It is vital to understand their role, however, because of the need to apply risk management techniques in a more accurate manner. One category of influences relates to the human participant in the risk environment. Examples include the person's background, tolerance levels, degree of accountability, available alternatives and confidence levels, to name but a few. Another set of influences relates to the science of risk itself, and could apply to any risk situation. Examples include aggregation, bottlenecks, chaos, correlation and dependency.

8. Time: there is always a time dimension to a risk

Every risk scenario incorporates uncertainty about a future

outcome. This does not necessarily assume a linear model of time, but does not allow for events in the past or the present to constitute risk. The perception or experience of risk is always lived in the present tense, but relates to future outcomes, which could be three milliseconds or thirty years hence.

Certain aspects of time also influence risk, such as seasons, cycles and simultaneity. A distinction is made by identifying time as a distinct precept of risk because of its ability to shape the whole profile of a risk through its involvement with each of the other risk precepts.

Time as a common dimension of risk

The dimension of time plays a fundamental role in the concept of risk. Most risk management processes assume the concept of time through their orientation around possible future outcomes. Although not clarified in most instances, risk management literature tends to accept that time is of a linear nature, in the Newtonian sense. The generally accepted view is that time in the context of three-dimensional space is deterministic – that one 'snapshot' or moment in time influences the next in a sequential manner. Particularly within the existing schools of risk management thought, there has not been much reason to challenge or examine this perspective.

There is little dispute that risk is bound up in the world of the future. If the concept of linear time is removed and replaced with a perpetual state of present existence, then risk becomes a completely different concept. Rather than the dynamic of an unknown future, risk would become predominantly a concept of change, shaped by perpetually interacting variables. Simple observation, however, indicates to us that the past is fixed and unchangeable, and that, in everyday terms, time has a sequential dynamic.

Deutsch (1997), however, maintains that time is a quantum concept rather than a deterministic one. Although certain events are causes and effects of one another, these cannot always be explained within the framework of classical physics. His view is that we live in "multiple versions" of reality, where the past is fixed but the future is open. Quantum time is reversible, and quantum events depend upon the future as well as the past. Time itself does not flow or move, and other times are just special cases of other universes.

Time is also regarded as an important variable in complexity theory. A complex system, whose behaviour cannot be described concisely, can exhibit temporal complexity (Stewart 1997), for example, a system that normally exhibits a simple value, but that changes in a complex way over a period of time. In theories of chaos and randomness, too, time plays a fundamental role through concepts such as time-series, recurrence of events and periodicity.

One's paradigm of time will influence one's understanding of predictability, which is a cornerstone of risk management practice. The instantaneous present is an extraordinary time because in it alone the transition from potential to actual occurs. The past is a simultaneous reality of present existence. The subjective values of time are a further consideration in the character of risk.

9. Triggers: in order for risk to exist, a possible trigger must be present to set in motion a change in outcomes

As far as this point in the risk structure, a participant could be exposed to risk, but the influence of the risk would not yet be brought to bear upon the asset and have brought about a

change in outcomes. A trigger is required to connect a change agent to an asset. These triggers are the proximate causes of a chain of events that causes risk to manifest itself in the form of some variability in outcomes.

Triggers can be prevalent in the relevant risk environment but need not necessarily be activated, since preventative measures may play a role.

10. Probability: risk always assumes that there is some degree of probability of a change in outcomes

The likelihood that the risk manifestation will occur is a factor of the interplay between the actions, assets, change agents, influences and triggers. The term 'probability' refers to this factor, and it is used in the general sense of the word rather than in an exclusively statistical sense. It measures the strength of possible influence on the reward or outcome. Related concepts include non-linearity, dispersion, degree of variability, degree of error, frequency and relative frequency.

11. Risk position: risk incorporates the measures that have been taken to date to influence that risk

Up to this point, the risk structure has assumed that participants are passive observers, with risk generated by their interest in the interplay of assets, actions, change agents, influences and triggers. The risk model implies that it is not possible for anyone to be neutral to risk. One could come closest to complete risk non-participation in life if one had no interest in any kind of asset.

Life exists in an environment of risk. The interplay of time and the human drive for reward are the fundamental components of risk. Man cannot by implication sit outside this risk environment. Even complete ignorance of risk conditions, or a decision to be utterly neutral with regard to risk decisions, is part of the process of assuming a 'risk position'. A participant's response to risk lies within, rather than outside, the risk framework, because the risk position has an influence on the probability of outcomes. A participant's decision, or even lack of decision, given a set of risk variables, shapes the degree of reward derived from the inherent actions.

A risk position allows for the possibility of a decision not to respond to the risk. A variety of interventions is also allowed for, for example, decision making, financial contingencies, preventative measures, transfer mechanisms and internal controls. Because of the inherent influence of pre-existing positioning in risk itself (for example, decision making or financial positioning), it is included within the integrated risk model.

12. Human origins: risk always has a human origin or cause

This precept suggests that all risks have human determinants. They may not be the only determinants, but some human causative component is always present. Participation in a risk environment is brought about through interest in an asset. To withdraw from a risk environment requires either the withdrawal of that interest, or the introduction of an intervention or risk position.

Human origins are also sometimes the trigger for a series of changes to outcomes or rewards. Often, however, they are human conditions or states that allow the change agents to manifest themselves. Examples include complacency, greed, fear, delay, denial, error, habituation, inexperience, perception and trauma. Such human origins can be introduced at any

stage of the risk dynamic and can manifest themselves in the striving for rewards. Human origins can shape the change agents and influences. They can also allow for the passage of triggers to connect with change agents. Human origins are inherent in the process of adopting risk positions. The overall probability of a risk dynamic is therefore influenced by human origins.

This risk dynamic should not be confused with the commonly held belief that risk is sometimes caused by natural phenomena (for example, storms), which are change agents and perils. The human cause of risk in the case of natural phenomena would, for example, be to choose to build a house in an area prone to flooding. The risk is the human dimension, rather than the natural phenomena.

13. Information: a lack of perfect information is always a variable that shapes every risk situation

This last precept illustrates that risk management is just as much a matter of information management as physical or financial interventions. If a participant were armed with perfect knowledge about future outcomes, or present causative dynamics within a known system, risk would be absent. Under such conditions, a participant would be able to take action knowing the precise consequences, and would therefore not be at risk. Even where the outcomes are conventionally thought of as negative, actions with full knowledge of the outcomes hold no risk for the interested party. It is not assumed that perfect knowledge is always attainable, however.

The outcomes of risk are not included within the risk structure, because there is no risk but knowledge once risk has manifested itself in the form of an outcome, or as an impact or change to an asset. Risk has become fact. The results of risk events and change lie outside the concept of risk itself.

How will this risk model enable risk management integration?

A common conceptual framework

In the first instance, and perhaps most importantly, the model defines and describes risk in a way that is common for each school of risk management. This common model of risk is therefore a starting point for dialogue and interaction about risk dynamics between the different schools of risk. The different types of risk practitioner should no longer perceive themselves as belonging to an isolated school.

A common language of risk

The second way in which the new model brings about an integrated approach to risk management is through the creation of a common language and terminology about risk. The use of common terminology means that different schools of risk can describe related dynamics of risk using the same terms.

For example, concepts such as 'outliers' are not used by most pure risk practitioners. Similarly, the concept of a 'peril' is not really part of the vocabulary of financial risk practitioners. The integrated approach, however, places each of these terms into the common category of 'trigger'. A trigger is the family of risk dynamics that sets in motion a change in outcomes. The financial risk concept of an outlier at the tail-end of a probability distribution, and the pure risk concept of peril, belong to the same grouping of events that forms part of

the characteristics of risk. An integrated approach, using the common precept of 'trigger', therefore allows a perspective on an organisation's complete spectrum of risk manifestations (triggers). All types of risk trigger can be identified and interpreted, no matter what school of risk they belong to, and interventions can take place with knowledge and understanding of the complete spectrum of such risk dynamics for the business.

The commonality of the terminology and concepts within the integrated risk model creates a process that encourages the different schools to exchange information about risk and to utilise each other's solutions to risk. A financial risk management concept such as volatility, for example, could encourage the use of a pure risk solution such as a captive insurance facility to insure against extreme volatility. Another example might be the encouragement of risk-taking in the field of pure risk in order to treat a particular risk problem. The application of predictive corporate failure techniques could give rise to financial risk or pure risk solutions. Hence, an integration of solutions to risk is encouraged by the use of a common risk perspective.

A common risk management process

The universalistic model of risk is not something that can be implemented in reality on its own. The risk model does, however, make apparent a new process of risk management. A process of identification, interpretation and intervention works its way through each of the thirteen precepts. The application of the model generates the integration of risk management techniques in two phases. In the first phase, the process is able to identify the thirteen precepts without using any particular school of risk as a reference point. An integrated approach to risk identification, therefore, does not begin in any particular school of risk management, but rather with the use of the integrated model of risk.

The first phase of risk identification, then, does not start with the preconceptions of any particular school. It is the use of the new risk model that generates risk management integration. This becomes more evident in a sequentially second phase of risk identification and interpretation. Having identified various precepts and their characteristics, the techniques of particular schools almost certainly become necessary in the ensuing process of risk interpretation.

The challenges to a cohesive risk strategy include these fundamental frames of reference for risk and the inherent need to balance the focus on value creation rather than value protection. The question is how a modern corporate organisation should approach this challenge of developing enterprise-wide risk management. In broad terms, it should focus on the following essential initiatives:

1. Focus on value

The enterprise-wide approach begins by clarifying what really matters to the business. What are the drivers of value? Which components and processes of the business generate its value? A value profile, complete with its quantification, is the starting point. This value profile should reveal where the dependencies, vulnerabilities and critical elements are in the business. These could include anything from a brand name to a hedge fund or an e-commerce application. Invariably, the value profile also reveals the engines and processes of cash generation of the business, leading to shareholder returns. This proves to be a particularly powerful means of breaking down functional risk management silos.

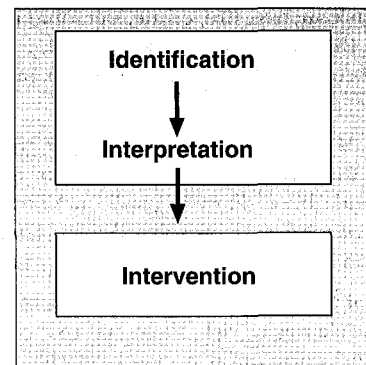


Figure 2. Universalistic risk management model

2. A common working methodology

The universal model of risk implies an integrated risk management process such as that outlined in Figure 2.

Although this generic model can be seen as a description of the overall risk management process, it is also the process that ought to be applied to each precept of the integrated model of risk. In other words, every precept of risk ought to be subjected to the process of identification, interpretation and intervention. It is submitted that this simple, three-fold process can be used to apply risk management to any type of risk. The process does not conflict with the equivalent models of risk used by the existing schools of risk management thinking.

Having scoped the initial steps of the risk management process, one can apply the simple version of risk management to each perceived risk or change agent, thus generating multiple parallel risk profiles, many of which will be interconnected.

The arrows in Figure 2 reinforce the idea that risks do not exist in isolation. Their co-existence within a system often causes an influence on other risk exposures within the same system. Each of these inter-connected risks also needs to be subjected to identification, interpretation and intervention. Indeed, by focusing on these interconnections, one builds a truly integrated approach to risk management.

However, this process of focusing on parallel risks and identifying the way they might influence one another still does not fully realise the richness of the risk environment. In order to fully apply risk management, one needs a wider application of the risk model to every node of change in the environment of the business.

The precepts cause risk management integration

Each of the precepts of the model has been conceptualised as all-embracing and all-inclusive. This means that an examination of any risk dynamic should include all dimensions of the universalistic precept. For example, the identification of change agents should not be confined to any particular school of risk management, as this would not encourage risk management integration. The identification of change agents should embrace all types of risk from an integrated standpoint.

How this approach differs from the existing approaches to risk management

The existing approaches to risk management tend to function according to classes of risk. This is particularly true of the pure risk and financial risk schools. In the pure risk school, for example, risk management processes operate according to

categories of risk such as fire, crime, personal injury and legal liability. In the financial risk school, however, risk management processes follow classes of risk such as currency, equity (market) and credit risk.

In the field of pure risk, there is usually some integration between risks that are primary in nature (for example, fire or breakdown) and those that are consequential in nature (for example, loss of profits or legal liabilities). There is generally little integration between classes of primary risk.

In the field of financial risk, there is often much integration of the different classes of risk. Financial risk concepts such as aggregation and correlation depend on the principle of an integrated perspective.

Integration of risk categories is not a meaningful consideration in the disciplines of corporate failure and risk-taking. Although the idea of a combination of factors causing an aggregate risk position is valid, the idea of multilevel causative relationships between risk categories has not received much attention from these two schools.

The idea of risk integration across all four schools is weak at present. If one looks at the principle of integration across schools of risk management, the picture is even bleaker.

The correct and thorough use of the integrated model will encourage completeness in identifying and interpreting risk. Each of the thirteen precepts should be rigorously worked through to yield an accurate interpretation of the risk dynamics inherent in a given scenario. This approach would differ from those of the existing schools of risk management, which generally only depict risk by using a few chosen precepts or dynamics. Precepts such as time, value and information are commonly omitted from risk interpretations. The subsequent risk management processes and interventions are therefore in danger of being incomplete.

Risk is a human phenomenon

So many of the existing approaches to risk management are bound up in technicalities. Risk is essentially a human phenomenon, however, and it is this behavioural dimension of risk that is the zenith of risk management integration. Deeper insights and interpretations of the human origins and causes of risk will greatly enhance our approach to risk management. The embedding of human dynamics in risk management processes allows for the concepts of risk-taking and risk protection to exist on the same continuum and opens exciting new opportunities of development for risk managers. Exploring how risk-taking variables affect risk profiles will add new dimensions to the work of risk managers. Equally, the incorporation of risk management science into strategy development will help companies build more robust business strategies.

In an increasingly non-linear business environment, companies can certainly no longer progress without a more complete understanding of the risk environment. Companies need not tolerate a fragmented and partial approach to risk management.

The concept of risk has evolved over thousands of years of societal development and has always been a fundamental dimension of human existence. As new scientific discoveries are made, the concept continues to evolve. As the characteristics of society develop, the concept of risk takes on new dimensions.

Numerous attempts have been made to define 'risk' as it is understood to prevail in our post-modernist society, but there has thus far been little or no consensus on a definition or model of risk. Most of the attempts to define risk grapple with just a few of its characteristics.

There is an irony in the fact that using the universalistic model also has its inherent risks. In adopting this model, one assumes that it will achieve certain aims (for example, integrate risk functions or identify all risks). Such is the all-pervasive nature of risk in our lives, however, that even the adoption of a given model has some attendant uncertainties. Practitioners of financial risk management are familiar with the phenomenon of 'model risk'. The assumptions made in using any model determine future performance.

It is hoped that the model of risk proposed here will enable risk practitioners to achieve consensus on the precepts of risk, and guide managers in building enterprise-wide risk management capabilities. Consensus on an integrated model of risk ought to be the first defining step towards developing risk management as a fully-fledged management science.

It is hoped that the arguments advanced here have demonstrated that risk can be defined and modelled so as to enable enterprise-wide risk management practices to develop from a consistent theoretical foundation. This paper also illustrates that the discipline of risk management also entails the processes of change management, information management and behavioural science.

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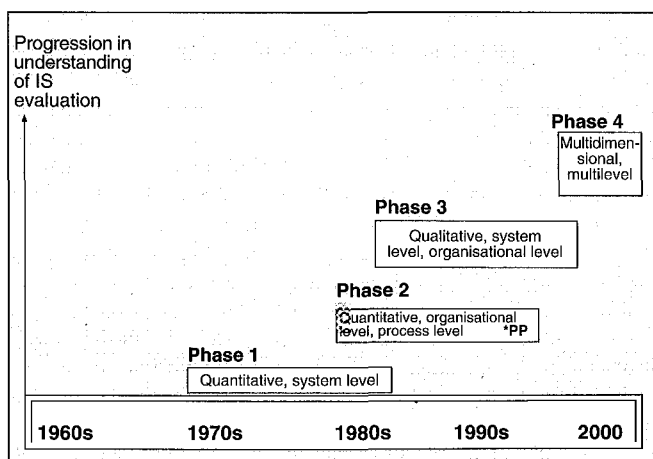
IT evaluation: how far have we come?

Marguerite Cronk* & Graham Fry†

This article traces the evolution in information technology (IT) evaluation methods over the past three decades, identifying issues that suggest developments in understanding the role of IT in organisations. IT evaluation has been influenced by varied philosophical differences in world-view. For example, positivists tend to favour quantitative methodologies, and post-positivists tend to favour qualitative approaches. Currently, multidimensional methodologies combining both quantitative and qualitative metrics have gained popularity. While this represents a development in IT evaluation theory, the factors affecting IT value outcomes and due consideration of unexpected outcomes still remain largely unexplored. Some of these factors are presented herein for possible inclusion in evaluation methodologies.

Introduction

Over the past thirty years, there has been a clearly discernible evolution in the methodologies proposed for the measurement of 'information systems (IS) business value'. This evolution has been congruent with the evolution of information system types and objectives, as well as our understanding of their contributions to the organisation. Over the years, the role of information systems in organisations has changed. They are no longer solely used to support or automate low-level functions. Instead, they are increasingly seen as a central feature of the firm's mainstream products and services, or of their delivery system. Information systems may be involved in radical transformations in products, organisational structures, work-roles, and patterns and relationships between firms. The traditional, project-driven, cost-based focus of evaluation is therefore shifting to examine business changes and business values (Kraemer, Gurbaxani, Mooney & Dunkle 1994). Figure 1 provides a graphical representation of the major changes in evaluation approaches over time, differentiating between quantitative and qualitative approaches as well as the level of measurement.



* PP: Productivity paradox

Figure 1. History of IT evaluation

Note: These phases represent generalisations only in both timing and the methods included in each phase.

IT evaluation can be coarsely divided into four phases based upon differences in type of measurement (qualitative or quantitative), level of measurement (system or organisational) and degree of complexity of the evaluation method. These issues illuminate underlying philosophies and assumptions.

Historical overview of IT evaluation phases

Phase 1 (mid 1960s – early 1980s)

The majority of measurement approaches published in Phase 1 were quantitative in nature. Research into the possible value of information systems began in the late 1960s with a focus on 'efficiency'. Efficiency referred to 'doing things right' (Drucker 1970) and usually involved comparing some measure of input with some measure of output. These early efficiency approaches focused on a single system, and rarely extended beyond direct performance of the system. Other quantitative measures examined parameters such as accuracy, precision, response time and reliability (for a complete list, see Delone & McLean 1992). However, as information systems proliferated throughout the entire business, the efficiency approach was found to be lacking and was replaced by the 'effectiveness' construct. Effectiveness focused upon 'doing the right things' for the business (Hirscheim & Smithson 1986).

Phase 2 (1980 – mid 1990s)

This phase covered a substantial period of time, but is considered a distinct phase, with the quantitative measurement approach firstly and primarily being applied at the organisational level, followed by measurement at intermediate, business unit and process levels. Popularity of the organisational-level, quantitative approach appeared greatest in the 1980s, peaking towards the end of that decade with the productivity paradox debate.

Organisational level measurements were the focus of a series of quantitative measurements relating IT expenditure to organisational performance (Cron & Sorbol 1983; Bender 1986; Turner 1985). These methods were limited to a financial perspective, relating overall IT expenditure to organisational performance through such measures as return on investment (ROI) and return on assets (ROA). The following few paragraphs present a summary of major contributors to this measurement approach.

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The impact of computerisation on firm performance, using multiple measures of computerisation and firm performance, was examined by Cron & Sorbol (1983). Two years later, Turner (1985) investigated whether IT expenditure (measured as a percentage of total assets) was related to organisational size or performance (as the percentage of net income to total assets). A similar approach was taken by Bender (1986), who measured IT investment by a ratio of information processing expenses to total general expenses, and firm performance by a ratio of total general expenses to premium income. Similarly, Harris & Katz (1989) examined the relationship between organisational profitability and IS capital intensity.

The results of these studies were equivocal, with the IT/firm performance relationship ranging from positive to weak to negative. There was little evidence of a cumulative tradition at this stage. The lack of consistent results in measurement of the correlation between IT expenditure and organisational performance suggested problems with this measurement approach. Whether the problem lay with the quantitative approach or the organisational level of measurement became the subject of much debate (Brynjolfsson 1993). However, quantitative approaches continued to appear in the literature, complemented by modifications such as the differentiation between contributions made by different types of IT.

Rather than abandoning the approach of the early 1980s, some researchers offered possible reasons for the conflicting findings, each highlighting underlying problems with previous organisational quantitative approaches (Strassmann, Berger, Swanson, Kriebel & Kauffman 1988; Weill 1989; Floyd & Wooldridge 1990; Sethi, Hwang & Pegels 1993).

Weill (1989) proposed that some of the inconsistencies in previous studies may have been due to the treatment of IT as a single entity. He categorised IT investment as strategic, informational or transactional and measured organisational performance using sales growth rate, ROA and non-production labour. A slightly different approach was taken by Floyd & Wooldridge (1990), who attempted to categorise IT investment into product and process IT that was measured against ROA. Though reporting in a similar time period, Strassmann et al. (1988) took quite a different approach, investigating the impact of IT investment on a performance measure called management productivity. IT investments were measured as mission critical information technology expense and management information system expense. These authors were some of the first to look at the role played by management in the realisation of 'IT effectiveness'.

In response to the collectivity problems associated with firm-level measurement, some researchers looked for the impact of IT expenditure on intermediate business unit-level performance variables and sought to link those to firm-level performance indicators (Barua, Kriebel & Mukhopadhyay 1995). Others applied quantitative measures at the process level, acknowledging the deficiencies of organisational-level measurement, but favouring the objective nature of quantitative measurement. In this approach, some of the deficiencies such as collectivity are reduced while still retaining the objectivity of a quantitative measurement (Davenport 1993; Mooney, Gurbaxani & Kraemer 1995).

Phase 3 (early 1980s – mid 1990s)

This phase runs almost parallel to Phase 2 but is directed by a post-modernist world-view, in contrast to the positivist view of the previous phase. Phase 3 is characterised by the

predominance of qualitative approaches to IT evaluation. Some researchers had already recognised the less tangible contribution of IT in the early 1980s (Hamilton & Chevany 1981; Keen 1981; Ives & Olson 1984), proposing approaches that required some measure of judgement or perception. This phase is characterised by the development of a range of 'financial surrogates', including qualitative measures such as user satisfaction (Ives & Olson 1984), user perceived effectiveness (Srinivasan 1985), perceived system goal fulfilment (Miller 1989), perceived usefulness and ease of use (Davis 1989) and system utility (Ahituv 1989).

The level of measurement was predominantly system level, as proponents not only saw value in quantitative terms but also saw problems with organisational-level measures, such as difficulty in isolating the contribution of IT from other organisational and external confounding factors.

A relatively smaller group of post-modernists applied the qualitative approach at the organisational level with measures such as perceived fulfilment of organisational objectives and organisational critical success factors (Fink & Tjarka 1994). Other approaches include issues of context (Symons 1991), and the 'right choice' of information technology (Willcocks, Feeny & Islei 1997).

Although there was a definite trend towards qualitative measures, it should be noted that even as late as the early 1990s, some practitioners and researchers – unhappy with the more subjective, less tangible measures – continued to investigate quantitative cost-benefit analysis (Weill 1990; Strassmann 1990; Katz 1993). This notion is understandable, as senior management often require value to be expressed in dollar terms, and issues of value are often debated at the proposal stage of the system. Users' perceptions of a system that is not in existence are of little help when deciding whether to invest.

Recognition of the strengths of differing types of measures (both qualitative and quantitative) and levels of measurement (system, process or organisation) gave rise to Phase 4, consisting of multidimensional approaches.

Phase 4 (1990s – 2000)

This time period is characterised by more complex systems of measurement employing a combination of quantitative and qualitative measures and more than one level of measurement (Serafeimidis & Smithson 1994). Two prominent multidimensional evaluation methods of this phase include information economics (Parker & Benson 1988) and the balanced scorecard (Kaplan & Norton 1992) approaches. Other less popular methods include business value linkage framework (Fink & Tjarka 1994), and enterprise measurement (Banker & Kauffman 1991). However, none of these methodologies is widely adopted by practitioners (McBride & Fidler 1994; Remenyi 1999). A number of variations of and additions to Kaplan and Norton's (1993) balanced scoreboard (Kaplan & Norton 1996; Graeser, Willcocks & Pisaniyas 1998) have been proposed, and perhaps represent the most recent stage in IT evaluation theory development.

However, although multidimensional approaches represent a step forward in the understanding of the multidimensional nature of the 'IS business value' construct, these frameworks do little to explain why the value is what it is measured to be (entailing the identification of probable causal relationships), and do not take into account unexpected, non-traditional outcomes. The following sections elaborate on these two areas of deficit.

Absence of causal relationships

As already stated, today's multidimensional methods consist of a variety of qualitative and quantitative metrics applied at various organisational levels, including various perspectives. However, the formulation of an evaluation methodology and the appropriate selection of metrics require considerable judgement based on a good understanding of the information system and the business. The significance of this judgement component may in part contribute to a lack of confidence in the information system evaluation outcome (Cronk & Fitzgerald 1997).

Because the value picture is so complex, it would be advantageous to be able to relate the measured value outcome to factors considered to play a part in 'IS business value' creation. In addition to increasing confidence in the value outcome, direction would be given for the development of value-maximisation strategies.

The holistic construal framework proposed by Cronk (2000) suggests that the IS value outcome was a result of the interaction of the system, the user and the organisation. It is proposed that there is some correlation between characteristics of the system (accuracy, speed and downtime), characteristics of the user (such as user skills, experience, attitudes, expectations and adaptability) and characteristics of the business (soundness of business strategy, ability to learn and manage change, value and cultural alignment within the organisation, and IT and business goal alignment). It is reasoned that if good results are obtained when assessing these three constructs, it should follow that 'IS business value' will also be demonstrated to be high (as determined by the chosen 'IS business value' evaluation method). In this way, the methodology derived to determine the IS business value contribution is validated and the value is confirmed. If any of the three constructs is examined and found lacking, maximum value contribution should not be expected. This additional insight assists in the formulation of strategies to address the areas of deficiency.

Unexpected outcomes

Current multidimensional evaluation methods select a range of value outcomes for measurement, such as user or customer satisfaction, organisational goal fulfilment (such as increased market share, and reduced product to market times), business process enhancement and organisational learning contributions. These outcomes are then related to the cost of the information system. This represents a sound basis for determining value outcomes.

It is proposed that the evaluation model should go beyond these intended outcomes, however, to include any resulting business effect, which may include:

- Risk introduction – either to the business or to other projects
- Staffing impact, in terms of numbers and redistribution
- Secondary and tertiary benefits
- Neutral effects
- Cultural effects (changes in power relationships, restructuring)
- The system's role as an agent for change
- Direct and indirect costs
- Stakeholder impact
- Business opportunity – including marketing impact and the broadening or narrowing of technical capability.

Traditionally, many (if not all) of these factors would be reported for a major applications project, for example, but they would be reported separately. However, by reporting them together with the parameters of multidimensional methods explained above, a more complete picture of outcomes can be seen. Naturally, not all of these areas would be appropriate for consideration in every case of information system evaluation. A check-list could be compiled for each organisation, however, and used in a standardised manner for IS evaluation.

Conclusion

In answer to the question, 'How far have we come?', it is suggested that the IT evaluation field has come a considerable way in the last few decades, progressing from system-level, quantitative efficiency metrics to complex multidimensional methodologies. Much remains to be uncovered, however. This paper has suggested two new areas for investigation.

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The systems approach as an alternative management mechanism for model conceptualisation

J.A. Watkins* & P.S. Kruger†

The managing executive of the twenty-first century should be equipped with an alternative management mechanism for structuring the outcomes of paradigm shifts introduced into organisations as a result of unstructured complex phenomena. This paper introduces a suitable alternative mechanism to the art of executive management, namely, the structured systems approach to model conceptualisation.

Introduction

This paper discusses an approach to and rationale for an alternative management mechanism, namely, the structured systems approach to model conceptualisation, for structuring the outcomes of paradigm shifts introduced into organisations as a result of unstructured complex phenomena. The approach, which is based on the philosophies formulated by respected academics during the twentieth century (including the authors' own contributions), is specifically aimed at assisting the managing executive tasked with solving unstructured complex phenomena, typically found in organisations of the twenty-first century.

Background

Managing executives of large organisations are drawn from diverse backgrounds, and it is not uncommon to find such executives coming to executive management from the financial, legal, accounting or engineering professions. The result of this trend is that executives are employed in positions they were not trained for, often climbing the corporate hierarchy ladders rapidly and ultimately attaining the position of managing executive.

It would be naïve to single out any particular profession to illustrate the dynamics of this trend; however, the example of the industrial engineer that becomes a managing executive of an organisation can be cited for this purpose. The industrial engineer (with training primarily in the engineering profession, a discipline grounded in analytical and reductionist thinking), that reaches the level of executive management may lack the necessary multifaceted management skills, with their focus on the handling of unstructured complex phenomena. Such unstructured complex phenomena are invariably grounded in societal and organisational realities, are viewed as 'systems problems', and require systems-integrated solutions. To bridge this competence gap, managing executives should be equipped with an alternative management mechanism for structuring the outcomes of paradigm shifts introduced into organisations as a result of unstructured complex phenomena. This paper introduces a suitable alternative mechanism to the art of executive management; namely the structured systems approach to model conceptualisation.

The construction elements of the structured systems approach to model conceptualisation are primarily vested in the philosophies of respected academics of the twentieth century that have dealt with 'hard' and 'soft' systems

approaches. The authors' own contributions to formulating an alternative management mechanism for addressing unstructured complex phenomena of the twenty-first century are also included.

To provide insight into the complexities of the structured systems approach to model conceptualisation, these construction elements will be analysed in order to construct a working model of the approach. A prerequisite for the analysis is a high-level understanding of the concepts of 'model conceptualisation', 'unstructured complex phenomena', 'system' and 'systems approach', which are defined as follows:

Model conceptualisation. The term 'model conceptualisation', as used in this paper, refers to a specific sequence of events, which precedes 'model construction' and 'model implementation'. These events, shown in Figure 1, include:

- The identification of unstructured complex phenomena
- An analysis of the identified unstructured complex phenomena
- The problem-solving approach to addressing the identified unstructured complex phenomena.

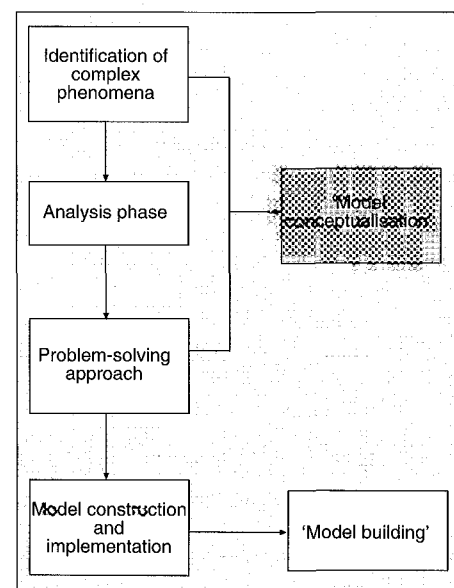


Figure 1. Conceptual sequence of events pertaining to 'model conceptualisation' and 'model building'

Unstructured complex phenomena. The term 'unstructured complex phenomena' refers to problems that are grounded in societal and organisational realities, are viewed as 'systems problems', and require systems-integrated solutions (Haines 1998).

System. Capra (1996) defines 'system' as "an integrated whole whose essential properties arise from the relationship between the parts which can be traced back to the root meaning of the word 'system' which derives from the Greek 'sunístáinai' (to place together)".

Systems approach. Churchman (1983) draws the analogy that "systems are made up of sets of components that work together as a whole, and that the systems approach is simply a way of thinking about these total systems and their components", which is in line with the view of Senge (1990), who is of the opinion that the discipline of the systems approach lies in a mindshift that:

- Sees interrelationships rather than linear cause-effect chains
- Sees processes of change rather than snapshots.

The hard systems approach

The 'hard' systems approach, as adapted from Checkland (1989), presupposes that real-world problems can be addressed on the basis of the following four assumptions:

- There is a desired state of the system, S_1 , which is known.
- There is a present state of the system, S_0 .
- There are alternative ways of getting from S_0 to S_1 .
- It is the role of the systems person to find the best means of getting from S_0 to S_1 .

This is supported by Habermas (in Jackson 1991), who believes that the hard systems approach is a manifestation of the technical interest in the prediction and control of natural and social systems. Furthermore, according to Habermas (Jackson 1991), hard systems methodologies seek as far as possible to follow the empirical analytical methods employed in the natural sciences.

In addition to the references cited in this paper, the authors acknowledge the fact that the hard systems methodology is an established concept to which contributions have been made over the years by, among others, Hitch, Hall, Quade, Machol, Chestnut, Jenkins, Lee, De Neufville & Stafford, Miles, Chase, Daenmzer and Wymore. The problem-solving methodologies specifically selected for their appropriateness to this paper are systems engineering and systems analysis, as formulated by Checkland (1989), with Jackson (1991) adding operational research and management cybernetics to the list. Systems dynamics, pioneered by Forrester (1972), concludes the list. It would be altogether inappropriate to analyse all the listed methodologies within the ambit of this paper. For this reason, Forrester's systems dynamics will be analysed selectively in order to position the approach as representative of hard systems methodologies.

Background to systems dynamics

The 'systems dynamics' approach of Forrester (1972) has its roots in the following four developments:

- Advances in computer technology

- Growing experience with computer simulation
- Improved understanding of strategic decision making
- Developments in the understanding of the role of 'feedback' in complex systems.

While the systems dynamics approach is not linked to the general systems theory, according to Richardson (1996), it is important to note that Senge (1990) identifies systems thinking in the systems dynamics tradition as the fifth of five disciplines of the learning organisation (Richardson 1996).

According to Sahin (1979), the systems dynamics approach to modelling social systems appears to be gaining rapid acceptance as a legitimate tool of management science, although it still evokes controversy. Sahin believes that the controversies might have been caused not so much by the methodology itself, but because of the areas to which it has been applied (for example, world dynamics) and the manner in which it has been applied (for example, using possibly heroic assumptions or building on partly impressionistic data).

According to Richardson (1991), the systems dynamics approach involves:

- Defining problems dynamically, in terms of graphs over time
- Striving for an endogenous, behavioural view of the significant dynamics of a system – a focus inwards on the characteristics of a system that themselves generate or exacerbate the perceived problem
- Thinking of all concepts in the real system as continuous quantities interconnected in loops of information feedback and circular causality
- Identifying independent stocks of accumulation (levels) in the system and their inflows and outflows (rates)
- Formulating a behavioural model capable of reproducing, by itself, the dynamic problem of concern. The model is usually a computer simulation model expressed in non-linear equations, but is occasionally left unquantified as a diagram capturing the stock-and-flow/causal feedback structure
- Deriving understandings and applicable policy insights from the resulting model
- Implementing changes resulting from model-based understandings and insights.

While systems dynamics is classified in this paper as a hard systems approach, it is acknowledged that interest has recently grown in systems dynamics as a soft modelling methodology. According to Morecroft (1988), this soft approach to systems dynamics has been spearheaded by Wolstenholme and Coyle. Moreover, Checkland (1989) also supports the soft approach to systems dynamics.

Philosophy of systems dynamics

Underpinning Forrester's systems dynamics is a theory of information feedback and control as a means of evaluating business and other organisational and social contexts. A systems dynamics view is one that places emphasis on structure, and the processes within that structure, assuming that dynamic behaviour in the real world can best be characterised in that way. Systems dynamics considers behaviour as being caused principally by structure; it is a

theory of the structure of systems and dynamic behaviour. Structure does not only include the physical aspects of plant and production processes; it also importantly refers to the policies and traditions, both tangible and intangible, that dominate decision making. Thus, systems dynamics assumes that analysis of a situation can be undertaken from an external objective viewpoint and that the structure and dynamic processes of the real world can be recreated in both systems diagrams and mathematical models.

Principles of systems dynamics

The philosophy of systems dynamics emphasises model structure, which supports an interest in prediction and control, and these will therefore be the main principles of analysis. Structure is seen as having four significant characteristics, which amount to the focal concerns of any systems dynamics analysis, namely:

- Order
- Direction of feedback
- Non-linearity
- Loop multiplicity.

Model and methodology of systems dynamics

Sahin (1979) is of the opinion that the most widely used approach to constructing 'initial' systems dynamics models is to identify the feedback loops and depict them as a causal loop diagram. This is supported by Richardson (1991), who confirms that "conceptually, the feedback concept is at the heart of the systems dynamics approach".

Morecroft (1984) provides the following description of a systems dynamics model: "A systems dynamics model is descriptive of the way a company functions; it does not contain idealized decision-making processes. ... It shows the division of responsibilities, the goal and reward structure of the organization, as well as the inconsistencies of policy that are a part of any real organization."

Flood & Jackson (1991) acknowledge that there are many versions of how a quality model can be formulated, hence their approach of providing a model developed from their own work, which consists of the following elements:

- Identification of the organisational problem, which focuses the attention of the decision makers and leads to their purposeful activity
- Carrying out 'task formulation' to assist in determining the appropriate way forward. A methodology that can typically be used for task formulation is total systems intervention
- Setting modelling purposes that determine in unitary fashion the essential characteristics of the model to be formulated
- Pragmatic review of extant models
- User assessment
- Model construction (starting with the drawing up of a model development sub-methodology)
- Introduction of a validation sub-methodology
- Model formulation
- Conceptualisation
- Formulation
- Simulation.

Model utilisation of systems dynamics

According to Meadows (in Flood & Jackson 1991), there are three stages in a decision-making process to which systems dynamics must contribute:

1. The first step entails appreciating, in a broad sense, the situation of concern and developing a non-precise understanding of the dynamics.
2. This broad understanding needs to be translated into ideas about how to improve problematic aspects, which requires deeper investigation into the structure that underlies behaviour, although exact precision is not necessary.
3. Lastly, there is the need for detailed implementation, where precision is vital.

The type of 'systems thinking' to have emerged from the concepts of systems dynamics is concerned with assisting the process of strategic debate by developing transparent models. These models, in the qualitative phase, facilitate knowledge capture and pluralistic exploration of process, structure and strategy, and, in the quantitative phase, are capable of being developed into computer-based micro-worlds and archetypes, by which insights can be disseminated in a 'hands-on' framework (Wolstenholme 1993).

The soft systems approach

The complexities of the soft systems approach have been researched extensively by respected academics, and the following can be listed as representative of this concept from a holistic point of view:

- The viable systems model of Beer (organisational cybernetics)
- Churchman's (1971, 1979, 1983) social systems design
- Checkland's (1989) soft systems methodology
- Ackoff's (1978) interactive planning
- Mitroff & Mason's strategic assumption surfacing and testing methodology
- Flood & Jackson's (1991) total systems intervention
- Ulrich's critical systems heuristics
- Mitroff & Linstone's (1993) unbounded systems thinking.

As in the case of the hard systems approach, it would be altogether inappropriate to analyse all the listed soft methodologies within the ambit of this paper. The social systems design methodology of Churchman has been selected specifically to represent the soft systems approach, as the analyses that follow are based on aphorisms, as opposed to a 'traditional' analytical explanation of the concept.

Introduction to Churchman's social systems design

In an analysis of Churchman's social systems design, it is interesting to note that Churchman (1983) believes that: "The systems approach consists of a continuing debate between various attitudes of mind with respect to society."

Churchman's perspective on systems thinking is the result of careful and profound philosophical exploration. The work of Churchman, while rewarding, is difficult to interpret, even for respected academics of the likes of Checkland (1989), Jackson (1991) and Flood & Jackson (1991) (by their own

admission). Churchman's work on his social systems design is outlined primarily in the following scholarly publications:

- *The Design of Inquiring Systems: Basic Concepts of Systems and Organizations* (Churchman 1971)
- *The Systems Approach and its Enemies* (Churchman 1979)
- *The Systems Approach* (Churchman 1983).

Social systems design explained

In *The Design of Inquiring Systems: Basic Concepts of Systems and Organizations*, Churchman (1971) considers that the most important intellectual activity is "the formulation of social systems". The book examines the work of five historical figures – Leibniz, Locke, Kant, Hegel and Singer – taking them to be designers of systems to produce sure knowledge. In an attempt to analyse Churchman's social systems design, Jackson (1991), Checkland (1989) and Flood & Jackson (1991) take the following four aphorisms that Churchman (1983) uses in *The Systems Approach* and expand upon them:

- "The systems approach begins when first you see the world through the eyes of another."
- "The systems approach goes on to discovering that every world-view is terribly restricted."
- "There are no experts in the systems approach."
- "The systems approach is not a bad idea."

The first aphorism analysed

The first aphorism ("The systems approach begins when first you see the world through the eyes of another") contains lessons from the philosophers Kant and Hegel:

- According to Kant (in Flood & Jackson 1991) and Checkland (1989), we all tell a particular 'story of the world' or have 'a philosophy of life' (*Weltanschauung*), based on our own *a priori* assumptions, which we take for granted. However, it is as well to recognise that there are other equally legitimate stories based upon alternative sets of *a priori* assumptions. Once we recognise this, we are moving towards the systems approach, because it becomes clear that 'subjectivity' must be embraced in systems thinking – different evaluations of what we want to attain from systems, and of their current state of performance, are possible. The only way of grasping the 'whole system' is to sweep in as many different perspectives as possible.
- According to Hegel (in Jackson 1991), it is wise for systems designers to recognise that there are many possible world-views (*Weltanschauungen*), based on alternative sets of assumptions that are taken for granted. Once accepted, it becomes clear that subjectivity should be embraced by the systems approach. Systems designers must accept that completely different evaluations of social systems, their purpose and their performance can and do exist. Churchman (in Jackson 1991) is of the opinion that the only way we can begin to approach an overview of the whole system is to view it from as many perspectives as possible.

The second aphorism analysed

According to Flood & Jackson (1991) and Jackson (1991), the second aphorism ("The systems approach goes on to discovering that every world-view is terribly restricted") opens the way for Churchman to a different understanding of 'objectivity'. Subjectivity is no longer to be rigorously

excluded, but must be included in any definition of objectivity – so that the restrictive nature of any one world-view can be overcome. Although every world-view is very restricted, it is also likely to be highly resistant to change. Certainly, world-views cannot be seriously challenged by presenting them with new facts, which they will simply interpret according to their fixed presuppositions. All this indicates the need for a dialectical approach to objectivity, which can be based upon the work of Hegel, the nineteenth-century German philosopher that introduced the notion of 'synthesis of opposites'.

Hegel's central idea, according to Pascale (1991) (and illustrated schematically in Figure 2), is that one entity (which he calls 'thesis', when juxtaposed with its opposite 'anti-thesis') can generate a new configuration that both includes and transcends the fundamental elements. This phenomenon is known as Hegel's dialectic.

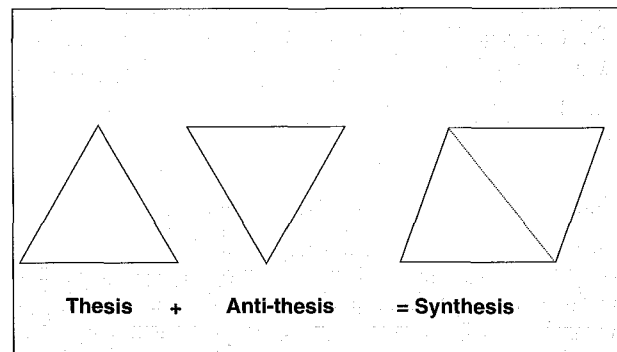


Figure 2. Hegel's dialectic (Pascale 1991)

The analogy that can be drawn from this is that a prevailing world-view (thesis) should be confronted by another world-view based on entirely different assumptions (anti-thesis). This is necessary in order to bring about a richer (more 'objective') appreciation of the situation, expressing elements of both positions while going beyond them as well (synthesis). The dialectical process advocated by Churchman can, according to Jackson (1991), be represented as comprising the following steps:

Thesis

- Understand the decision maker's proposals
- Understand the world-view, or *Weltanschauung*, that makes these proposals meaningful

Antithesis

- Develop an alternative *Weltanschauung*
- Make proposals on the basis of this *Weltanschauung*

Synthesis

- Evaluate data on the basis of both *Weltanschauungen*
- Arrive at a richer appreciation of the situation.

The third aphorism analysed

According to Jackson (1991), the third aphorism ("There are no experts in the systems approach") should be taken to heart most strongly by systems designers. When it comes to matters of aims and objectives, which inevitably involve ethical considerations and moral judgements, there can be no experts. Systems designers, because they seek to take on the whole system, may become arrogant in the face of opposition from apparently sectional interests. It is incumbent on them to listen

to all 'enemies' of the systems approach (such as religion, politics, ethics and aesthetics), since Churchman (1979) believes that these enemies reflect the very failure of the systems approach to be comprehensive.

The fourth aphorism analysed

In the fourth aphorism ("The systems approach is not a bad idea"), Churchman tries to capture the spirit of his mentor, the pragmatist philosopher, E.A. Singer (a former civil engineer) (Mitroff & Linstone 1993), who advocated the attempt to take on the 'whole system'. Increasing purposefulness and participation in systems design, through the process of dialectically developing world-views, is a never-ending process. Hence, Churchman (1971) writes: "The Singerian inquirer pushes teleology to the ultimate, by a theory of increasing or developing purpose in human society; man becomes more and more deeply involved in seeking goals."

Churchman (1971) believes that there is a need to help bring about a Lockean consensus around a particular world-view so that decisions can be taken and action can occur. Before this world-view can congeal into a *status quo*, however, it should itself be subject to attack from forceful alternative perspectives.

Model conceptualisation approach

It is important to bring to the attention of the reader at this point that an 'approach' will be formulated in this paper, namely the 'structured systems approach to model conceptualisation', which must be clearly distinguished from the process of building a 'model'. This sequence of events, formulated here in its most basic format, is depicted in Figure 1. This 'approach' will be concerned primarily with the development of principles concerning the use of systems ideas in solving the unstructured complex phenomena that confront executive management. This paper deals with an 'approach', as opposed to a 'model', by virtue of the fact that the research is focused on unstructured complex phenomena, which are invariably grounded in societal and organisational realities and which require systems-integrated solutions to solve. The following observation of Randers (1980) adds credibility to the content and objectives of this paper (justifying why this paper outlines an approach rather than a model): "Because there is no educational text on model conceptualisation, the sequence of presentation in published papers describing models is commonly mistaken for the actual steps in the creation of those models."

An 'approach', according to Randers (1980) and as suggested in this paper, should deal with the following issues (among others):

- How is the problem chosen?
- How does one achieve a useful perspective on the problem area?
- How does one succeed in capturing the essentials of a complex, real-world phenomenon in a relatively simple model?

In the view of the authors, a structured systems approach to model conceptualisation for solving unstructured complex phenomena will ensure that all the variables pertaining to the phenomenon are selected, considered and structured to culminate in a feasible and viable systems model. The wisdom of the respected Dr John D. Sterman supports the authors' position; Sterman (1988) believes that one should "beware the analyst who proposes to model entire social or economic systems, rather than the problem". Moreover, it is important to note that the concept of a structured systems approach to model conceptualisation is in line with:

- The approach of Clark & Augustine (1992), who believe that "to pursue a modelling methodology, we must identify a complete and relevant set of information attributes, assign different dimensions to these attributes, and test the performance of the system on these several dimensions".
- The approach of Forrester (1987), who believes that "the obvious purpose and test of a model of an industrial system is its ability to predict a specific future action". From this, the obvious analogy can be drawn that the quality of input to a model has a direct bearing on the model's ability to accurately predict the future action.
- The approach of Ackoff (1978), who believes that "in dealing with a problematic situation, a decision maker must develop a concept – a representation or a model – of it. ... He attempts to solve the problem as he conceives it. ... Thus, if his conception is wrong, the solution to the problem as conceived may not solve the problem as it exists."

While a more general approach to problem solving will suffice for day-to-day organisational problems, unstructured complex phenomena will require a different approach. This is because, according to Emery & Trist (1965), the environmental contexts in which organisations exist are themselves changing at an increasing rate towards increasing complexity and very often as a result of a forced intervention. The 'characteristics' of organisational environments demand consideration if there is to be an advancement of the understanding in the behavioural sciences, specifically under the impact of technological change, which more often than not occurs as a result of a forced intervention (Emery & Trist 1965).

The dynamic process of model conceptualisation

The process of model conceptualisation is illustrated in Figure 3. Each of the phases of the process is discussed in detail:

Phase 1. The strength of the structured systems approach to model conceptualisation rests on the premise that executive management formulates its solutions to unstructured complex phenomena by using interdisciplinary teams. One of the main reasons for using such teams is to ensure that conclusions are reached on the basis of scientific methods, rather than falling into the trap of leaving issues unresolved for protracted time periods. Another reason is to prevent management from rushing into poorly thought-out solutions based on preconceived ideas about an assumed problem.

Phase 2. This phase deals with the identification of the problem, commonly termed the 'problem definition'. Within the context of a 'research and development' style analysis, this phase comprises the 'analysis', through which one would try to build an understanding of the problem by 'taking it apart'. This can typically be achieved by gathering information about structure and process by observation, as well as by collecting secondary data through informal interviews. This phase is equivalent to the first phase of the decision-making process from systems dynamics, which entails appreciating, in a broad sense, the situation of concern and developing a non-precise understanding of the dynamics.

Phase 3. In this phase, the opposite of the process followed in the previous phase applies. One tries to understand how the problem elements fit into the larger system by grouping them together in terms of their tangent planes. This action entails an explanation of the whole by assembling an explanation of the parts. A different approach is to deploy the concept of 'variety

reduction', which will enhance an understanding of the difficulties and the ways in which the problem elements should be dealt with. This phase is equivalent to the second stage of the decision-making process from systems dynamics, which determines that this broad understanding needs to be translated into ideas about how to improve problematic aspects, which require deeper investigation into the structure that underlies behaviour. The aim is to draw out the essence of 'what is to be done', 'why it is to be done', 'who is to do it', 'who is to benefit or suffer from it' and 'what environmental constraints facilitate or limit the proposed actions and activities'. A natural extension to Phase 3 is Phase 4, the formulation of the ultimate *desiderata*, or 'alternative world-view'. The reader's attention is drawn to the fact that the problem-grouping phase shown in Phase 3 has tangent planes with the integration approach phase, shown in Phase 7. The tangent planes are vested in the principle of 'project management', as it is in this phase that the planning pertaining to the integration approach phase is initiated, with particular reference to 'how to get to the pilot' – the invention or selection of new ways of getting there. This requires specifying the courses of action, practices, programmes and policies to be used. Furthermore, this phase is meant to generate maximum creativity among the members of the interdisciplinary teams in lieu of creating an alternative world-view in Phase 4.

Phase 4. This phase deals with the subjectivity of the structured systems approach to model conceptualisation and has been formulated by the authors from various conceptual ideas from their own field experience, including those of the respected philosophers and academics Hegel, Kant, Churchman, Checkland and Beer. These conceptual ideas are based primarily on the following premises:

- Recursion
- Causal loop diagrams and reinforcing and balancing processes
- Alternative sets of assumptions.

These premises are juxtaposed to culminate in an 'alternative world-view', or *Weltanschauung*, with two perspectives, namely:

- A microscopic view
- A telescopic view.

This phase is best described if its individual parts are analysed, as shown in Figure 4. The objective of the alternative world-view (Frame 6) is to challenge (subjectively) a prevailing world-view (Frame 4). Alternative sets of assumptions (Frame 3) are considered the anti-thesis component of the process. These 'alternative sets of assumptions' represent nothing more than the contrasting views that different people may have of the 'same situation' when a problem arises. Increasing purposefulness and sustained improvement are achieved through causal loop diagrams and reinforcing and balancing processes (Frame 1). They are also achieved by using recursion processes (Frame 2), which are applied not only to the prevailing world-view (Frame 4), but also to the alternative world-view (shown in Frame 6 and represented by Frames 1.1 and 2.1). This ultimately results in the continuous development of dialectic world-views – becoming a never-ending process and culminating in the principle of 'continuity'. Any world-view that congeals as the *status quo* should have been subjected to forceful alternative perspectives, as upheld in this phase. The alternative world-view will represent the richest picture, not of the problem, but of the situation in which there is perceived to be a problem. Synthesis of opposites (Frame 5) requires closer

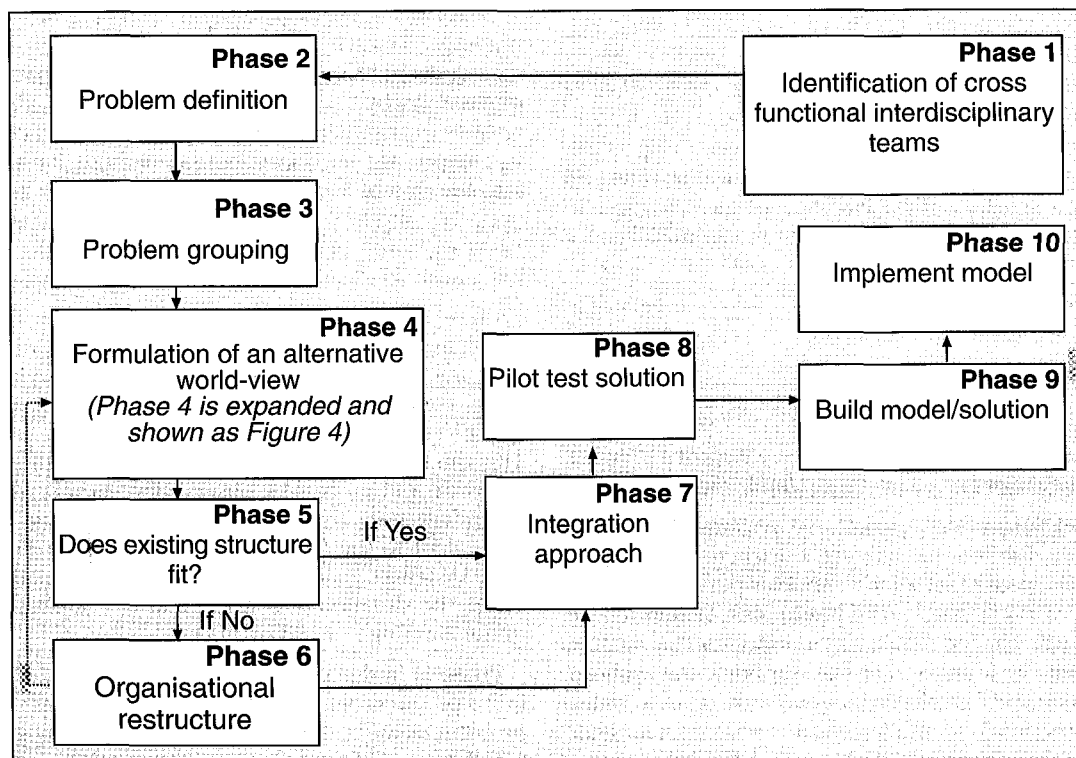


Figure 3. Model conceptualisation process

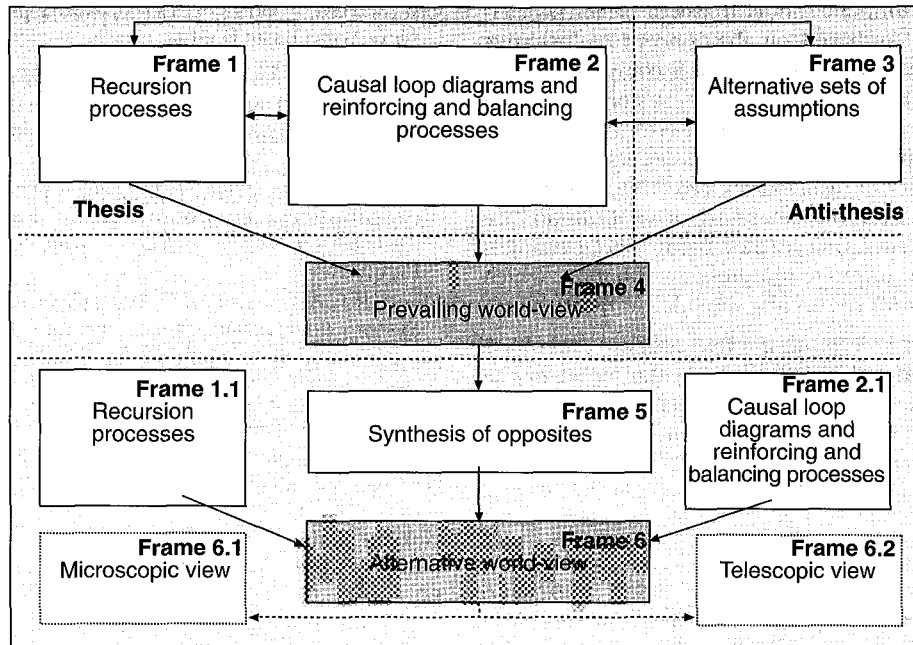


Figure 4. Alternative world-view (represented by Phase 4 in Figure 3)

scrutiny. Challenging the prevailing world-view with the alternative sets of assumptions produces a set of conceptual entities, which represents a synthesis of opposite ideas. It is important to note that in the authors' problem-solving experience, it is most unlikely for all the views to emerge as being the 'same' idea in symbiotic unison. The elements of the concept of a 'synthesis of opposite ideas' are:

- Exact and concisely formulated verbal descriptions, not only of unstructured complex phenomena, which require solutions, but also of the root causes of such phenomena
- Pure views of purposeful potential activity, which represent viable and feasible solutions to the phenomena
- 'Technologically' viable views
- The subjection of the synthesis of opposite ideas to 'radical' thought by selecting a single solution and improving it further so that it culminates in a real-world solution. (This must happen before the synthesis of opposites, shown in Frame 5, can be transformed into the alternative world-view.) This represents a set of 'management principles', which must be present if a set of activities is to comprise a system of purposeful activity – the telescopic view shown in Frame 6.2. It would be naïve to assume that only one solution could emerge from the synthesis of opposite ideas. If these steps occurred in a simulated environment, it might indeed be possible; however, this paper is about real-world situations, thus creating its own complexity and also its own simplistic remedial mechanisms. Sets of structured activities can now be further compared to bring together intuitive perceptions of the problem and provide an epistemologically, deeper and more general account of the realities beneath surface appearances – the microscopic view shown in Frame 6.1. This gives effect to the basic systems hypothesis that systems concepts provide a means of 'teasing out' the complexity of 'reality'.

Phase 5. The ultimate desiderata, formulated in Phase 4 as an 'alternative world-view', must in this phase be compared with the existing organisational infrastructure of the

organisation. If it is found that the alternative world-view can be incorporated into the existing organisational infrastructure, the next step in the process can be initiated, whereby the integration approach phase (Phase 7) can be formulated. If not, the organisation is required to restructure in the next phase. It is of the utmost importance to note that the alternative world-view formulated in Phase 4 may entail organisational restructuring.

Phase 6. In this phase, the restructuring process flowing from the previous phase must take place.

Phase 7. This phase can only be initiated after the alternative world-view has been incorporated into either the existing (refer to Phase 5) or restructured infrastructure (refer to Phase 6). Key elements listed below ideally form part of this phase in the form of 'formal structured project management' operating in the context of 'continuity':

- Timeframes for piloting, model building and ultimate implementation
- Resource allocation
- Budgetary considerations
- Materials
- Equipment
- Physical location
- Project planning
- Planning decisions
- Communication (external and internal)
- Change management
- Executive buy-in
- Staff acceptance.

Phase 8. Phase 8 represents the pilot – the future environment of the system – which will be represented as a quantitative model that simulates its performance under different operational conditions. The pilot as described is a

representation of the ultimate model that will be constructed in Phase 9. The pilot is based on the concept of 'negative feedback', whereby the output of the pilot is compared with a predetermined objective or goal. If the system does not achieve the objective or goal, the margin of error (the negative feedback) then becomes the basis for adjustments to the pilot design to bring it closer to realising the objective or goal. The comparisons referred to in this phase are of vital importance and are essential to generating further debate about changes that could be made to improve the problem situation, which would be the impetus for re-running the pilot.

Phases 9 and 10. Phase 9 (build model/solution) and phase 10 (implement model) fall strictly outside the ambit of the structured systems approach to model conceptualisation. They have been included, however, to complete the process from a holistic perspective.

Conclusion

The authors approach the proposed model conceptualisation process by providing a simplistic, holistic, conceptual sequence of events pertaining to 'model conceptualisation' and 'model building' (as shown in Figure 1). Figure 1 shows that a clear distinction can be made between the two elements, and emphasises that what is proposed in this paper is not a 'model' but an 'approach' to the formulation of a model.

In addition, the entity of 'model conceptualisation' is placed in perspective as encompassing the identification and analysis of problems and the approach to problem solving, as opposed to the entities of 'model construction' and 'model implementation'. The systems approach as an alternative management mechanism is shown to be firmly vested in the structured elements gleaned from hard and soft systems methodologies. Furthermore, the key elements of the structured systems approach to model conceptualisation are analysed in detail in this paper, culminating in a structured alternative management mechanism to be applied by executive management in its quest to solve unstructured complex phenomena.

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Web-enabled and Web-enhanced businesses

Dan Remenyi*

"All we can expect from one another is new and interesting information. We cannot expect answers. Solutions, as quantum reality teaches, are a temporary event, specific to a context, developed through the relationships of persons and circumstances."

Margaret Wheatley, *Leadership and the New Science* (1992).

The e-business-dotcom phenomenon may be understood as consisting of Web-enabled business and Web-enhanced businesses. These are two quite different approaches to the use of the Internet and the Web. Web-enabled business brings a high degree of innovation in an attempt to create a new business form, while the Web-enhanced business addresses the issue of improving corporate processes and practices in order to achieve improvements in efficiency and effectiveness. Although both Web-enabled business and Web-enhanced businesses need to be strongly profit focused, it is generally easier for Web-enhanced business to achieve an appropriate level of profit.

Introduction

E-business has made a very significant impact on how business in general is thought about at the beginning of this millennium (Van der Zee & Strikwerda 2001; Venkatraman 2000; Timmers 1999; Siegel 1999; Kaplan 2000; Gulati & Garino 2000; Hamel 2000; De Kare-Silver 2000; Norris & West 2001). It has been instrumental in creating much discussion and it has also been a powerful magnet for new ideas (some of which have been clever and others of which have not) about how to operate, finance, market and manage a business.

However, by now the term e-business actually covers two very different activities that are conducted on the Web. These may be usefully described as Web-enabled businesses and Web-enhanced businesses. A Web-enabled business, which is also sometimes referred to as a 'born-on-the-Web' business, is quite different from a Web-enhanced business, which is increasingly being thought of as the digital transformation of a traditional organisation.

Web-enabled businesses

Web-enabled businesses are those businesses that could not have existed without the specific facilities offered by the Web. Examples of such businesses include Yahoo.com, Altavista.com, Amazon.com, Confetti.com, CommerceOne.com, Freightwise.com, First-E.com and e-Bay.com. The main *raison d'être* of these Web-enabled businesses is to create completely new markets and, in some cases, products and services that did not exist before. These are pioneering initiatives that have pushed the frontiers of business forward, at least to some extent, by attempting, in some cases, to create and apply new business models, and sometimes new business strategies, for the creation of wealth (Cronin 2000). These web-enabled businesses are what are generally referred to when dotcoms¹ are discussed. They are nearly always start-up businesses, which have been created by combining young entrepreneurial talent with the resources of venture capitalists. In general, the market (and the stock market in particular) has been extraordinarily over-optimistic with regard to the impact and the value of these businesses (Siegel 1999), and it now appears that, although these dotcom organisations are important, they will

not necessarily have the impact on the economy that only a few years ago they were expected to have.

Web-enhanced businesses

Web-enhanced businesses, or digitally transformed businesses, are those already established businesses that have been changed (and sometimes radically changed) by the use of the facilities available through the Internet and the Web. Examples of such businesses include Dell, Federal Express, Britannica, Cisco, Ryanair, Tesco, Yellow Pages and ToysRus. These are not start-up businesses, but are organisations that existed before the arrival of the Internet and the Web. They have transformed themselves and/or their business processes through the use of the technology provided by the Internet and the Web. These Web-enhanced businesses (as opposed to the Web-enabled businesses) will most probably be responsible for the really important and lasting impact of the e-business revolution (Cameron 2000). Examples of the most frequent benefits from digitally transformed businesses are more effective and comprehensive supply-chain management (Tapscott, Ticoll & Lowy 2000), reduced transaction costs, higher margins, bigger markets and fewer errors in the order-to-delivery cycle. In short, this amounts to using the Web as a vital strategic tool. This view was supported by Cameron (2000) when he said: "Business processes will take centre stage in e-Businesses, forcing the IT organisation as we know it to disappear. Technology management will become the responsibility of business process owners – both inside and outside the corporation."

Furthermore, young entrepreneurs with the resources of venture capitalists do not generally manage such organisations. Professional management, using the resources of the established business, operate this type of business entity.

Although Web-enabled and Web-enhanced businesses represent two very different business frameworks, they are unfortunately often incorrectly grouped together. They are also sometimes confused with a distinction that is made concern-

1. It is, however, not entirely true to say that all dotcoms are exclusively Web-enabled businesses, as it is more useful to think of Dell.com as a Web-enhanced business (in other words, an already established business that is simply using the web as a strategic tool).

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ing e-businesses between what is called 'business-to-customer' and what is called 'business-to-business'. Of course, the described difference between Web-enabled businesses and Web-enhanced businesses has nothing at all to do with the distinction between business-to-customer and business-to-business websites. Thus, both Amazon.com, which operates on the business-to-customer basis, and CommerceOne, which operates on the business-to-business basis, are both Web-enabled businesses; Ryanair, which operates on the business-to-customer basis, and Cisco, which operates on the business-to-business basis, are both Web-enhanced businesses.

What e-business offers

The most effective way of understanding the distinction between Web-enabled businesses and Web-enhanced businesses is to look closely at what e-business does and to examine a business model for both a Web-enabled business and a Web-enhanced business.

Whatever approach a business takes to the Internet and the Web can really offer only one or more the following four dimensions:²

1. Provide global reach in marketing or purchasing and some aspects of business support
2. Offer extensive linkages between the organisation's website and the websites of others
3. Allow the organisation's clients, prospective clients and other stakeholders to have continuous access to its offerings (in other words, 24 hours a day, 7 days a week and 365 days a year)
4. An opportunity to enhance the functions or processes of the business by changing the way information, communication, transactions and distribution can be handled (Angehrn 1997).

These four characteristics or dimensions that apply to how business may be conducted or pursued using the Internet and the Web allow for a different approach to markets for buyers and sellers, collaboration between industry players, hours of doing business and the way in which companies can establish and develop their business relationships with others. For established businesses, these dimensions result either in the creation of new processes or practices or the enhancement of those already in place (in other words, Web-enhanced businesses); alternatively, they can allow organisations to try to create new frameworks for conducting business (in other words, Web-enabled businesses). In the case of the Web-enhanced business, the focus is on new processes or practices such as those employed by Dell, Federal Express, Ryanair and Cisco, while for Web-enabled businesses, it is the novelty of Amazon.com, Yahoo.com and e-Bay.com.

Regardless of whether an organisation uses the Internet and the Web for the purposes of Web-enabled business or Web-enhanced business, all four of these dimensions may be used, and it is in this similarity of the components of the technology that the confusion often lies.

To help focus on the way these two approaches are applied, it is useful to look closely at two different business models that are well known and may be regarded as successes. The first business model is an example of perhaps the most famous Web-enabled business of all, Amazon.com.

Amazon.com's business model

In envisaging the creation and development of Amazon.com as a business, its founder, Jeff Bezos, used the following seven facts and assumptions to underpin the business model:

1. There is a global market for books at the right price. Book margins are large and transaction costs can be kept low, especially as book purchasers pay the carriage.
2. Books are relatively easy to sell without customers having to view the merchandise (in other words, 'sight unseen').
3. Book buyers want convenient shopping, and being able to buy books from the office or home provides the greatest convenience.
4. Book buyers want a large range of books³ from which to choose, as well as help in choosing from that range.
5. Staff would make extra efforts in the expectation of great rewards from share price increases, for example.
6. Being a high visibility first mover would give the firm a considerable competitive advantage.
7. Profit and positive cash flow are irrelevant as long as the stock market keeps pushing up the share price.

To regard Amazon.com simply as a bookshop that sells on the Web is to misunderstand the nature of the business. The business model of Amazon.com contains several completely new insights into the creation, operation and development of a new genus of business. It is true to say that not all the seven points articulated in the above list were entirely new. However, some of the ideas are novel, and Amazon.com represents the first instance of the operationalisation of this collection of ideas (Godin 1999).

Before Amazon.com, there had really been no appreciation of the global potential of the book business. There were some national chains of bookstores, but there were no multinational operators with anything that could be described as a global reach. There was not the realisation that perhaps only a few hundred cities have really excellent bookstores and that there are people all over the world that want, or need access to, a wide range of books. The issues of the range of books, the home or office shopping convenience to book buyers, or the sale of products sight unseen had not been raised before – let alone the question of being able to sustain, over multiple years, the required funding for a loss-making business through a rising share price in a bull market. Some would argue that this funding aspect of the Amazon.com operation was extremely innovative and led to many other organisations expecting to do the same and not always being able to succeed.

This level of novelty, which characterised Amazon.com, is the hallmark of the Web-enabled business that brings into existence something quite new.

However, it needs to be noted that business models change or evolve over the life of the business and that the business model of Amazon.com is therefore somewhat different today in a number of important respects:⁴ the range of activities,

2. These four direct functions that may be developed through the use of the Internet and the Web are, of course, additional to the fact that business can utilise the vast quantity of information that may be accessed through this technology. Google.com alone give the business analyst access to more than one billion web pages.
3. Amazon.com boasts some three million titles available.
4. All businesses need to change their business models as they evolve. However, it is probably necessary for Web-enabled businesses to change their business models faster than traditional operations. This is because their business model can be imitated very quickly. It is clear that today there are hundreds, or perhaps even thousands, of Web bookshops.

products and services is much broader; the price advantage to the customer of doing business with Amazon.com is no longer present; the motivation of the Amazon.com staff is different; and the organisation can no longer rely on a rising stock market to facilitate the funding of its losses. As a result, Amazon.com is now in trouble⁵ and is reputed to be searching for an organisation with which to merge.

Dell Computer's business model

Unlike the Web-enabled business, the Web-enhanced business will not attempt a completely new approach, but will rather focus on the original business and enhance its operation by the use of new processes that have become available through using the Internet and the Web. A clear example of a highly successful Web-enhanced business is that of Dell Computers. The vision underpinning Dell.com may be expressed as follows:

1. The Web can make it easier for buyers and suppliers to do business with Dell.
2. The Web can help Dell to provide more help and service to clients at reduced operating cost.
3. Buying from Dell is easier through the Web than by using the older 0800 free phone service.
4. Dell can deliver customised personal computers to purchasers faster and more cheaply, with fewer inventories, by using the Web to improve its supply-chain management.
5. Product enquiries and order status checking can be quicker and easier for the client through the Web, as well as less expensive for Dell.
6. Dell can substantially minimise helpdesk resources by providing the right self-service information on its website.
7. Personalised service can be provided through its Premier Page Web facilities.

Although Michael Dell has pointed out that Dell's website has made an enormous difference to the business (to the tune of hundreds of millions of dollars additional profit per year), Dell has not tried to create a brand-new business type. Dell is still a computer assembler and vendor, but a more efficient and effective one. What Dell has essentially done is to improve the older business functions and processes. In the hands of Dell Computers, the Internet and the Web are not used to break completely new ground, with the result that there is much less difficulty in ensuring the success of these types of applications (Patel & McCarthy 2000). For Dell, the Web has been a major tool for entrenching itself as the market leader in the supply of personal computers.

As a general rule, the majority of Web-enabled businesses have struggled to show profitable returns, while many of the Web-enhanced businesses have not. There are several important reasons for this, only one of which is the problem of attracting customers and convincing the market to do business with organisations that have very little real presence at the place where the transaction takes place. Other problems are often related in one way or another to the maturity of the management of many Web-enabled businesses.

The importance of the business model

It is clear that the business model is an essential part of the success of the organisation for both Web-enabled and Web-enhanced businesses. Sound business models underpin effec-

tive businesses, while weak business models only cause problems and often lead to the collapse of the business. It is interesting to note that both Amazon.com and Dell had low price as part of their initial business model. Amazon.com has dropped that strategy, however, and Dell computers are by no means the cheapest available. It seems that, as the Web matures, the original need to offer low-cost goods and services is abating. The issues now have more to do with offering choice and service.

Web-enabled versus Web-enhanced business

Although the distinction between Web-enabled and Web-enhanced businesses is a very important one in formulating corporate strategy, it should be noted that there is some knock-on and/or overlap between these different approaches to business (see Figure 1).

This knock-on and/or overlap exists in two different senses. Firstly, established organisations that intend simply to enhance their current operations by using the Web to enhance their current processes may well find themselves being drawn into completely new businesses. There is little doubt that this is the way in which the *Encyclopaedia Britannica* was drawn into a new business model, which converted the old publishing business into a Web shopping mall. RyanAir.com is another example of a business that has been substantially transformed using Web technology.

The fact that a Web-enhancement initiative may lead to Web enablement is directly in keeping with the concepts of business scope redefinition described by Scott Morton (1991) in the seminal work, *The Corporation of the 1990s*.

The second knock-on and/or overlap effect exists in that successful Web-enhanced businesses need to use the same Web technology to ensure that their business processes are as effective and efficient as possible. This amounts to having the business Web-enabled.

Web-enabled business and Web-enhanced opportunities

There are numerous different opportunities to either Web-enable or Web-enhance a business, and it is useful to put these into a framework in order to see the types of applications that may be most advantageous. The framework used here is the well-established two-by-two taxonomy – business-business (B2B), business-consumer (B2C), consumer-business (C2B) and consumer-consumer (C2C), as illustrated with examples in Figure 2.

When the Web-enabled or Web-enhanced dimensions are mapped on to this two-by-two matrix, as is done in Figure 3, it is possible to establish where it is most likely that these types of applications will be found. Thus, in the B2B quadrant, opportunities for both Web-enablement (described as W-A in Figure 3) and Web-enhancement (described as W-H in Figure 3) are to be found. Here the applications will be Web-facilitated business networks, with peer-to-peer delivery. These will be agile systems for suppliers, distributors, services providers, infrastructure providers and, of course, customers. In the B2C quadrant, there will be continued emphasis on e-marketing and other client-focused activities.

5. Over a period of about 15 months, the share price of Amazon.com has fallen from more than \$110 per share to a low of about \$8 per share. Jeff Bezos openly admitted on *The Money Programme* broadcast by BBC2 in March 2001: "I have for two years now warned small investors not to invest in Amazon.com."

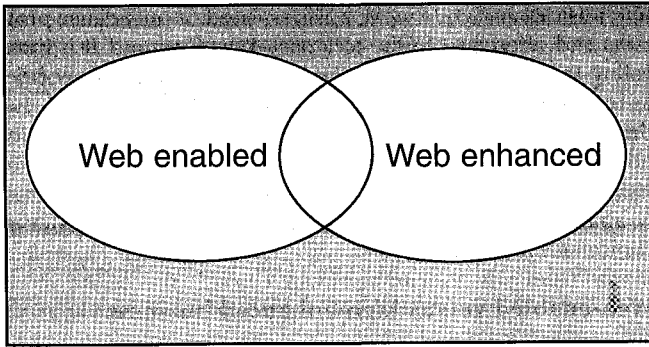


Figure 1. The knock-on and/or overlap – Web-enabled business and Web-enhanced business

	Business	Consumer
Business	Dell ValueChain CommerceOne Just2Clicks	Amazon Lastminute Hoythot Cahoot
Consumer	Priceline Mysimon Bestbookbuys	e-Bay e-Bid Napster

Figure 2. The business–business, business–consumer, consumer–business and consumer–consumer taxonomy

	Business	Consumer
Business	W-A W-H	W-H W-A
Consumer	W-A	W-A

W-A: Web-enablement

W-H: Web-enhancement

Figure 3. Mapping Web-enablement and Web-enhancement on to the business–business, business–consumer, consumer–business and consumer–consumer taxonomy

However, C2B and C2C applications are areas of considerable innovation, and the notion of Web-enhancement does not really apply. The type of applications found in these quadrants are usually ones that could not have existed without the Web. This is certainly true of organisations such as Priceline.com, Mysimon.com and Bestbookbuys.com in the C2B quadrant and e-Bay.com and Napster.com in the C2C quadrant. Thus, it

is in these quadrants that complete new business ideas will spring up, which, when successful, will make very large returns for their initiators. Of course, these will also be very high risk areas, and there will therefore also be a fair share of failure.

A higher level of innovation

It can be argued that it is possible to go much further than the business model of Amazon.com in seeking to implement a novel approach to business. It is sometimes said that the real sign of novelty is being able to radically change the way people think about collaboration using Web and Internet technology. One of the pioneers of collaborative action on the Web has been LetsBuyIt.com. There is no doubt that this organisation has a different approach, which is expressed in the business model supplied on the firm's website:

LetsBuyIt.com is developing a leading pan-European e-commerce business based on its innovative, member-driven business model. This model, called co-buying, offers LetsBuyIt.com's members an opportunity to aggregate their demand for a product or service in order to achieve favourable price terms. Members of LetsBuyIt.com are able to request merchandise and services, which LetsBuyIt.com then secures on preferential terms from suppliers and manufacturers.

There is no doubt that this is a distinctly novel way of offering goods and services to the public. It is an example of Web-enabled business that is pushing the envelope even further than other business models have. Perhaps the point that needs to be made is that LetsBuyIt.com is an organisation that has had a difficult time in establishing itself and has only very recently been resuscitated after having had to stop operating because of a lack of funds.

Another quite different business model was launched by Priceline.com. In this case, airline ticket purchasers were invited to state how much they were prepared to pay for an airline seat between destinations in the USA. This was a form of airline seat auctioning that worked well enough. Priceline.com was sufficiently pleased with the results of this pioneering approach that they decided to try it out on other products such as groceries and gasoline. Unfortunately, this did not work, and, together with reversals in their relationships with some of the airlines, these moves brought Priceline.com into considerable financial difficulty.

Summary and conclusion

The last few years have been very exciting for those involved in e-business. In less than ten years, e-business became what some people thought was the most effective way of doing business. It was estimated by the British Broadcasting Corporation in July 2000 that there were some 10 million e-businesses on the web and that venture capitalists were investing in these new business at the rate of \$100 billion per year. This was an unprecedented level of interest and activity that clearly could not be sustained. Furthermore, the stock market bubble allowed some dotcom organisation to obtain altogether unrealistic valuations.⁶ In so doing, it created a large number of paper millionaires and even some paper billionaires.

6. In early 2001, the BBC discussed the concept of the 200 Club. The 200 Club is exclusively for chief executive officers that have presided over organisations whose market capitalisation has declined by \$200 billion or more. At that time, there were three organisations that qualified: Intel, Cisco and MicroSoft.

E-business and dotcoms peaked in influence in 2000, when it became obvious that the approach to, and understanding of, this phenomenon was not optimal or complete. As a result, there has been a considerable amount of re-thinking, by both established companies and by venture capitalists looking for start-up opportunities, concerning how to conceptualise and manage investment in this arena. This re-thinking has caused companies to go back to fundamental ideas of corporate strategy and to have a hard look at how they can use e-business as a tool to support their objectives.

One of the first steps that is needed to achieve this is the realisation that there is not just one simple e-business-dotcom phenomenon. Under the banner of e-business, several different sets of business concepts and strategies are being played out. One of the most useful ways of thinking about this is through the lens of the Web-enabled and Web-enhanced business taxonomy. Understanding this distinction is an important step in coming to terms with how to manage investment in this area.

Of course, it is important to realise that the current lack of enthusiasm for some e-businesses and dotcoms does not in any way suggest that this phenomenon is over. All it means is that the attitude of the stock market, venture capitalists and industry and commerce in general has matured significantly and that the new period that is now beginning (and has been called the 'post-dotcom era') is really only the 'post-crackpot-idea-dotcom era'. There is still plenty of life left for smart e-businesses and dotcoms. In fact, it has been suggested by Jeff Bezos that we are still in the Kitty Hawk era of e-business and that we cannot even visualise or guess what the 747 version of e-business will look like.

It would appear that there are interesting times ahead.

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Creating a supply chain model that incorporates the integration electronic business aims to deliver

O.J. Jordaan*

The supply chain model includes the full chain, from the supply of the raw materials to the delivery of the final product or service. Organisational concepts – in the areas of knowledge management, technology and customer management – impact on the supply chain model. These concepts are defined, and the supply chain model is discussed in the context of the impact that such issues can have on it. Finally, a new presentation of the model is suggested in order to convey the relationship of the model to such issues.

Is the supply chain model still relevant in the computing business world of today?

The theory around the supply chain and the way it has depicted acquisition, transformation of raw materials and supply of the final product (or service into product) has been in use for some time. The question now arises whether this theory has any relevance in a world of ubiquitous computing, where the ability to communicate bigger volumes of information, over greater distances, in faster ways, is changing the world we do business in at an ever-faster pace. It is therefore the intention of this study to explore the interrelationship between the supply chain concept and information technology in order to present a revised model based on the insights gained during this analysis.

Two major factors must be borne in mind when considering supply chain theory in conjunction with computing. One is the basic supply chain concept, and the extent of its development, based on the ability of technology, while the other is the organisation and its use of technology, especially information technology and computing technology.

This paper will look at the theoretical definition of the supply chain, then combine this with the ability and designs of technology in use by business and consider how these affect the supply chain model. Finally, it will attempt to present a conclusive model, combining the theory of the supply chain with the use of technology, particularly information and computing technology.

The conclusion of this paper will then answer the question of the relevance of the supply chain model in the modern computing business world.

Definition of terms

Enterprise resource planning (ERP) systems

In large organisations, many different and diverse functions are performed. These diverse functions are all designed with the purpose of reaching the organisational goals set by management. Organisation-wide systems seek to incorporate all the diverse functional systems into a single system that will facilitate information flow, remove duplication of information and increase efficiency of processes. ERP systems, as described in a market survey by Deloitte Consulting (1998: 2) in the USA, can be seen 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 ERP is to consolidate all the separate systems into a single system that shares all common information used throughout the organisation. This has many advantages, from having to capture information only once to enabling synchronised interaction between functions that have never been synchronised before. The concepts of shared information, standardisation, centralised information management and processing come into play with such systems.

Customer relationship management (CRM)

In his article, Gronroos (1994) analyses various aspects of the relationship between the organisation as a supplier and customer. He recognises that the relationship is about customer retention and relationship economics. Summarising his description of the different aspects, it would be possible to conclude: "Customer relationship management is the process of establishing, maintaining and developing the relationship of the organisation as a supplier and customer with the goal of beneficial outcome to all parties within the relationship."

It is important to note that this relationship is an organisational one, which is not dependent on the relationship between individuals (although this aspect is not excluded). It is an agreed level of interaction with the objective of being financially effective for all parties and meeting all their operational goals.

Electronic commerce

Electronic commerce (e-commerce) has been explained as "buying and selling done over the Internet" (Benchmarking Partners 1999), which is possibly the briefest of definitions.

When an organisation starts conducting business transactions in an electronic medium and moves away from the traditional physical processing of monetary transactions, it is 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 very closely linked with the Internet as a mode of global communication that allows transactions to take place between parties virtually anywhere in the world.

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Various methods of conducting e-commerce exist and can impact on an organisation and its structure in different ways, some of which include:

1. Intranet transactions

Transactions between business units of the same enterprise that are conducted electronically on the enterprise's Intranet represent one type of e-commerce, known as an electronic data interchange (EDI) method. From the author's experience, there are various different kinds of transactions that take place in this way:

- Centralised procurement. Operational business units in an enterprise place requirements through EDI on the central procurement unit that combines the requirements of all the operations and then does the enterprise procurement.
- Centralised inventory management. The operational units use EDI to place a demand for inventory on the central control unit.
- Operation-to-operation transacting. EDI is used as the buy-sell transaction method between operations in a single enterprise that require goods or services from one another.

2. Extranet transactions

Extranet transacting is done through a network outside the organisation and is typically an Internet transaction. It is, however, also feasible to create an extranet between partners in a supply chain and transact through an external network.

According to the Gartner Group (1999a), e-commerce is expected to have an impact on all areas of industry and force widespread restructuring. The ERP market and e-commerce are also on a course that will bring them closer to one another. With ERP vendors introducing e-commerce functionality and the advent of object-oriented programming, it will be easier to enable e-commerce and network transacting, and different systems in different organisations will be brought closer to interacting electronically. The technology makes it possible to connect the demands of the organisation's customers with the suppliers. This integration of suppliers and buyers using the same data has various effects on the supply chain, including shortening the supply time and reducing inventory.

Recent developments in terminology in this field have also defined smaller sections of the e-commerce space.

E-business

E-business has been explained briefly as "business done over the Internet or equivalent media" (Benchmarking Partners 1999) and encompasses all financial transactions between organisations. E-business differs from e-commerce in that e-business focuses on financial transactions while e-commerce focuses on a wider range of business transactions.

I-business

I-business has been defined as "e-business or e-commerce done in a way that allows trading partners or different parts of the same organisation to align their activities, integrate information or improve decision making by exploiting the ready access to information that the Internet gives them" (Benchmarking Partners 1999). This definition includes transaction information and other relevant information that enables transactions. E-business and i-business can be differentiated if it is understood that e-business entails only

business transactions relating to purchasing and sales, while i-business includes those aspects, as well as the sharing of business intelligence, for example, capacity planning, scheduling, sales figures and forecasts that allow the business partners to understand more about their respective businesses. This is related to alliance strategies between organisations.

Collaborative commerce (c-commerce)

In c-commerce, enterprises harness the full power of the Internet to gain revenue and improve profit by going beyond rigid supply chain models and simple information sharing. C-commerce applications are expected to replace static, Web-enabled supply chain and value chain applications as the dominant application model by 2004 (at the 0.8 level of probability) (Gartner Group 1999b). In business terms, this would mean sharing information to the extent that the organisations in the relationship would understand their respective competitive advantages.

Supply chain

Organisations exist to acquire and convert material or services into a product in order to create wealth. The process or sequence of events that is used in this conversion can be described as the supply chain. Melnyk & Denzler (1996) define the supply chain as "the sequence of suppliers and organisational buyers that spans all stages of processing from raw material to final consumers" and illustrate it as shown in Figure 1.

These authors define the "transformation process" as comprising two types of activities:

1. Core activities to the organisation, managed by the organisation
2. Non-core activities to the organisation, managed by the suppliers to the organisation.

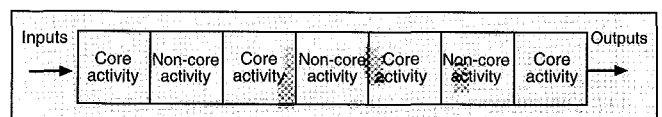
Another author, Turner (1993) defines the supply chain as a "formal linkage among all levels in a marketing channel ... a technique that looks at all the links in the chain, from raw materials suppliers through various levels of manufacturing to warehousing and distribution to the final consumer".

Although the definitions of both Melnyk & Denzler (1996) and Turner (1993) refer to the manufacturing environment, the concept of transformation is just as applicable to the delivery of a service product, entailing the transformation of service offerings in order to deliver a final service product.

The ability to link customers with suppliers, as enabled by information systems, is described by Hines (1995) as the supply chain enabler (see Figure 2). Although this author refers only to EDI as a transfer method, the concept that is described is enabled by the kinds of technology already discussed.

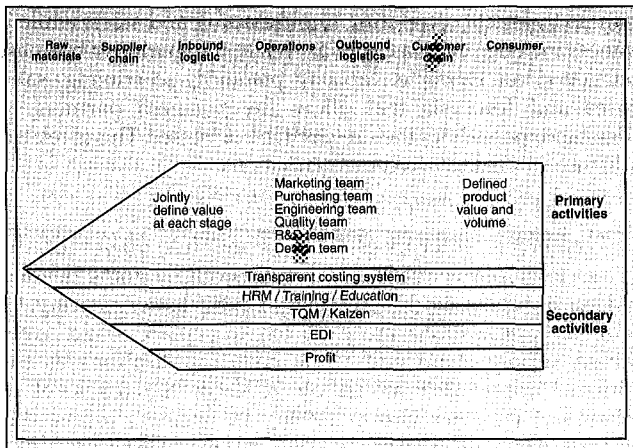
It is clear that the driver in this case is the consumer/customer. It is important to note that there is an implicit relationship between the consumer/customer and the supplier of raw materials.

From the definitions provided, it is also possible to conclude that the supply comprises a number of different activities, some of which are critical to the delivery of a product and some of which are supportive of the other activities or processes.



Source: Adapted from Melnyk & Denzler (1996)

Figure 1. Supply chain



Source: Hines (1995)

Figure 2. The integrated materials value pipeline

Ubiquitous computing

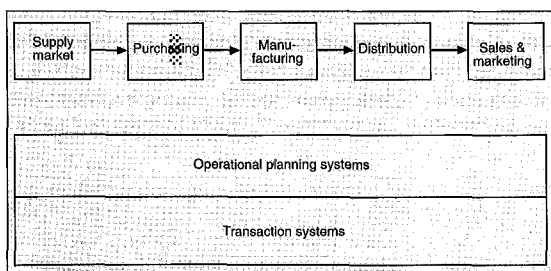
The name for this concept is descriptive in that computing in the ubiquitous environment is not bound by logistical or geographical restraints.

In a strategic analysis report by the Gartner Group (1998) on technology trends that are expected until 2008, the "spontaneous computing era" is considered as the equivalent of ubiquitous computing.

The ability to produce more powerful devices in smaller sizes is expected to bring the use of computing to the stage where it is no longer system related but a spontaneous action, and a means to an end wherever required. The Gartner Group (1998) projects the office of the organisation to be an "untethered" office, which gives the employee complete freedom of movement and access to information and obviates the need for a physical office for performing work tasks. These projections have a potentially profound impact on the structural design in the organisation, as well as on the ability of different processes in the supply chain to interact, whether within or outside the organisation. The notion of structured workforces reporting to another level of control comes into jeopardy in this context. With movement so free, different demands are placed on the supply chain and different assumptions are made about its abilities.

The supply chain on the basis of original theory

The supply chain includes both processes or activities that are core transformation processes and those that support them. By definition, the supply chain has a beginning and an end. The supply chain starts with the acquisition of the raw material or service offering and ends with the final delivery of the product or service to the internal or external customer.



Source: Adapted from Turner (1993)

Figure 3. Decision-support and transaction systems

Turner (1993) depicts the value chain process as comprising transaction and decision support systems, as shown in Figure 3. This model is consistent with that of Melnyk & Denzler (1996) in that it includes both execution and enabling processes or activities.

Although both types of processes or activities are required in delivering the product or service to the customer, it is clear that they would be viewed in different contexts within the organisation. There are direct transformation processes or activities on the one hand, and indirect or enabling processes and activities on the other. Another way of describing this differentiation is to say that there are both core and supporting processes or activities.

Taking into account that the definition of the supply chain suggests that it starts with the supplier of raw materials, basic services or information and ends with the customer, each cycle through the supply chain is a defined start-to-finish event or process. This model could thus be characterised as the one-event supply chain. It would therefore be appropriate to describe a very simplified example of such an event by saying that it is the sequence of sourcing raw materials for a product, procuring the material, receiving it from the supplier, transforming the material into a saleable product, delivering it to the customer, and receiving payment for delivery. This is achieved by managing the relationship with the parties involved in such a manner as to benefit all the participants. This view of the supply chain is illustrated in Figure 4.

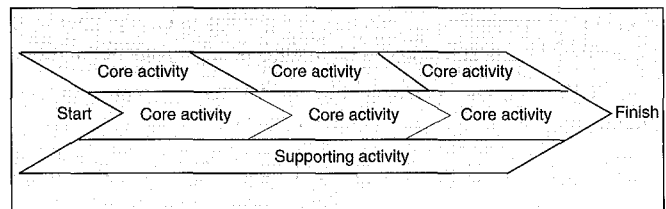


Figure 4. The one-event supply chain

Based on the developments in the field of CRM, it is clear that there is much more to the execution of the supply chain than a single event. It is therefore important to understand the model depicted in Figure 4 and impose the effect of the CRM principle on it.

The influence of CRM on the presentation of the supply chain

With customer relationship management systems having been brought into the realm of marketing and client customer interaction, it is important to ensure that the principles of CRM form part of the supply chain model that is presented. This is essential in order to ensure the link between the customer and the supplier as depicted earlier. This concept can be explained by using the example of a supplier to an organisation being able to see the demand requirements of the clients of that organisation – almost 'looking through' the organisation to the client. The supplier of the organisation is thus able to schedule the supply to match the demand placed on the organisation by the client.

The following principles underlie CRM:

1. Being able to schedule and coordinate the full supply chain can serve to reduce costs over its total span. Decreasing cost in one process of the supply chain could increase cost in another area, which is contrary to the principle of lower cost in the supply chain as a whole. For example, if an industrial plant decreases its raw material stock levels by getting the

supplier to own and manage the warehouse, the cost to the plant is reduced, but the total cost in the supply chain remains the same. If the reduced stock levels in the warehouse come about through better stock management, planning and coordination, however, there is resultant cost reduction for the entire chain.

2. Enhancing relationships in the supply chain in order for all parties to learn how to interact with one other has the result of decreasing relationship costs in the long term, as well as the cost of changing suppliers.
3. The third principle is to avoid unnecessary quality costs for suppliers.

In the design of the previously depicted models of the supply chain (Figures 1-4), these principles were well illustrated and the models therefore seemed to be complete. The principle of customer retention (being able to repeat the supply chain event multiple times or continuously) was assumed in the models, but the illustration of this principle was lacking. This created the possibility that the models could be viewed without a full appreciation of the cyclical nature of the supply chain. In order to develop the model to the extent attempted in this paper, it is important that the cyclical nature be shown, as illustrated in Figure 5.

The ability to recognise that the supply chain is a continuous process, which is built and evolves through repeated iterations and cycles of execution, emphasises the principles that underlie CRM. The model presented in Figure 5 depicts the supply chain as a rotating cylinder with the activities and processes recycling, as the chain is used again and again. The client, who is at end of the cycle in the other models, is now at the start the next cycle. Since it is a principle of CRM to retain the client relationship, the client's requirements determine what is required from the suppliers. This in turn drives the start of the chain (if the suppliers are seen as the starting point), and the process repeats itself. At this stage, it is also important to note that the 'start' of the supply chain is regarded only as a point of reference - whether the chain begins with the customer or the supplier is no longer of great importance, since the cycle is repetitive. The customer could also be regarded merely as a trigger to a process, but this view would not in itself enable the supply chain to its fullest extent.

Hammer (1990), in his article 'Reengineering work: don't automate, obliterate', describes different aspects of using technology in the organisation and mentions that organisations use technology to automate old methods and

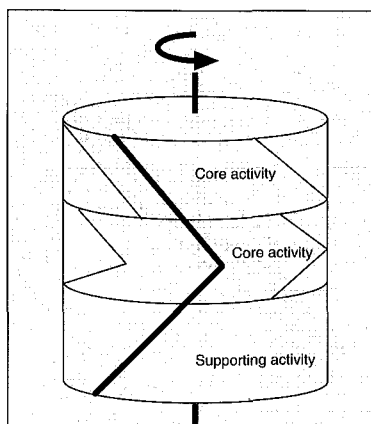


Figure 5. Introducing CRM to the supply chain

processes. The principle of reengineering stresses the importance of avoiding the duplication of activities, and the ability to optimise the supply chain through technology can be regarded as one of the strongest tools in enabling the supply chain.

In order to explore this integration aspect of the supply chain, it is important that the ability of the ERP systems be placed in context with the supply chain model illustrated in Figure 5.

ERP and what it can add to the picture

Business process reengineering (BPR) is described by Hammer & Champy (1993) as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements".

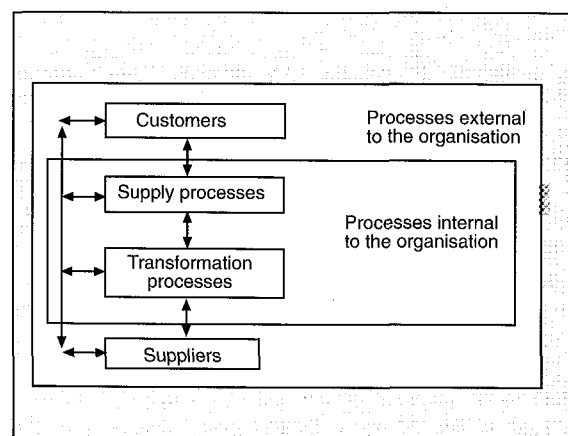
This concept is supported by certain principles described by Melnyk & Denzler (1996: 230):

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 and control resources should be minimised.
5. The reconciliation of inconsistencies should be minimised.

Another principle of BPR is to reduce or eliminate the duplication of processes, for example, using the same supplier information in purchase orders and receipts and also linking this information to debtors. Another example would be to use the same item or material code for procurement in production and the same product number or code for production, delivery and sales. This would enable the same information to be used in completely different parts of the organisation without recapturing the supplier details in the different areas. Information would thus be captured only once.

The ERP system enables this concept in the supply chain. With the advent of ERP in organisations, the standardisation of information for organisations was seen as best practice in utilising ERP more effectively.

Handfield & Nichols (1999) illustrate this concept by indicating that information flows between all the processes and process steps, not only within the boundaries of the organisation, but also to suppliers outside. The flow between the customer, the supplier and the process steps inside the organisation can be illustrated as shown in Figure 6.



Source: Adapted from Handfield & Nichols (1999)

Figure 6. Information flows in the supply chain

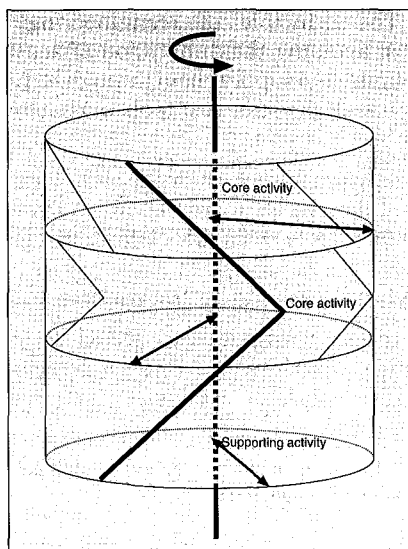


Figure 7. Introducing CRM and ERP to the supply chain model

This concept can be illustrated by adding a central access to the cylindrical illustration of the supply chain and recognising that the different processes or activities within the supply chain have the ability to look at standardised related data. This enables the supply chain to coordinate requirements, dates, standards and all relevant information from a central source and thus to enable the more efficient execution of the supply chain processes or activities.

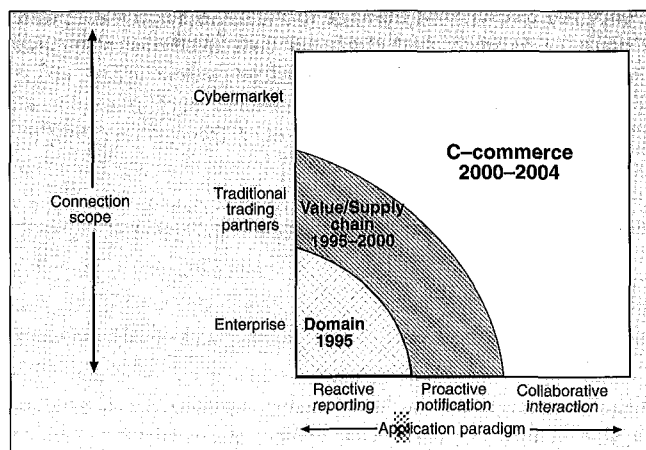
This model illustrates the supply chain in relation to CRM and ERP. The aspects of the strategic management of the supply chain and the effect of collaborative commerce (c-commerce) will be examined next.

The boundaries of the organisation further challenged as c-commerce starts to become a reality

The Gartner Group (1999b) explains that c-commerce is developing from the known areas of ERP and traditional supply chain partners and can be defined as “mutually beneficial cooperative problem solving and opportunity exploitation – beyond traditional, predefined trading partners to quickly foster new, different and innovative ways to solve business problems and capture new business. C-commerce applications will enable enterprises to deliver greater value to customers by: (1) Synchronising and optimising events and activities among a dynamic set of business partners and (2) enabling dynamic, business process execution.” This is illustrated in Figure 8.

This implies that the normal integration along the supply chain is no longer valid in the execution of the supply chain for the modern business environment. The ability of supply chain partners to integrate their information and processes will enable faster, more innovative and better problem solutions for all the parties in the supply chain agreement, creating a virtual organisation linked by the integration of information systems.

By its very nature, this imposes the requirement that the information in the supply chain not only be available to the various processes or activities but be relevant for the process in the entire supply chain. Problems thus have to be solved and decisions made in the context of the entire supply chain, rather than at the point of the individual process or activity. This requires that at any level or plane in the supply chain, information from the rest of the supply chain is available in a form that is relevant and useful.



Source: Gartner Group (1999b)

Figure 8. Business application evolution to c-commerce

Implicit in this argument is the requirement that the information be standardised, coordinated and synchronised across the entire supply chain. This constitutes another way of expressing the supply chain model.

A new way of looking at the supply chain

The model that describes the supply chain in the context of the new demands on the business and the manner of execution of the supply chain must uphold the following principles:

1. Supply chain knowledge management must be centralised and integrated.
2. All processes or activities and areas in the supply chain must have equal access to supply chain knowledge (in other words, the same distance from the centre).
3. Relevant knowledge from the entire supply chain must be available to all processes or activities.
4. The model must illustrate the cyclical nature of the execution of the supply chain.
5. The supply chain must have the ability to react and adapt to the requirements of the environment and the customers.

In order to illustrate these principles, the tubular shape depicted in Figures 5 and 7 must become a spherical shape revolving around a knowledge management axis and core (see Figure 9). The levels of processes or activities are still shown.

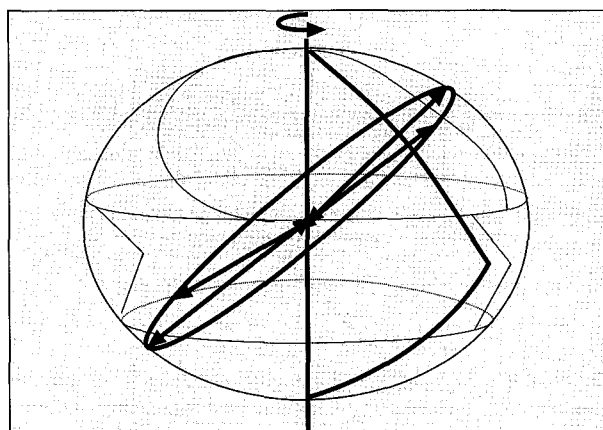


Figure 9. The new-look supply chain model

The way that processes or activities look at the supply chain knowledge is no longer horizontal to the process or activity but depends on where in the supply chain the need for knowledge originates; a section through the supply chain will indicate the area of knowledge relevant to the process or activity.

Conclusion

It is argued that the supply chain model is still relevant. In the context of technological advances and developments in the business models of the day, the way that the supply chain is conceptualised and presented needs to be argued. The new representation of the supply chain model presented in this paper suggests that the advent of technology has changed the mechanism of execution of the entire supply chain. It therefore suggests further that the way the supply chain is conceptualised and managed in the context of the associated partners also needs to change.

It is no longer important to manage every activity or process in the supply chain independently and individually; it is important to see the activity or process in the context of the entire supply chain. The execution of the processes or activities is no longer influenced by geography or the information differences in the chain. The execution is driven by full knowledge from start to finish, where and when needed. The result is that the business no longer has the traditional geographical and time-related boundaries that are influenced by knowledge empires in different areas of the process. The business now presents a very different concept, with different requirements for evaluating the supply chain within which the organisation operates.

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South African and global business schools: an industry review

C. Strasheim*

This paper deals with the development of the global management education industry. The South African management education industry is covered first. Research aimed at directing South African business schools to adapt to challenges facing the business environment is reviewed, as well as the forces impacting on the South African management education industry. These developments are then compared with the international situation by means of a general historical overview of business schools in the United States (US) and a brief discussion of business schools in Europe and Asia. The paper concludes with some directions for South African business schools.

Introduction

It is generally acknowledged that the Master of Business Administration (MBA) or Master of Business Leadership (MBL) degree is one of the best qualifications for preparing learners for senior management. Globally, the market for MBAs has grown tremendously; more and more institutions offer the degree, and even more institutions have expanded their offerings to other markets through distance education, satellite campuses or agreements with private organisations. "In line with rising demand for top management and leadership, a Master of Business Administration (MBA) degree continues to be a highly sought after qualification in [South Africa] and the rest of the world" (*Business Day* 2000a).

All business schools have felt the changes in some way or another, and since the MBA/MBL market is booming, most business schools seem to thrive, or, at worst, survive.

According to *Business Day* (2001a), South Africa's skills shortage still presents an increasing obstacle to economic growth, especially since the number of formal-sector jobs is projected to rise by 45 000 between 1998 and 2003, according to the Human Sciences Research Council.

The purpose of this article is to cover the development of South African business schools, and make comparisons with developments in international schools. The methodology followed for this article includes an extensive literature review of academic papers and research reports aimed at curriculum content. A thorough analysis was also made of articles relating to business schools in the popular press. Main pointers from the literature review are highlighted. The challenges facing South African business schools are addressed and are compared with the challenges facing US, European and Asian business schools. The ranking of US business schools receives some attention. The paper concludes with some recommendations for South African business schools.

Literature review pertaining to South African business schools

The need for proactive and decisive policies to develop the South African manager is widely acknowledged (*Financial Mail* 1997; Bricker 1990). From the mid-1980s onwards, a number of published articles have aimed at directing business schools in adjusting their curricula to suit global as well as southern African requirements.

Harari & Beaty (1986) suggest changes to 'Africanise' the South African MBA. They suggest that the functional courses should be more closely related to the South African context, with academics writing their own texts, case studies and exercises.

Slabbert (1987) investigated the curricula covered in management training, and the career anchors of a group of MBA/MBL students. Tromp (1989: 27) states that "[South African] management education is often criticised for not producing competent managers." He refers to the changing content of the managerial task, offers various management education strategies for the South African situation, and identifies black advancement and the development of entrepreneurs as priorities for business schools.

Hofmeyr (1990: 103) calls on South African business schools both to contextualise and internationalise their curricula: "A more thorough and rigorous global perspective should be incorporated in all aspects of the curriculum." Hofmeyr notes (p. 108): "Many of the comments I have made here have to do with contextualising our management education: responding to our own challenges and trends and not simply replicating an American model. I want to caution, however, that there has to be a balance between South Africanising our curriculum and staying close to developments in the international business scene." The article goes on to point out that insufficient attention is being paid to developing 'people skills', ethics, participative management and leadership. Hofmeyr reasons that politics and business are inextricably linked and that attention should therefore be paid in business curricula to the socio-political context of the business environment.

With respect to teaching methods, Hofmeyr urges more active, rather than passive, learning by implementing experiential learning techniques, such as games, debates and simulation. He also calls for 'outreach' initiatives for the development of entrepreneurial skills and job creation. Tromp (1989) also proposes innovative and unique approaches by management educators. Hendrikz (1991) suggests that simulations could be used for more effective management education.

Jonck (1991) surveyed MBL alumni, the top 100 companies in South Africa, professional bodies and academic institutions to obtain a basis for a new MBL curriculum.

Wood (1992) points out that employers require students to have a broader based learning culture, flexibility and adaptability. "[Employers] demanded leadership training also in

international business aspects, social issues and the broader business interface. In the new South Africa, people skills were expected to play a major role." (Wood 1992: 24).

Doody (1997) considers whether various issues relating to the MBA programme satisfied the educational requirements of Wits Business School (WBS) graduates.

Bezuidenhout (1997) identifies critical competencies required by senior managers by obtaining the opinions of management educationalists and senior managers within South African organisations, especially human resources managers. Strasheim (1998) assesses the perceived effectiveness of the MBA in developing the competencies required by senior managers from a student perspective, while Louw (1999) investigated the effectiveness of the MBA/MBL in developing skills and traits from the perspectives of alumni and employees.

Strasheim (1998) and Louw (1999) urge business schools to improve product quality or curriculum content. Strasheim (1998) found a significant positive correlation between student satisfaction and perceived quality of academic tuition. Bhowan & MacDonald (2000) found that the roles played and competencies required by South African managers are essentially the same as those of managers worldwide.

Historically, business schools have concentrated on functional skills such as management, finance, accounting, marketing, organisational behaviour, strategy, human resources management and operations management. The need for competence in these fields remains, and they need to be part of the core curriculum, but on their own they are not sufficient. South African society finds itself nationally in transformation, regionally in disarray and internationally in an increasingly complex and turbulent situation. Business plays a leading-edge role, and South African managers need to be prepared for this (*Business Day* 2000b).

Forces impacting on the South African management education industry

The management education industry in South Africa is becoming increasingly competitive. Many foreign universities have entered the arena. "In 1990, students could choose between only half a dozen MBA programmes at the big state universities. Today there are nearly 20 MBA courses, mostly franchised from foreign universities" (*Business Day* 1998). "Prospective MBA students in [South Africa] have a bewildering array of options from a wide variety of local and international business schools, as well as online access to the intellectual capital of ivy league schools like Columbia, Harvard and the London School of Economics" (*Business Day* 2000c).

A list all the universities offering a Master of Business Administration, Master of Business Leadership or Master of Commerce degree from premises inside South Africa, the degree offered and the date of inception (where available) can be found in Table 1.

Government-funded South African business schools experience basically two types of international competition. The first type of competition is similar to a franchise operation, where an administrative department is settled in South Africa, and the MBA is offered either part-time with the requirement that students attend regular lectures, or by using some form of distance-teaching model, from premises in South Africa. Both private and government-funded local universities have responded to the competition by adopting this form of tuition.

The second type of international competition allows students living in South Africa to obtain an MBA through distance education by making use of technology (*Business Day* 1997a). This second type of institution does not operate from premises inside South Africa, and it is difficult to obtain an indication of the size or impact of the this type of international competition.

Business schools internationally seem to be experiencing a boom. Foreign business schools operating in South Africa experience a competitive advantage. Not only are they very flexible and able to pay better salaries to lecturers, but they also are very efficient (*Business Day* 1998). Another advantage for foreign business schools is that South African students perceive the international degree to be a huge benefit.

For the South African management education industry, there are at least four different forces at work to change the environment in which business schools operate, namely:

1. First force: global, technological and market changes
2. Second force: increased competition at three levels
3. Third force: market pressure to drop standards
4. Fourth force: a new higher education system introduced by the government.

These issues are discussed in more detail in the sections that follow.

First force: global, technological and market changes

It is imperative that business schools use curricula, course materials and teaching models that are up to date and internationally competitive in the fast-changing technological and global environment. The business schools have to keep track of courses and specialisations that are in particular demand, and these have to be adapted to the local environment without losing the global perspective. According to a survey among academics, human resources managers, government officials and personnel agencies (*Finansies & Tegniek* 1998), the demand for careers in the medium-term future was, in order of importance: information technology, engineering, management, medical professions and entrepreneurial fields.

Operating practices and teaching models of business schools have to be streamlined, and efficiency has to be improved if business schools wish to remain competitive. Opportunities arise from the ability to increasingly use technology to support learning.

Second force: increased competition at three levels

The past decade saw increased competition among local business schools and, in addition, even greater competition from foreign universities operating from premises inside South Africa.

The third level of increased competition is from foreign universities offering an MBA at a distance, and operating from outside South Africa.

"The multimedia explosion of the 1990s has driven the launch of a number of international programmes. Duke University's Fuqua School of Business welcomed its first class of 'global executive MBAs' last May [1996]. The University of Chicago started a Barcelona-based degree in 1994, and the University of Michigan's international MBA plan is in its fifth year" (*Business Day* 1997a). The Fuqua School is based on the

Table 1. Higher education institutions offering an MBA or equivalent from premises in South Africa

Government-funded local universities	Degree	Year¹
University of Pretoria, Graduate School of Management	MBA	1949
University of Cape Town, Graduate School of Business	MBA	1964
University of Stellenbosch, Graduate School of Business	MBA	1964
University of South Africa, Graduate School of Business Leadership	MBL	1965
Wits Business School	MBA	1968
University of Durban-Westville, Graduate School of Business	MBS	1974
Potchefstroom Graduate School of Management	MBA	1978
Rand Afrikaans University: Department of Business Management	MCom	1989
Africa Growth Network with Potchefstroom GSM	MBA	1997
Gordon Institute of Business Science (GIBS), University of Pretoria	MBA	2000
University of the Orange Free State, De Paul University in Chicago	MBA	2000
University of South Africa, Graduate School of Business Leadership / Open University, UK	MBA	2000
Rhodes University Investec Business School ²	MBA	2001
Private institutions offering MBAs from universities abroad		
GIMT: Henley Management College	MBA	1989
Executive Education: Newport University	MBA	1989
CAMDEV: Heriot-Watt University, Edinburgh, Scotland	MBA	1991
De Montfort University	MBA	1996
Milpark Business School (Thames Valley University, UK), Midrand University	MBA	1996
Global School of Business: University of Hull, UK	MBA	1997
Global School of Business: Bond University	MBA	1997
University of Southern Queensland	MBA	
Damelin: Oxford Brookes University	MBA	
Management College of Southern Africa (MANCOSA)	MBA	
Dimension Data International Centre for Management Development (ICMD) – Manchester Business School, UK, University of Wales	MBA	
Technikons offering MBA and similar degrees/diplomas		
University of Wales – Technikons: Natal, Wits, Vaal, Port Elizabeth, Pretoria, Free State	MBA	
Cape Technikon (Curtin University of Technology)	MBA	
Technikon SA	MTech BA	

Source: *Professional Management Review* (2000)

1. Refers to year of first MBA intake in South Africa (Strasheim 1998)

2. *Business Day* (2001b)

Internet, with a password-protected site on the Web, where students can download assignments, exchange ideas and review lecture notes. The University of Michigan prefers video conferencing. Most of the US schools require that students gather for a period for some face-to-face contact.

It is imperative for local distance-learning institutions to keep a close eye on this new third source of competition. It could be that the affordability of these programmes, as well as the technological skills required of both the student and the institution offering the degree, could impede their immediate impact on the local market.

Alan F. White of the Sloan School of Management is on record as saying: "The new techniques and technologies of distance learning hold the potential to revolutionize executive education" (*Business Week* 1995). Satellite communication seems to be very popular, with eight business schools in the US active in almost 100 corporate classrooms (in 1995). McClenahan (1997: 21) reports that "full-time, on-campus MBA students continue to outnumber their part-time colleagues by a wide margin", but that "the list of colleges and universities using e-mail, client servers, and the Internet to teach ... is growing rapidly."

"A number of online teaching and learning sites have been established. One of the most powerful of these, Unext.com, includes Columbia Business School, Stanford, Chicago, Carnegie Mellon and the London School of Economics. This development has made some of the world's leading teaching and learning materials available to anybody, at prices significantly lower than those of the corresponding courses available at the institutions themselves" (*Business Day* 2000b).

In the past, there were sharp differences between contact and distance learning, but these differences have become blurred by interactive learning. Supported interactive learning, where there is a combination of face-to-face tuition and Internet-based interactive learning, can be very successful (*Business Day* 2000d).

In reaction to the foreign competition, South African business schools have innovated their programmes and formed international linkages. The new competition has raised concerns about quality in the local programmes (*Business Day* 1997b), and there is also talk of 'fly-by-night' foreign schools (RSA 1997: 2.55). During 1997, it was reported that the effect of foreign competition had not yet been felt by local business schools: "Business school chiefs report either growth or no evidence of switching to the foreign institutions" (*Business Day* 1997b). Some of the local schools have expressed their concern that certain of the foreign schools do not impose entry requirements, whereas local schools require most students to have a degree and work experience (*Business Day* 1997b).

Third force: market pressure to drop standards

South African business schools find it increasingly difficult to maintain standards as there is an unprecedented demand for black managers, and because the deficiencies in the formerly black education system have put the majority of these students at a disadvantage. This pressure is likely to increase in future, given the requirement of the new Employment Equity Act. "Black graduates with business qualifications are in great demand. The black students are getting a premium though. They are being fast-tracked through organisations" (*Business Day* 1998).

Apart from the impact of the increasing emigration of professionals, South Africa also has an enormous shortage of managers. Wood (1992) estimated the ratio of managers to subordinates to be in the region of 1 : 40 and expected the ratio to deteriorate to 1 : 70 in the new millennium.

Fourth force: a new higher education system

In August 1997, the government published a White Paper on Higher Education, which aims to change fundamentally the internal environment of the universities. "The higher education system must be transformed to redress the past inequalities, to serve a new social order, to meet pressing national needs and to respond to new realities and opportunities" (RSA 1997). The restructuring of the higher education system saw the institution of the South African Qualifications Authority (SAQA), which was established jointly by the departments of Education and Labour, with inputs from organised business and labour. The aim of SAQA is to oversee the development of the National Qualifications Framework (NQF), including "the registration of national standards and qualifications; ensuring compliance with provisions for accreditation; and ensuring that standards and registered qualifications are internationally comparable" (RSA 1995).

The object of the NQF is to "create a national framework for learning achievements; facilitate access to and mobility within education and training; and enhance the quality of education and training" (RSA 1995).

Government funding to the universities could be greatly reduced, and, during the period of transition, decision making could be extremely slow and the process of having courses and programmes registered very time-consuming. Nevertheless, all private institutions operating in South Africa will also be required to register their courses and programmes. The relevant sections of the White Paper state that:

2.55 The Ministry recognises that private provision plays an important role in expanding access to higher education, in particular, in niche areas, through responding to labour market opportunities and student demand. The key challenge in expanding the role of private institutions is to create an environment that neither suffocates educationally sound and sustainable private institutions with state over-regulation, nor allows a plethora of poor quality, unsustainable 'fly-by-night' operators into the higher education market.

2.56 A regulatory framework will be established under the Higher Education Act, to ensure that only private institutions with the necessary infrastructure and resources to provide and sustain quality higher education programmes will be registered. Such programmes will need to be accredited through procedures established by the South African Qualifications Authority (SAQA) as part of the NQF (RSA 1997).

The Department of Education requires private institutions that offer degrees to register in accordance with the Higher Education Act (*Business Day* 2001b). The registration process does not affect public higher education institutions, since they derive their authority from acts of parliament, and their programmes are all accredited by the Council on Higher Education.

The report on the future size and shape of South African higher education captures the rationale for the restructuring of higher education. The proposals could be understood as a continuum of differentiated and diversified institutions that can

better serve the varied local, regional and national economic needs of South African society. In its report, 'Towards a New Higher Education Landscape', the Council on Higher Education attempts to put strategies in place to ensure that higher education is on the road to the twenty-first century. Although the South African University Vice Chancellors' Association has rejected the report, the matter will still be the subject of intense debate and institutional manoeuvring. The central issue may become obscured in the process, namely that higher education has a vital role to play in helping South Africa to develop an internationally competitive economy (*Business Day* 2000e). There will not be any extra funding for universities and technikons, however (*Business Day* 2000f).

An alarming issue is the declining rate of participation in higher education, which has dropped to levels equivalent to those of the least developed countries. In South Africa, only 15% of the relevant age group is enrolled in the higher education system, and numbers are continuing to fall. This percentage compares unfavourably with the 51% average participation rate for member states of the Organisation for Economic Cooperation and Development. The comparative figure for the US is 71% (*Business Day* 2000e).

Around the world, national higher education systems are being challenged to play new roles in response to the knowledge and human resource needs of the twenty-first century in the context of rapid globalisation. In developing countries, higher education systems must also develop strategies to limit the impacts of globalisation that marginalise developing nations. "Unless there are fundamental changes in higher education, the prospects of economic growth, social development and social equity – creating a better life for all – are remote" (*Business Day* 2000g).

Historical development of US business schools

A brief history

The first business school in the USA was founded in 1881 when a wealthy Philadelphia businessman, Joseph Wharton, donated \$100 000 to the University of Pennsylvania for the establishment of the first US school of finance and commerce. Reactions from within the university were that a school of commerce had no place in a university. Early in the twentieth century, opposition to business education in universities began to fade as the demand for graduates grew rapidly (Cheit 1985).

Until the end of the nineteenth century, there were only three business schools in the USA. Business schools began to flourish in the early twentieth century, and by 1920 there were 50 business schools in the country. By 1940, the number had increased to 85, and by 1985 the USA had approximately 200 accredited business schools, and the number of partially accredited programmes exceeded 1000. (Miles 1985). By 1997, the number of institutions offering an MBA had grown to more than 700 (Byrne 1997).

In the 1950s, business school curricula were narrowly focused along vocational specialisations, and programmes failed to adjust to the needs of the changing environment. New organisational forms required managers with overall general management capabilities. Against this backdrop, in the mid-1950s, the Ford Foundation and the Carnegie Foundation commissioned studies of business needs and business education capabilities and practices. The reports were published in 1959 and came to similar conclusions (Gordon &

Howell 1959): "business school facilities had to be upgraded and more emphasis should be placed on research and analytical competence in the social and behavioural sciences; resources had to be allocated away from large, unspecialised undergraduate programmes and toward the MBA and PhD degrees; fewer narrow 'vocational' courses in the various functional fields; and an overarching push for rigor, depth, and analytical content across the business school curricula" (Miles 1985: 64).

After these reports, faculties upgraded their research and analytical capabilities. By the late 1960s, business school graduates added much-needed value in the middle to top management echelons of US business. This period saw a rapid growth in the number of MBA graduates. "In the academic year ending in 1965, US business schools conferred only 7585 MBA degrees. The size of the graduating class grew more than six-fold (to 46 650) by 1977" (Cheit 1985: 46). According to Byrne (1997), US business schools now graduate approximately 85 000 MBAs every year.

On 5 May 1981, when business deans and professors assembled to celebrate the centennial of the Wharton School, they also honoured their own achievements. There was very little time for self-congratulation, however. By the early 1980s, a new cycle of inbreeding had become apparent. Business schools were criticised for "turning out too many highly trained but analytically narrow-minded specialists" (Miles 1985: 66). This attack blamed the MBA education for being "too academic, too technical and too narrow" (Cheit 1985: 47).

A serious debate about the nature and scope of management education followed in the 1980s. Miles (1985: 63) questioned the relevance and content of business education: "Criticisms range all the way from polemic indictments of business education as the prime cause of all our economy's industrial woes, to more reasoned concerns that business programmes, even in the better schools, are in danger of slipping out of synchronisation with emerging business and organisational needs. We clearly are in a period of major change, and questions concerning the quality and direction are, therefore, highly appropriate."

Hayes & Albernathy (1980) paid tribute to the previous generation of US managers for their carefully planned and highly aggressive action across three time frames: short, medium and long term. "The first of these time frames demanded toughness, determination, attention to detail, the second, capital and the willingness to take sizeable financial risks, the third, imagination and a certain amount of technological daring" (Hayes & Albernathy 1980: 68). However, they blamed US management for the slump in the US economy at that time and argued that the business curriculum was based on a shallow concept of the manager. They criticised management education that encouraged "a preference for (1) analytic detachment rather than the insight that comes from 'hands-on' experience and (2) short-term cost reduction rather than long-term developments of technological competitiveness" (Hayes & Albernathy 1980: 68). Cheit (1985) suggests that a provocative article possibly sparked Hayes & Albernathy's criticism.

Cheit (1985) analysed criticisms from more than 200 journals, newspapers and other sources. He identified thirteen complaints about business schools and grouped them under four headings (see Table 2).

Cheit identified two models of management education – the academic and the professional models. "A business school that

Table 2. Thirteen complaints about business schools, 1985

They emphasise the wrong model	
1	The schools produce technical staff specialists rather than leaders.
2	The schools are too quantitative, too theoretical, too removed from real problems.
They ignore important work	
3	The education overlooks important human, organisational and community skills.
4	Inadequate attention is given to entrepreneurship, technology and productivity.
5	The education neglects important international concerns.
6	The schools fail to deal with managerial obsolescence – they do not provide sufficient continuing education.
They fail to meet society's needs	
7	The schools lag in affirmative action and US management thus remains unrepresentative.
8	Business schools are unnecessary – Germany and Japan do well without them.
9	Too many business schools are producing too many MBAs.
10	The MBA degree is not worth the cost.
11	MBAs' salaries are too high.
They foster undesirable attitudes	
12	The schools foster a short-run, risk-averse attitude in their students.
13	The schools encourage a variety of undesirable personal characteristics in students, including unrealistic expectations, job hopping and disloyalty.

Source: Cheit (1985: 50-51)

follows the academic model regards the field as a science. Its approach is essentially discipline-driven. Instruction emphasises the disciplines that underlie issues and the analytical techniques that can be used to study them. ... Overall, the curriculum gives priority to disciplines and techniques. ... Faculty members are rewarded for publication, especially for creative work that demonstrates theoretical treatment of issues" (Cheit 1985: 53).

"A business school that follows the professional model will give primary emphasis in its curriculum to the functional fields of business and applying techniques to them. Its approach is essentially field-driven. ... Because management is considered more an art than a science, the object of instruction is to develop judgement and encourage students to exercise it in dealing with complex, unstructured problems. ... Business strategy and entrepreneurship are important courses. Since the school sees itself as training decision-makers, its pedagogical style and its environment acquire some of the competitive aspects of the business environment. The school maintains many contacts with the business community and engages in joint projects with research and management development. ... Published research is an element in faculty advancement, but it is not the most important one" (Cheit 1985: 53-54).

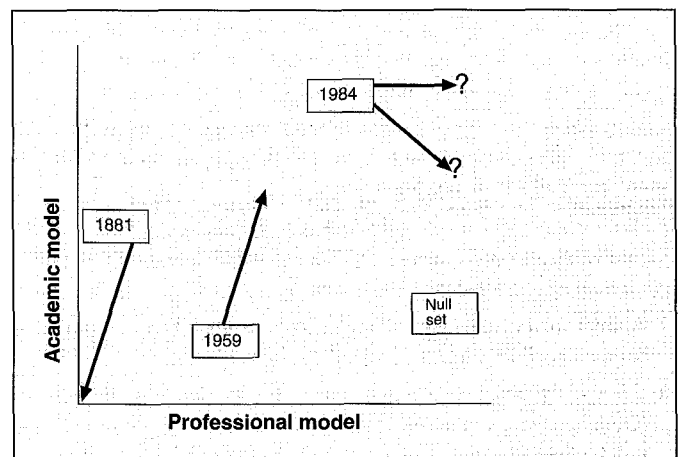
Cheit (1985) explained that business schools could combine elements of the academic and professional models, as well as the quality of education of each model. Schools also differed in the quality of students they attracted, and the extent to which they challenged their best students. Cheit's argument is best understood in the graph presented in Figure 1.

The first business school (Wharton) was founded in the square labelled 1881. The critics of that era argued that a business school should not be part of a university, as indicated by the arrow, pointing south and slightly west, that is off the map. Business schools gradually slipped down to the square labelled 1959, when the reports of the Ford Foundation and the Carnegie Foundation were published by Professors Robert A.

Gordon of Berkeley and James E. Howell of Stanford (Gordon & Howell 1959). Reactions to these reports resulted in a general movement to the square labelled 1984. Cheit argued that a school could follow the academic model with a high level of quality, incorporating elements of the practical model, but that the reverse was not true. It was impossible to attain a highly practical model with low academic quality. He denoted such a position as the null set, as indicated on the map. Cheit asked whether the criticisms of the 1980s were directed at moving east, or both south and east (from the square labelled 1984), as indicated by the two question marks on the map.

Since the flood of criticisms, many changes have occurred at business schools, and it is difficult to establish their direction and the causes of the movements. Cheit acknowledged that the criticisms warranted a response, but faculty members seemed reluctant to accept a move south.

The stock market crash in 1987 intensified the debate, and business schools and their MBA programmes were widely blamed for the crises in the US economy. The controversy over



Source: Cheit (1985: 55)

Figure 1. The academic and the professional models

Table 3. A comparison between traditional learning and action learning

Traditional learning	Action learning
Historic case studies	Current real cases
Individual orientation	Group-based learning
Learning about others	Learning about self and others
Study other organisations	Study own organisation
Programmed knowledge	Questions plus programmed knowledge
Planning	Planning and doing
Arm's length	Arm-in-arm with client
Input based	Output/result based
Past oriented	Present and future oriented
Low risk	Higher risk
Passive	Active

Source: Margerison (1988)

whether the MBA graduate was a specialist or a generalist began to become even more apparent. The struggle intensified to balance the demand for functional specialisation and the demand for a focus on the skills of the general manager across broad organisational needs.

Snell & James (1994) referred to the functional orientation in business schools as the "tangible" orientation to managerial subject matter. The tangible orientation tends to regard the manager's job as one of attaining clear, practical, tangible results that are readily quantified and assessed, and managerial success is achieved by drawing on conceptual tools and analytical techniques from the functional fields. Snell & James also referred to the "intangible" orientation to management education that transcends the "neat functional pigeonholing". "The intangible orientation tends to view learning for and within the managerial world thus construed not as a straightforward matter of acquiring and practising analytical techniques, but rather as a complex business of secondary socialisation" (Snell & James 1994: 320-321).

Various authors, from both South Africa and other countries, argued for a more integrated and professional model of management education (Porter & McKibben 1988; Reed & Anthony 1992; Hofmeyr 1990, Cheit, 1985). However, many authors (Cheit 1985; Albanese 1987; Brown 1993, 1994) also argued that a more practical approach should not come at the expense of a strong academic programme.

According to Cheit (1985), the changes that were witnessed in US business schools in reaction to the criticisms in the 1980s were basically in three areas:

1. An increase in functional work, especially in manufacturing and business development, which included a new emphasis on entrepreneurship and innovation
2. A shift in focus towards operations in an international context, as well as global competitiveness
3. An area that is less clearly defined, because it is difficult to cover in the established academic disciplines, namely, the field of extending the competencies needed for effective management. The competencies are often referred to as skills, and this area addresses the need to balance cognitive with non-cognitive or affective skills.

This debate continued in the 1990s. Criticisms of established approaches to management education were articulated by business leaders and some mainstream business professors (see, for example Linder & Smith 1992). Criticisms were also voiced by critical management academics (Nord & Jermier 1992). These two groups generally pursued different agendas and favoured divergent priorities. However, there is currently a degree of correspondence in their views. Their criticisms share a deep scepticism about the value, relevance and practical efficacy of established management theory and the way that this is imparted to potential or practising managers who are currently struggling to address new and diverse challenges – social, ethical, and ecological, as well as commercial and political" (Willmott 1994: 105-106).

Willmott (1994) argued in favour of the action learning approach to management education, which combines the cognitive insights of management academics with practical experience. Margerison (1988) contrasted traditional learning with action learning (see Table 3). In response to the call for more practical (and less academic) approaches to management education, Peattie (1996) combined his experience of in-company training with the action learning model, and found mixed results.

According to Byrne (1997) the innovations in the USA made MBA graduates more valuable than ever. Business schools were perceived to be excellent in nurturing leadership and teamwork, and increased emphasis was placed on globalisation, information technology, entrepreneurship and innovation. Business was taught as a whole instead of as a set of disparate functions, and academics were more involved in real business.

Continuous education

A voice that has become more voluble in the 1990s has been the call for business schools to become more involved in ongoing learning in order to avoid management obsolescence. "Ongoing development and learning are becoming so critical that they are being seen as an element of competitive advantage" (AACSB 1997: 1). Companies should embark on a route of continuous education as a strategy for enhancing performance and competitive position. An important issue is that the development of employees should not focus only on individual development, but should also be tied to the strategic objectives of the firm.

An interesting aspect of business education is the attitude towards computerisation. Business schools in the USA seem to have moved to a great extent to microcomputer ownership. In a survey conducted in 1997, 42% of schools offering MBA-programmes and 49% of schools offering EMBA-programmes (Executive MBA) required that their students own their own microcomputers (AACSB 1997). Thirty percent of the schools that participated in the survey required that students have computer skills, and Web-related skills were required by 12% of the schools.

The current situation

Currently, business schools in the USA are experiencing an unprecedented bull market. At virtually all the best schools, applications, GMAT scores and starting-pay packages for MBA graduates are setting an all-time record. Graduates often receive two or more job offers.

According to Byrne (1997: 2), "employers believe the wave of innovation that has swept through business schools in recent years has made MBA graduates more valuable than ever. Ten years ago, these schools made little if any effort teaching leadership or teamwork, ... today they are doing a much better job in these areas. ... They are placing greater emphasis on globalisation and information technology. They're also trying to teach business as a whole instead of a set of disparate functions, and they're breaking down the walls that have long separated academia from the real world of business."

Business schools also form partnerships with business in order to counter the problem of finding professors that are up to date with information systems management. An example is the Fuqua School of Business at Duke University, North Carolina (widely regarded as one of the most innovative schools in using technology), which has a very fruitful partnership with IBM. A handful of MBA students was given access to ThinkPad laptop technology, and assessed its effect in the classroom, thus helping to shape Fuqua's technology strategy. A product that is being tested is the TransNote, which allows users to write and file hand-written notes. The TransNote has a leather cover and opens like a folder. The left half houses the traditional laptop, and the right half a screen that allows students to write notes. Since much of what people write comprises not just words, but also ideas, diagrams, systems and models, it is ideal for taking notes in class (Business Day 2001c).

Crowley (1999) reports that top-ranking business schools are starting to offer technology-focused MBA programmes. The problem experienced is that there are good programmes for information technology and good programmes for business, but there are not many programmes that are good at both. IT-professionals wishing to go back to school for a business education find it increasingly difficult to take two years off for the full-time MBA in the USA, since the break is simply too long for the fast-paced industry. Companies are absolutely begging for students with increased backgrounds in technology. Deans and professors acknowledge the importance of technology education in their MBA programmes, but none has an established method for teaching students how to make wise decisions about IT. How to teach technology appropriately is probably one of the most important questions that schools wrestle with today (Crowley 1999).

Bolan (2001) criticises business schools for failing to provide graduates with adequate e-commerce experience. When stu-

dents are being prepared for the e-world, they should experience the e-environment in the course of their training. The greatest reluctance comes from academic communities, generally because offering such training means that a huge number of faculty also have to be trained.

Several international schools have addressed the market needs to offer a programme in electronic commerce. Wharton School at the University of Pennsylvania has launched an innovative post-MBA course for top executives that want to advance in e-business (Business Day 2000h). Wharton also uses some unconventional methods for developing leadership. Each year, a group of 20 students is admitted to slots that take them up to Mount Everest in Nepal. Professor Useem, who teaches leadership, uses the trip, an optional part of the course, to teach leadership in a real-life setting (Business Day 2000i).

Business schools in Europe

According to Lewis (1995), the first business school established in Europe was the IESE in Barcelona. In 1965, the Manchester and London Business Schools were established. The Open University in the United Kingdom (UK) developed a distance-learning method for the MBA. Management education and business schools in Europe were, until the late 1980s, based largely on the US model (Easterby-Smith & Tanton 1988), and European managers generally did not perceive the MBA as necessary (Economist 1989). A survey of 45 business schools in Europe conducted in 1989 by Economist Publications showed that 18 were less than five years old (Economist 1989). Easterby-Smith & Tanton (1988), in the Lancaster report on European management education, called for increased emphasis on transformational management, human resources management and ethics in business.

According to Smith (1993), the value of the MBA was seriously debated in the UK in the early 1990s. At that time, more than 100 different institutions offered the course. Much of the press interest then related to the expansion in MBA provision, and concerns that quality might not necessarily keep pace with quantity. The relevance of the courses to company requirements was questioned, and concerns were expressed about the employment prospects of MBA graduates.

Smith (1993) states that, in the 1970s, fewer than 1000 students per year enrolled for MBA programmes in the UK. According to Miles (2000), the number of British students with MBAs rose from 5831 in 1994 to 8298 in 1999. The number of places in UK schools also increased from 10 844 in 1994 to 12 627 in 1999. The number of business schools offering an MBA doubled from 47 in 1986 to 92 in 1992. Of the 92 business schools, only 28 have Association of MBAs (AMBA) accreditation, which can be regarded as a British 'industry standard' (Smith 1993).

Lewis (1995) contends that the European schools adapted more quickly to the internationalisation of business markets, as they offered transnational placements and even language training. The European School of Management in Paris offers a masters course in which students are required to travel to Paris, Berlin, Oxford and Madrid (Lewis 1995).

The three best-known business schools in Europe, referred to as the 'big three' by Krause (1997), include INSEAD (Institut European d'Administration des Affaires, in Fontainebleau) in France, the International Institute for Management Development (IMD) (Lausanne, Switzerland) and the London Business School (LBS) in the UK. Krause (1997) reports that

most European business schools are convinced that they can build on their 'European environment' and challenge US predominance. The major driving force is the enlargement of the European Union (EU). INSEAD plans to expand a 1997 level of 483 students from 56 countries (Krause 1997): "INSEAD is certainly an exception in terms of expanding the student body, but throughout European Union countries, there is huge, new interest in business education, with the MBA becoming more acceptable", says George Bickerstaffe, editor of the authoritative *Which MBA?*, an annual guide to more than 100 business schools around the world, nearly half in EU member countries. 'More and more undergraduates and company recruiters want a second career handle and are finding it in the MBA,' says Bickerstaffe, who estimates that of the 800 business schools around the world, the majority are in the United States, about 200 are in Europe, roughly half in Britain. Some of the several hundred European schools offering MBAs are, however, weak on content and quality teaching" (Krause 1997: 30-31).

According to Krause (1997), the Brussels based European Foundation for Management Development (EFMD) has established a pilot accreditation backed by 400 members, including educational and business institutions. Eighteen leading European business education institutions work together to develop their criteria and procedures for accreditation. They include the 'big three', as well as other leading schools in France, Spain, Italy, the Netherlands, Sweden, Finland and Slovenia.

In Germany and France, the MBA is not a government-recognised degree. Nevertheless, the HEC School of Management, funded mainly by the Paris Chamber of Commerce, continues to operate and is widely regarded as the flagship of French business education (Krause 1997).

Many European schools form ties with US business schools. HEC cooperates with the Amos Tuck School of Business at Dartmouth University and Templeton College at Oxford University to exchange professors, collaborate in research and develop joint executive management programmes. Other examples include the Milan-based SDA Bocconi business school in Italy, which established a double-degree programme in business administration and international facilities to allow the enrolment of 600 students each year, from relations with the Bologna branch of the Johns Hopkins University School of Advanced International Studies (SAIS). Northwestern University's Kellogg Graduate School of Management offers a joint MBA programme developed with the Otto Beisheim Graduate School of Corporate Management near Koblenz in Germany, the first school in Germany to offer a major in business administration (Krause 1997).

According to Lewis (1995), Bath University has developed strong links with Japanese business schools, and Lyon Business School offers an MBA in conjunction with Cranfield School of Management.

Asian business schools

According to Engardio, Winzenburg, Roberts & Di Cicco (1995), companies across Asia find themselves short of professional managers. MBA programmes are being improved and private institutes offer "anything from time management to teamwork." Engardio et al. mention that Asian schools had to adapt western programmes to suit the Asian business environment. Asian schools have relied heavily on US programmes for their curricula, and often use US textbooks. The

US tradition of downsizing could cause chaos in paternalistic Asia, where workers expect their loyalty to be reciprocated. Empowerment in Asian cultures could be interpreted as insubordination: "... traditional US programmes don't prepare students for Asian-style deal-making, where big opportunities come and go in an instant and where personal contacts often take precedence over American-style due diligence. The chief of one of Hong Kong's leading property developers says he has fired every one of the Western-trained MBAs he had hired right out of school, because they weren't responsive enough to the Asian environment. Now he looks for MBAs with five to seven years' experience in Asia. 'If you analyse too much,' he says, 'you can't make money'" (Engardio et al. 1995).

Engardio et al. report that Asian business schools are restructuring their MBA training to adapt to a regional focus. At the Asian Institute of Management in Manila, 60% of case studies used were written in-house or elsewhere in Asia. The Sasin Graduate Institute of Business Administration, the top business school in Bangkok, Thailand, offers a graduate course in cross-cultural management that focuses on neighbouring countries such as Vietnam and offers weekend training for mid-career Thai executives. "The school emphasises team projects and builds *esprit de corps* with social activities ranging from overseas trips to annual Halloween bashes" (Engardio et al. 1995).

Most MBA training in Asia is done in English, but some schools are becoming more culturally and linguistically representative of Asia. The Hong Kong University of Science and Technology flies in US lecturers, and half of the 40 full-time students will attend exchange programmes at US universities. The elective courses include Mandarin, mainland Chinese economic reforms, case studies of local companies and breakfast lectures with Hong Kong business leaders (Engardio et al. 1995).

Engardio et al. report that Asia-skills are sought particularly urgently in Taiwan. There are huge numbers of MBA graduates, but they lack the managerial experience required by big-growth industries such as the computer industry. The engineers, on the other hand, lack the managerial skills to manage global businesses. Taiwan's most prestigious National Chengchi University's College of Commerce has improved its curriculum to include more international studies, communication skills and information technology. The school has also launched a technology-and-innovation management programme.

In Singapore, the business school at Nanyang Technological University requires its MBA students to undertake an overseas study mission. The students are required to write elaborate case studies, which are then published in a book about business opportunities in the area visited (Engardio et al. 1995).

"Nowhere is the need for professional managers more serious than in China. As a result, the government has designated nine universities ... to start MBA programmes. ... The new China Europe International Business School (CEIBS) in Shanghai [was] launched with financing from the European Union. For this year's 60 full-time MBA slots, CEIBS received 4000 applicants from across China" (Engardio et al. 1995).

Haight & Kwong (2000) report that many business schools benefit from China's desire to learn about the 'Western way' of conducting business. Business schools from the US, Europe, Canada and Australia offer programmes to Chinese students either directly or through the Internet. The huge demand for an MBA far outstrips supply. Only 56 Chinese universities offer the degree, and each university can accept approximate-

ly 200 MBA students annually. These 56 universities offer an MBA that is nationally recognised, but there is no limit to the number of students that may enrol in provincially recognised programmes. The demand for MBA graduates is expected to accelerate, and graduates manage to earn salaries that are about 2.5 times those of personnel without the degree.

In summary, business schools in Asia are still in a developmental phase, and the market is vast, but the focus in these business schools is to adapt traditional western management theories to suit the Asian culture, environment and management style. China has a huge potential market, and several US and other international schools have seized opportunities in China.

Recommendations for South African business schools

Engaging in more customer research

Business schools are not in touch with their customer base. They rarely survey or consult their customers, and thus do not know what their customers expect. Various stakeholder groups should be involved in the surveys, for example, students, graduates, their employers and business.

Business schools then need to devise appropriate techniques for market segmentation. Admission requirements could prove a very helpful technique for customer selection. Selectivity has been proved to be an excellent mechanism for US business schools in fostering a good reputation (Astin 1984). The programmes offered by institutions with a good reputation become much sought after, with the advantage of attracting more customers, so that the institution can become even more selective.

Astin (1984) found that a strong academic programme was by far the best recruitment device. In several surveys, it was found that choice of institution was heavily influenced by a strong academic programme and commitment to education: "... our evidence strongly suggests that those colleges that are most successful in improving their local reputation are those that turn out the most satisfied customers: students who feel that they have been challenged, that they have learned, and that their time has been well spent. In effect, students seem to have a positive attitude towards those colleges that are able to get them *involved* in the process of being a student" (Astin 1984: 10).

Preparing MBA customers for their role

The importance of preparing MBA customers for their role cannot be overstated. Zemke & Schaaf (1989: 14) state that "the more complex the service, the more important that education becomes".

Godsell (1992: 26) says that education is a process that "prepares the individual to be an effective participant in his or her world. ... It is by definition a lifelong process. ... Education is an active process. It must start with the individual or it will not happen at all. Without effort and continuous application on his or her part knowledge, skill and confidence can not be acquired." This understanding must be very clear for the MBA student.

The MBA customer should be educated during the marketing and selling process. The reality that an MBA is not a guarantee of a successful career has to be communicated. The importance of the role of the individual has to be understood.

"There is a consistent message from spectators and chroniclers about the issues that face the organisation looking to thrive and survive in the 21st century (Moss-Kanter 1985; Morgan 1988; Handy 1989; Drucker 1992). The message in vari-

ous forms is that we are truly moving to a new age as we approach the new millennium. Organisations are experiencing, and will continue to experience, demands from the environment, which will require them to make major shifts in their ways of operating. ... Change is no longer a single transition; it has been described using the metaphor of 'permanent white water' (Vaill 1991). "Through all of this runs the importance of people of calibre at all places in the organisation, willing and able to contribute in a responsive and flexible way" (Snell & James 1994: 330-331).

Building stronger business and customer relationships

The focus in business schools is very often on transactions rather than relationships with customers, and on acquiring new customers rather than maintaining a relationship with current customers (alumni and students). The quality, relevance and usability of databases are either non-existent or insufficient in most business schools.

It is extremely important that business schools build relationships with current customers. Very satisfied customers become loyal customers, return frequently and spread positive word of mouth. The MBA is a product that is high in "credence qualities" (Lovelock 1996) and the quality of the product is difficult to determine for the customer, during and even after the purchase. The MBA is a knowledge product. As Bendixen, Borman & Spence (1995) suggest, MBA consumers enhance their ability to perform by purchasing the product. The MBA consumer experiences a high degree of uncertainty during and after the process, because it is difficult to judge quality, and knowledge products have a short life span.

It is necessary to understand the process whereby the student makes a choice of institution. As Bendixen et al. (1995) state, consumers of knowledge products perceive there to be a high consequence risk when the wrong choice is made. Price is therefore regarded as less important, and consumers actively seek the opinion of others when they evaluate knowledge products. Very often, the opinions of current or graduate students are sought, and good relations with current customers are therefore of the utmost importance.

With the increasing need for continuous education, business schools have to ensure that their product range is such that customers will be able to return frequently for short courses in the latest developments in management thinking. In this way, current customers can be transformed to life-long customers.

Strong relationships with business are essential. Business schools should be much more in touch with needs in the business environment. Business could provide more and better job opportunities for graduates and become a useful source of bursaries and sponsored students. Business could also prove helpful in the development of academics, using academics for consultation and establishing professorial chairs.

Stevens (2000) notes that colleges and universities are in danger of becoming less relevant to society because they do not understand the forces of market demand. "Business schools have known that significant changes are needed in what professors teach, how professors teach, and how professors provide students with a general education and preparation for their careers. ... The corporate world would like to see more 'realistic, practical, hands-on' education with greater emphasis on the development of 'people' (i.e. leadership/interpersonal) skills. Both business schools, and their faculty, do not interact enough with the business community" (Stevens 2000: 3).

Business should become much more involved in the restructuring of higher education. Business could take the initiative in establishing a forum for the exchange and development of views as a continuing base for influencing public policy and institutional change. The national skills crisis should be taken seriously, and addressing it requires a coordinated effort to act collectively through an appropriate forum and develop a political will. It requires vision and leadership to bring together an inherently disorganised set of players and interests.

With the current restructuring of the higher education system, business has an unprecedented opportunity to influence the future of higher education. Internationally, many corporations, universities and governments are revisiting the relevance of the roles played by education systems in society, "tasks which business and universities in this country regard as novel, even revolutionary" (*Business Day* 2000j).

"Government will need vision, courage and management skills in reshaping higher education. It needs business as a strategic partner in the difficult task of rethinking the higher education system to one far better suited to a middle income developing country" (*Business Day* 2000j).

Keeping curricula in line with market demands

In the US, the outcomes of the research sponsored by the Ford Foundation (Gordon & Howell 1959) and the Carnegie Foundation (Pierson 1959) resulted in a dramatic shift towards rigorous curriculum content. The rigorous curriculum is enshrined in the standard of the American Assembly of Collegiate Schools of Business (AACSB). Similar changes are also noticeable in South African business schools.

Strasheim (1998) and Louw (1999) find that SA business schools are perceived to perform best in the development of functional competencies, but not according to expectations. Business schools need to have a much broader focus than just on functional competencies. Students, alumni and business believe that there are several other competencies that should be developed by business schools, namely, professional, managerial and individual competencies.

South African business schools should follow international examples while retaining their local focus. The appropriate term to use here would be to 'glocalise' the curriculum – in other words, maintain a strong focus on the local socio-political and economic environment and business culture, but at the same time create an acute awareness of global competitiveness and the South African role in global business.

Disciplines that require serious attention in South African business schools are information systems management, entrepreneurship, e-business and technology management. According to *Business Day* (2000k) most international business schools now offer a plethora of new electives in the digital economy, including e-commerce. The new economy is not a fad, and adding new electives is all well and good in the short term, but not at all sufficient in the long term. In every course, schools need to address the Internet and the impacts of the new economy. The Internet is the biggest technological change since the industrial revolution, and business and market demands will force business schools to rewrite their entire curricula and to integrate teaching (a knowledge product) and technology. "Therefore we have no option but to extend our curriculum. We must not be satisfied with producing only functional excellence. We must strive to produce the leaders,

entrepreneurs and managers of tomorrow who will play wide roles in and on behalf of business" (*Business Day* 2000b).

The major challenge for South African business schools is to become even better at the functional disciplines and at the same time to use new and innovative approaches to integrate across functional boundaries in the development of professional and managerial competencies.

The competency approach to management education lends itself to the specification of learner outcomes. The critical cross-field and developmental outcomes as stipulated in the Regulations pertaining to the South African Qualifications Authority Act (Act No. 58 of 1995) (RSA 1998) are appropriate in the context of management education. The challenge is to design a learning model that can address the above cross-field outcomes as well as the specific skills and outcomes required of successful managers in southern Africa.

Business schools in South Africa might consider establishing their own accreditation standards, as is being done in Europe, or use the SAQA requirements as an opportunity to work together and ensure that the NQF is used as a vehicle for ensuring proper standards. Since the building blocks of the unit standards are based fundamentally on certain competencies and capabilities, South African business schools are advised to focus future curriculum development around specific outcomes, and competency based education could be used as a starting point.

Leadership roles

The university is not an easy environment in which to manage. Of the various organisational cultures described by Handy (1985), the university setting is typically an existential culture where Dionysus, the god of wine and song, presides. Handy (1985: 30) describes it as a culture where it is admitted that: "if anyone is responsible for us and our world, it is ourselves. We are in charge of our own destinies. In the existential culture, the organisation exists to help the individual achieve its purpose. The existential culture is excellent, therefore, where it is the talent or skill of the individual which is the crucial asset of the organisation. This is the culture preferred by professionals. They can preserve their own identity and their own freedom, feeling owned by no man."

The leader or manager of this organisation has an exceptionally challenging task. As Handy (1985: 30) puts it: "Dionysian cultures are splendid places to work in. I have worked in one myself – a university. Professionals usually have job security, agreed fee scales, allocated territories or spheres of influence, guarantees of independence. This is marvellous for them. But not for those who have to lead or organise or manage such people. For there are no sanctions that can be used on them. Dismissal, money, perks or punishment are all outside the jurisdiction of the leader. Even promotion or selection decisions are made, as a rule, by groups of equals. Professionals do not willingly receive orders, fill in forms or compromise their own plans. ... For these are the organisations of consent, where the manager governs with the consent of the governed, and not with the delegated authority of the owners. It may be democracy, but it is very difficult, and exhausting, to deal with."

Stevens (2000: 2) also notes the difficulties of leadership in tertiary institutions. "Unable to determine either personnel or policy, nor even to maintain quality control of the product, an

academic chief executive has nothing of the powers or responsibilities of a CEO in private industry. ... Further, collective decision-making by hundreds of prima donnas, none of whom can be fired or even demoted for being wrong, is not a system that any other institution has adopted anywhere else in the world."

Very unique approaches are required to manage a business school effectively. The bureaucracy in the typical university system can be extremely rigid, and change in this environment is difficult to implement because of slow decision making and financial constraints.

Leaders in business schools have a daunting task. Cheit (1985) asked the dean of the deans of business schools, Sidney Davidson of the University of Chicago, what he saw as a dean's most challenging leadership task. He replied: "Maintaining balance – the appropriate balance between competing academic and professional interests. ... In principle, the interests of the academy and the profession are in basic harmony – both want excellent instruction, research and service. But in practice, service to the academic disciplines competes with service to practice, and an inward orientation to theory and scholarship competes with an outward orientation to applied problems and operations" (Cheit 1985: 53).

Stevens (2000) offers directions about the art of running a business school in the new millennium, in the face of internal inertia and external change pressures. He mentions that change is a powerful influence that must be anticipated and managed in business schools. "The dean's job is not one of herding cats. Although there are days when it feels like the dean is being asked to raise the Titanic with his bare hands, others see the job as rearranging the deck chairs on the Titanic as it goes down! In fact the job is great 98% of the time. Ninety-eight percent of the people are on board and get out of the way of change. The other 2% not only do not get out of the way, they attempt to take up 98% of the dean's time" (Stevens 2000: 2.) Stevens recommends that business school deans rely on their ability to persuade and convince and less on rank, power or authority. He has found educating and informing faculty, and then supporting informal leaders to spearhead change, to be a good change strategy.

Stevens urges deans of business schools to display what he calls 'academic leadership'. He emphasises the need to become more successful in developing and exercising leadership within universities and schools at all levels. The ability of higher education to cope with the significant changes occurring in the social, political and economic environment is questioned. He blames academic leadership, which includes faculty and administrators, for not providing the proactive sustained leadership within the universities and schools that would place them at the forefront of executive thinking and action. Academics have allowed the media, their organisations and the public to dictate their agenda, rather than to lead the way.

National competitiveness

South African business schools have a responsibility to the country to help improve its ability to compete internationally. Godsell (1992) urges the development of people skills and calls for effective education. "Then we can unleash a human potential which can transform the economic architecture of South Africa in a single generation" Godsell (1992: 27).

Meyer (1996: 8-9) highlights the need for education in improving South Africa's competitiveness: "To compete inter-

nationally the region as a whole needs to develop its people power through qualification frameworks and education and training policies and strategies which are compatible and linked to regional economic policy and strategy. ... A world class perspective is not confined to the region, the country or even specific industries and enterprises. It applies to each individual. Each individual in a modern economy needs to understand how he or she can add value through continuous improvement in the quality of what he or she does, the service that he or she provides and the efficiency and cost effectiveness by which he or she does it." This understanding has to be internalised by the all the stakeholders in management education.

Developing academic excellence

It is imperative for business schools to develop a very strong base of academics. They are the key service providers and embody the core competency of business schools. Cappelli & Crocker-Heffer (1996: 7) view core competencies as one of the best ways of improving competitiveness: "Distinctive human resource practices help to create unique competencies that differentiate products and services and, in turn, drive competitiveness."

The International Association for Management Education (AACSB) standard on faculty qualifications has traditionally rested on a fairly narrow definition of such qualifications. Academics in AACSB-accredited business schools have traditionally been selected and rewarded for their academic credentials (DBA or PhD in business) and their ability to conduct empirical research. According to Henninger (1998), the AACSB has adopted a slightly expanded definition of a qualified faculty member to include a professionally qualified category. A professionally qualified faculty member was defined as someone without the traditional academic credentials (such as a DBA or PhD in business). Deans of business schools surveyed by various researchers have indicated that they anticipate only modest changes in the credentials and research expectations in their business schools (Henninger 1998).

Agarwal & Yochum (2000) researched the effect of accreditation status of business schools on the starting salaries of new PhDs in full-time positions at business schools. They find that, across disciplines, starting salaries for new PhDs at accredited US schools are significantly higher than those at non-accredited schools. *Business Week* (2001) also reports that business schools find it increasingly difficult to hire new PhDs, since the growth in the number of business-oriented PhDs has grown only 3.5% over the past decade, compared to fields like biology and history which have grown 36% and 88% respectively. Starting salaries for business PhDs can easily be double that of a history PhD. Only about 50% of business PhDs continue their careers at business schools; the rest are lured away by higher salaries at consulting firms and think tanks (*Business Week* 2001).

None of the South African business schools has yet applied for AACSB accreditation. The University of Stellenbosch Graduate School of Business (GSB) is the first South African business school to have applied for, and been granted, EFMD (European Foundation of Management Development) accreditation. The accreditation is for three years, after which evaluation will take place. In the meantime, the EFMD has recommended improvements to the GSB, especially in building its international connections and content (*Business Day* 2000). The University of South Africa's Graduate School of Business Leadership (SBL) is in the process of filing a report for accreditation with the EFMD.

Research has become increasingly important for lecturers. Research and consultation are essential for academic staff to enable them to bring relevant examples and case studies into class, and to keep them at the cutting edge of their speciality.

Conclusion

Business schools in South Africa will have to adapt very quickly to the forces impacting on the industry. The need to remain at the frontiers of management thinking, up to date with the latest technologies and environmental changes, is imperative if they wish to avoid obsolescence.

The aim of individuals entering an MBA programme is to obtain a formal education at masters level that equips them with the competencies required to manage and function effectively in the new world of work. As a consequence, MBA students are demanding people with high expectations and ambitions. Business schools have a responsibility to manage expectations, keep pace with customer needs, and find better and innovative ways of serving their customers.

Business schools that are service oriented will prosper, because the customer chain is becoming more discerning. Excellent business schools listen to their customers and deliver service reliably. They acknowledge that the needs of the customer chain are constantly changing. The forces changing the world of work are the impetus behind the increased need for multiple competencies in management. Adjusting to the changing needs requires business schools to have a concerted and continuous campaign to make service delivery more service oriented, and in line with the requirements of the time. Constant renewal, training and development of service deliverers should be a priority, given that South African business schools are increasingly obliged to compete globally.

The cycle of service for the MBA consumer is a long and enduring process, almost like the Comrades marathon. Just as athletes that enter the Comrades do not expect it to be easy and without pain, MBA students perceive the MBA to offer a major challenge. As long as the Comrades maintains its prestige and is well organised, athletes will keep coming back.

The author would like to apply the following quotation from Hayes-Albernathy (1980: 71) to the South African MBA: "We have to stop marketing makeable products and learn to make marketable products."

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Emulating the Black & Scholes model with a neural network

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An artificial neural network model was created to emulate the Black & Scholes (1973) model in estimating the price of an option. A single hidden layer neural network with six inputs, representing the inputs to the Black & Scholes model, twelve hidden neurons and one output neuron were used. Results showed this model capable of accurately emulating the Black & Scholes model.

Introduction

A proper understanding of risk and the management thereof has always been the cornerstone of success in the financial world. Financial derivatives have been created as instruments to aid in the management of risk. These instruments are traded on open markets, and proper pricing is therefore of the utmost importance.

The mathematical modelling of financial derivatives has become a lucrative and rewarding science. Multidimensional mathematical techniques, suitable to complex, non-linear problem solving, such as matrix calculus, stochastic processes, neural networks and chaos theory, are applied with varied success.

One such mathematical model used for option pricing is the famous Black & Scholes (1973) model. This article focuses on research done to develop a neural network model to emulate the Black & Scholes model.

Research objectives

It is evident from market data that the actual market prices achieved for traded options differ from the theoretical prices as calculated with the Black & Scholes model. The logical conclusion to be drawn is that not all relevant information is taken into account in the Black & Scholes model.

The aim of the research was to develop a neural network model that could estimate the price of an option at least as accurately as the Black & Scholes model. With such a neural network model in place, it is argued, it should be possible to extend it, through the incorporation of relevant economic parameters, to create an improved model capable of estimating option prices closer to actual market prices than is possible with the Black & Scholes model. It should be noted that this research addressed only the emulation of the Black & Scholes model, and not the extension thereof.

Option theory

A derivative financial instrument is one of which the value depends on the value of another, more basic, underlying financial instrument. An option is such an instrument that confers on its owner certain rights, but creates no obligation for its owner to exercise these rights. In this way, the impact of the worst negative scenario is minimised, but the benefits of a positive scenario are retained. It can be defined as follows: an option confers on its owner the right to buy or sell the underlying financial instrument at a specific price, on or before a specific future date.

The Black & Scholes pricing equation for a European-style call option over an instrument providing a constant dividend yield, as emulated in this research, is:

$$c = Se^{-q(T-t)} \cdot N(d_1) - Xe^{-r(T-t)} \cdot N(d_2) \quad (1)$$

where

$$d_1 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - q + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{(T-t)}}$$

$$d_2 = \frac{\ln\left(\frac{S}{X}\right) + \left(r - q - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{(T-t)}}$$

- X is the strike price of the option
- S is the spot price of the underlying financial instrument
- r is the risk-free interest rate
- d is the constant dividend yield provided by the underlying financial instrument
- $T-t$ is the time to expiry of the option or options, in years
- σ is the volatility of the spot price of the underlying financial instrument
- $N(x)$ is the cumulative probability density function (pdf) for a variable that is normally distributed with a mean of 0 and a standard deviation of 1.

The values for the six input variables X , S , r , d , $T-t$ and σ are obtainable from market data, with σ calculated as the estimated future volatility in S over the remaining life of the option.

Neural network theory

Many publications have seen the light on this subject. In summary, a neural network is a knowledge-based method that attempts to imitate the working of the human mind. The use thereof is indicated to solve problems that are mathematically intractable or where no clear solution domain is dictated by the nature of the problem. These problems often involve many interdependent input variables and huge quantities of data that have to be interpreted to correctly identify the actual problem, and then to correctly describe the problem. For such a problem, where an explicit solution cannot be found, the next-best solution is to find an approximation that is sufficiently accurate to be applied in practice, and it is to such situations that knowledge-based methods are perfectly suited.

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A neural network is a conglomeration of interconnected neurons, or processing elements, that can be trained with existing input and output data to behave in a required way. Two aspects are of importance, namely the construction of the network to suit the application, and the definition and availability of sets of input and associated output data that can be used to train the network. The network should also be tested extensively in order to estimate the tracking error with a certain level of confidence.

Neural network model

MATLAB software was used for all calculations, data generation and neural network creation, training and testing.

The input vector to the neural network model consisted of the six input variables to the Black & Scholes model. The output vector represented the estimated option price.

The neural network was trained with a simulated data set, calculated with the Black & Scholes model. It was tested with a different simulated data set, similarly calculated. The training data set was generated by following a Monte Carlo approach, entailing the uniform random drawing of the value for each input variable from within its realistic range, as defined in Table 1. The associated output vector was calculated using equation (1). The size of the training data set was 2000 vectors. The testing data set was generated by varying each variable in the input vector over its total realistic range, while holding the other variables constant at a typical value, as defined in Table 1. This approach was followed to allow validating the response of the neural network model over the entire range of each of the input variables. Again, the associated output testing vector was calculated using equation (1). The size of the testing data set was 100 vectors for each of the input variables.

Referring to Table 1, the value for X was arbitrarily chosen around 100 (cents). The range for S was chosen as $X \pm 50\%$. This range represents anything between deep-out-of-the-money options at $X - 50\%$, to at-the-money options at X , to deep-in-the-money options at $X + 50\%$. The range for r was chosen according to realistic market expectations, and is 1% to 25%. The range for $T-t$ was chosen from expiry date to the date when a typical traded option is issued, and is two years. The range for q was chosen according to realistic market expectations, and is 0% to 30%. The range for σ was chosen as 1% to 100%, which is the possible statistical range.

The neural network topology chosen was a multi-layered, feed-forward network. The reason for this choice was that this topology is ideally suited to function estimation. Also, due to the nature of the data available (inputs with associated outputs), associative learning was indicated, and feed-forward networks are ideally suited to associative learning.

Dual and single hidden layer network architectures were evaluated, with different numbers of neurons in the hidden layer, and different transfer functions. In each case, the network was trained with the training data set and tested with the testing data set. Results are shown in Figures 1 and 2, where HN indicates the number of nodes in the hidden layer(s), and $RMSE$ is the root of the mean squared error, as given in equation (2). A minimum value for $RMSE$ would indicate an optimal network configuration. For normalised data, as used in this research, the $RMSE$ multiplied by 100 is also the percentage error, which might be more readily interpretable.

Table 1. Input variables

Input variable	Realistic range	Constant value
X	80-120	100
S	40-180	100
r	0.01-0.25	0.1
$T-t$	0-2.0	1.0
q	0-0.3	0.05
σ	0.01-1.0	0.5

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - t_i)^2} \quad (2)$$

where

y_i is the output value achieved by the network

t_i is the target or theoretical value

n is the number of test vectors applied.

The $RMSE$ was calculated as the arithmetic average of the $RMSE$ values calculated when varying each of the input variables over its realistic range. For each architectural configuration, evaluation was done 25 times, with the best single result plotted on the graph.

From Figures 1 and 2, it is clear that no definite pattern exists where the $RMSE$ shows a tendency towards a minimum, and no advantage stems from a dual hidden layer network, as opposed to a single hidden layer network. No conclusion could thus be drawn as to the optimal architecture configuration. Eventually, the simplest network configuration, yielding a minimum $RMSE$, was chosen.

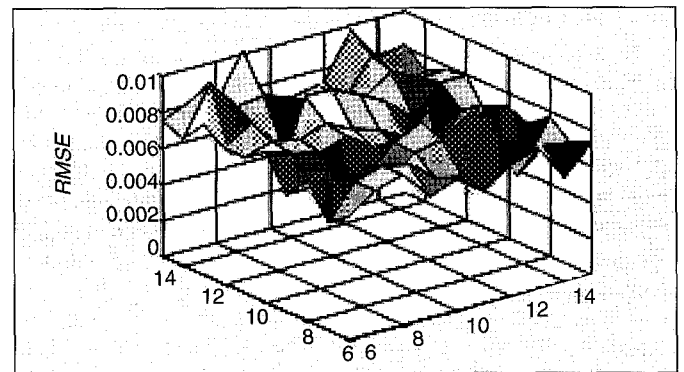


Figure 1. Dual hidden layer neuron search

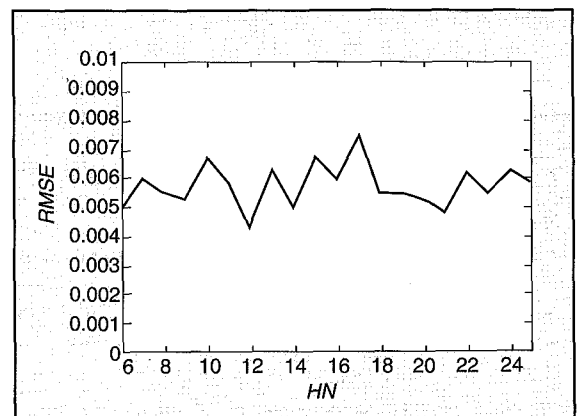


Figure 2. Single hidden layer neuron search

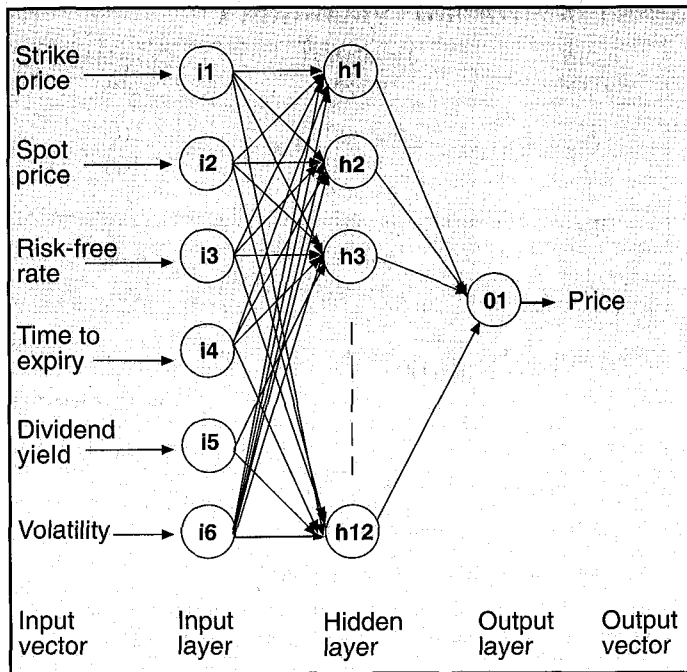


Figure 3. Network architecture

The chosen neural network architecture consisted of an input layer with six neurons to which the input vector is applied, one hidden layer with twelve neurons, and an output layer with one neuron from which the output vector is retrieved. This neural network architecture is shown in Figure 3. The transfer, or activation, function used with each neuron in the hidden layer and in the output layer was the *tansig* non-linear function.

The network was trained using a back-propagation training method, with an associative learning paradigm. The learning rule was implemented by the 'gradient descent with momentum' algorithm. The training algorithm was based on the 'BFGS quasi-Newton' method. The sum squared target error goal was set to 0.5. The momentum constant was set to 0.95. The MATLAB functions *newff* and *train* were used to create and train the network, with previously mentioned choices as arguments.

Results

Figure 4 is a Trellis map consisting of six frames, where each frame shows a plot of the response of the neural network (the estimated price) to the varied input variable, as well as the theoretically calculated response to the varied input variable. The frames represent, in the sequence top left, top right, centre left, centre right, bottom left and bottom right, the response to the input variables X , S , r , $T-t$, q and σ .

The RMSE values achieved with the testing data set for each of the input variables are given in Table 2.

A hypothesis was set and tested, namely to emulate the Black & Scholes model with an accuracy of at least 99.5% and a confidence level of at least 95%. This was achieved by drawing 100 vectors uniformly at random from the testing

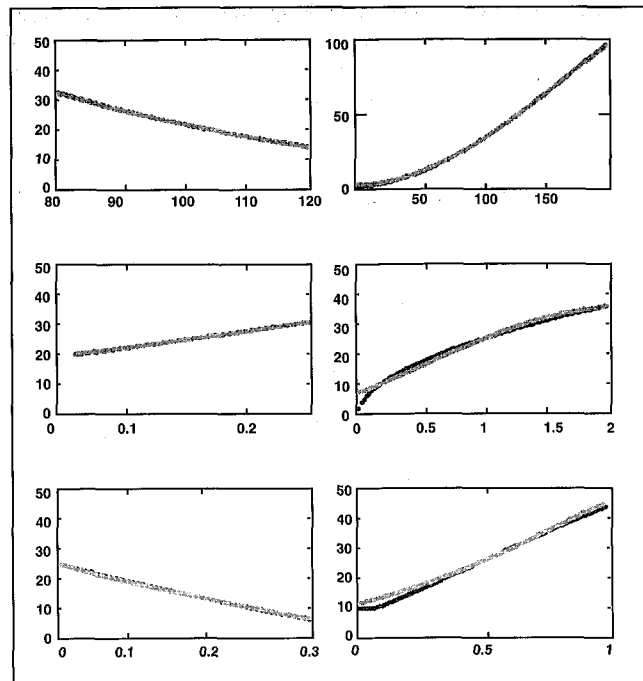


Figure 4. Results

Table 2. RMSE achieved with testing data set

Input variable	RMSE
X	0.0013
S	0.0034
r	0.0009
$T-t$	0.0091
q	0.0011
σ	0.0102
Average	0.0043

data set, applying each of these vectors to the neural network model, for each result calculating the RMSE with $n=1$, and counting the number of times the RMSE was equal to or less than 0.005. This sum was the confidence level.

Results showed that a confidence level of 96% was achieved, which proved the hypothesis.

Conclusion

A neural network model was constructed to emulate the Black & Scholes model for a European call option over a share providing a constant dividend yield. Results proved that the constructed neural network model could emulate the Black & Scholes model with an accuracy of at least 99.5% and a confidence level of at least 95%.

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The South African Essential Services Committee

Part I: The definition of essential services in South Africa

Dhaya Pillay

This article reports on the work of the Essential Services Committee during the first four years of its existence. Most of the cases heard by the committee are discussed in clarifying the approach to the definition of essential services. The law and procedures applicable to the committee are also explained.

Introduction

The Essential Services Committee was established by the Labour Relations Act of 1995 (RSA 1995). On 5 October 1996, the Minister of Labour appointed three people who were knowledgeable about labour law as its members. Its purpose is to investigate and decide which services are essential and to resolve disputes in this regard.

Definition of essential services

'Essential services' is defined in the Act (section 203) as :

"(a) A service the interruption of which endangers the life, personal safety or health of the whole or any part of the population

(b) the Parliamentary service

(c) the South African Police Service."

Each element of the definition is analysed in turn.

Service

The role of the Essential Services Committee is to designate a service, or a part of it, as essential. Alternatively, it may determine that an employee is employed in an essential service (RSA 1995: sections 70(2), 71, 73(2)). It is therefore inaccurate to refer to employees, a business or a company as essential. The practical significance of this distinction is that once a service is designated as essential, the question of who renders it is a separate issue. The provision of a number of services may fall within several sectors, both private and public. A service, then, is better described as a continuum of activities that may span more than one enterprise or authority.

Depending on who provides the service, it may or may not be essential. Private entities, such as blood transfusion companies, and public utility companies that provide water, for example, may be the exclusive providers of such services. Such services become essential if, among other reasons, there is no other adequate, affordable, alternative supply. Technological developments, globalisation and the facilitation of cross-border transactions, however, also mean that services may now be available from diversified sources and may no longer be exclusive.

There may be a constitutional obligation for the state to provide certain basic services such as health, safety and court services. In Italy, the definition of essential services is directly related to fundamental constitutional rights. Accordingly, the constitutional right to freedom of movement and to free communication results in transport and television services being essential (Treu 1998; Italy 1990: article 1(2)(b) and (e)). In

South Africa, only those constitutional rights that impact on the life, personal safety and health of the population would fall within the jurisdiction of the committee. Just because a right, such as the right to education, is entrenched in the Constitution (RSA 1996) does not make it an essential service.

The committee may also enquire whether the service was previously designated as essential, and, if so, what caused it to lose its status, and why it has become necessary to reconsider its status. The stock answer to the last part of the enquiry is that employees in these services may not have considered industrial action previously as there was no constitutional protection of the right to strike. Furthermore, in recent years, the rights of workers have been at the forefront of popular interest, with no fewer than five labour statutes being drafted in as many years. The establishment of the Commission for Conciliation, Mediation and Arbitration (CCMA) has also exponentially increased the awareness of labour rights. There is therefore no guarantee that employees that have never taken part in industrial action before will continue not to do so in the future.

The provision of blood transfusion services was not previously an essential service. Under the Public Service Labour Relations Act (RSA 1994), health and medical services, and all services that supported these services, were defined as essential (RSA 1994: section 20); however, blood transfusion services were not provided by the public service. Four transfusion service enterprises were responsible for providing these services to particular geographic regions. For example, the South African Blood Transfusion Service catered for Gauteng and the Natal Blood Transfusion Services for KwaZulu-Natal. Each establishment was run as an independent private enterprise. Some were registered as non-profit companies in terms of section 21 of the Companies Act (RSA 1973). They were therefore not regulated by the Public Service Labour Relations Act. As they were not part of any local authority service, they were also not covered by the old Labour Relations Act (RSA 1956).

Interruption

In order for a service to be designated as 'essential', it must be subject to the threat of interruption, irrespective of whether such interruption is partial or complete. If industrial action is unlikely to interrupt the service, for example, because of mechanisation or computerisation, or if the interruption could be avoided, for example, by outsourcing the service or by using replacement labour, the service may not be designated as essential. Outsourcing usually entails costs. If the employer outsources services, there is economic pressure on both the

strikers and the employer to resolve the dispute quickly. If the service is outsourced during industrial action, strikers exercise the right to strike without endangering the life, personal safety and health of the population. There may be a risk to their continued employment, however, if the employer were to discover that outsourcing is, in fact, more efficient. This provides an additional incentive for employees to settle quickly so that their long-term job security is not jeopardised.

That outsourcing may incur economic hardship for the employer is not a valid consideration in deciding whether the service is essential. However, when investigating health services provided by publicly funded nursing homes, the committee concluded that the financial situation of these institutions was so desperate that it was impossible for them to outsource functions such as catering and laundry. One of the reasons, therefore, for designating the services of publicly funded nursing homes as essential was that outsourcing was not an option.

The committee may be less concerned with the morality of relying on replacement labour. Its primary purpose is to limit the right to strike only if it is strictly necessary. Recourse to replacement labour is a policy choice that is left to the employer and employees. If replacement labour is more repugnant to them than the limitation of the right to strike, they may agree that a service is essential and conclude a minimum service agreement that eliminates the need for replacement labour.

Another consideration is the training that is required and the length of time it would take to train people sufficiently to render the service. Highly skilled personnel are not easily replaced. If a service is essential, it is therefore likely that during industrial action, it may not be possible to maintain an uninterrupted supply of that service by employing replacement labour. Parachute makers employed by the South African National Defence Force were declared essential because, it was submitted, despite being mentally disabled (and perhaps because of their disability), they had mastered the tedious techniques of parachute making. Replacement labour would be hard to find. It was also not feasible to stockpile the parachutes. If suitable replacement labour is reasonably accessible, the likelihood of an interruption may be limited or eliminated.

The interruption must be caused by industrial action. This is implied, not from the definition, but from the context in which the term 'essential services' is used in the Labour Relations Act. If the state discontinues the provision of critical health services because of lack of funds, the committee would have no jurisdiction.

Endangers life, personal safety or health

'Endanger' means to put at risk, imperil or jeopardise. Couched in the present tense, it also implies that the conditions prevailing at the time the designation or determination is made must be considered, rather than circumstances that may obtain at some point in the future. Some jurisdictions such as Quebec widen the definition by including welfare (Canada 1996: section 111.10), or the economic well-being of individuals, as in Sweden and Italy. At the far end of the spectrum, countries such as France and Britain include inconveniences perceived as undesirable by the public (Bernier 1994: 83).

In South Africa, the probability of economic harm, no matter how real, is not regarded as endangering to life, personal safety or health (Hodges-Aeberhard & Odero de Dios 1987: 552). If this were ever the case, application could be made to the committee for an urgent determination. The economic hardship, for example, that fruit farmers fear in the event of a strike is not a basis for designating fruit farming as essential. Assuming that a strike could devastate the enterprise to such an extent that it would have to be closed down – possibly endangering the life and health of the community that depends on it for employment – it would first have to be established as a reasonable probability¹ that the enterprise would close down and that such closure would endanger life and health in the community. This would not be an easy task, considering, firstly, that the strikers who are part of the affected community may resist such a finding. Secondly, if the strike were to cause the closure of the enterprise and the eventual endangerment of the life and health of the community, the strikers could call off the strike. Thirdly, the employer is empowered to dismiss for operational reasons during a strike. Hence, the employer and the employees have the remedy in their own hands. Fourthly, proving that the economic hardship would cause an endangerment would require substantial evidence, particularly as it would be an eventuality that had not yet occurred.

In such circumstances, the committee might be slow in intervening proactively, but alternative remedies are available. Intervention by the committee could constitute undue interference in the power play, as the underlying tactic during industrial action is to cause or threaten economic harm so that demands are met. If the impact of the strike on the public were greater, the committee might intervene.

Previously, the International Labour Organization's (ILO) Committee on Freedom of Association accepted that a strike could be restricted if it caused "serious hardship to the national community and provided that the limitations are accompanied by certain compensatory guarantees" (ILO [S.a.]: para. 533). Since 1979, it has applied the definition strictly (Hodges-Aeberhard & Odero de Dios 1987: 551). This definition has been adopted and applied in South Africa. Serious hardship is not an endangerment to life, personal safety and health.

An inconvenience is not an endangerment. The interruption of public transport might be more than merely inconvenient and could result in serious economic losses, not only for the transport company but also for industry and the national economy.

The objective of securing arbitration as the preferred tactic for resolving collective bargaining disputes is not a basis for determining a service as essential. Likewise, the competitive advantage that may flow from being designated as the provider of essential services is also not a consideration. Hence, if there are two medical services operating in an area, an application by one of them to be designated as essential would not succeed if its motive were to gain a competitive advantage over the other service.

1. The standard test in civil proceedings applies – Baxter (1996: 739); *Simaan v. South African Pharmacy Board* 1982 (4) SA 62 (A); *South African Pharmacy Board v. Norwitz* 1982 (2) SA 674 (A); *Cirota and Another v. Law Society, Transvaal* 1979 (1) SA 172 (A); *Rheeder v. Ingelyfde Wetgenootskap van die OVS* 1972 (3) SA 502.

The committee must also consider when a service becomes essential. In an investigation of the payment of social pensions, the evidence showed that pensioners were sometimes denied their pensions for a month, for example, in the event of a robbery or an administrative problem. Pensioners would usually manage to overcome the temporary setback by borrowing money or relying on relatives and neighbours for material support. Hence, the committee determined that the payment of social pensions would become essential one month after such pensions fall due.

An analysis of the time when a service becomes essential is also relevant to determining a minimum service agreement. Thus, no minimum service is required during the month following the date when the pension payment falls due, as the service only becomes essential one month after it falls due. Furthermore, the impact of the interruption of certain services, such as power, is more immediate than others. It is also likely that the interruption of all the services that depend on electricity would occur simultaneously as the power distribution system is designed so as to supply large areas automatically. To a lesser extent, the impact of the interruption of the supply and distribution of water is also immediate. The interruption for a few hours of court services or even certain publicly funded health services (for example, routine inoculations) may not be a risk.

The time limits that precede a strike, namely, thirty days for conciliation (unless a certificate of non-resolution is issued earlier) plus forty-eight hours (or seven days in the case of the public service) are also taken into account. For example, the committee may be slow to designate a service as essential if it has never been designated so before, preferring instead to determine the matter during the pre-conciliation and notice periods when the conditions are more certain.

It may also happen that a service is not essential at all times and may only become so when certain circumstances prevail. For example, a chemical or effluent clearance service² would not be essential unless there were a chemical spillage in a public place that posed a threat to the life, personal safety and health of the population. Such a spillage might not occur for an entire bargaining year. It would therefore be wrong to find that the service was essential all of the time. Some options for parties in this situation would be to enter into a collective agreement in terms of which the employees agree to exercise their right to strike subject to a return to work or standby provision which the employer may invoke in an emergency. The least desirable option would be for either party to apply as a matter of urgency to resolve a dispute when there is a spillage and the staff are on strike. Attention is also drawn to pending draft legislation on disaster management services (RSA 1999; RSA 2000). The right to strike will also have to yield during national emergencies and conditions of war (Hodges-Aeberhard & De Dios: 559).

Population

Another condition is that the endangerment must impact on the population. Plants and animals are not protected by the definition. In *Crocodile Valley Citrus Co. v. South African Agricultural Plantation and Allied Workers* (case no. ESC 102), a Nelspruit dairy farmer applied to the committee to have the services provided by four of his cowhands declared essential on the grounds that his priceless pedigree Jersey cows would die if they were not milked twice a day. These employees had

been specially trained and had to undergo regular routine medical tests to ensure that they were free of any communicable diseases. As the definition of essential services refers to protecting the population or any part of it, and to not animals, this application was advisedly not pursued. In Quebec, however, when aquarium workers went on strike and tame dolphins would not accept food from anyone other than their usual trainers, the trade union offered a maintenance service when some of the dolphins started to die and there was a public outcry (Lemieux pers. comm.).

Parliamentary services and South African Police services

The parliamentary and police services were not included in the definition as drafted at June 1995 when NEDLAC called for public submissions on essential services. To fortify the definition and to rank these services with others that might be investigated later, it was legislated that they were deemed to have been designated as essential by the committee (RSA 1995). By listing these services in the Labour Relations Act, the Legislature prevented the committee from considering whether the services are essential in terms of subsection (a) of the definition.

ILO Convention No. 151 (clause 3, article 1, part 1) permits the application of the right to organise in the public service to the police, to be determined by national laws. In making its recommendations, the Fact-finding and Conciliation Commission (ILO 1992) accepted that the police and armed forces may be excluded from application of the principles of freedom of association (p. 658). Furthermore, Dickson CJC, a judge in the Canadian Supreme Court of Appeal, was prepared to find that "[t]he essentiality of police officers and fire fighters is obvious and self-evident, and does not have to be proven by evidence. Interruption in police protection and firefighting would clearly endanger life, personal safety and health. Therefore, the Legislature's decision to prevent such interruptions was rationally connected to the objective of protecting essential services" (Canada [S.a.]).

The ILO Committee on Freedom of Association also acknowledges that the right to strike may be restricted or prohibited in the public service for public servants that exercise authority in the name of the state (ILO [S.a.]: para. 526). The police would fall into that category.

It is debatable whether the listing of parliamentary services as essential meets the ILO standards. As a result of the ILO's adopting stricter criteria for defining categories of public servants that may be barred from striking, the starting point is no longer the fact that national public service legislation applies to them. It is "the nature of the functions they perform" (Hodges-Aeberhard & Odero de Dios 1987: 551) that will determine whether they may strike. It is not self evident that parliamentary services are strictly essential all of the time. An additional dimension to the debate is that South Africa is a constitutional, rather than a parliamentary, democracy. Historically, the prohibition against public servants striking was founded in the belief that the state was sovereign (Stewart 1995). Parliament could not be impugned by strikes. As parliament is not sovereign in a constitutional democracy, it is arguable that it should not have automatic immunity against strikes.

Parliamentary services may be strictly essential, for example, when the National Assembly needs to extend a

2. *Drizit v. CWIU*, case no. ESC 099. This referral was not pursued after the parties met with the committee.

declaration of a state of emergency in terms of section 37(2)(b) of the Constitution (RSA 1996), or when the state president summons parliament to an extraordinary sitting to conduct special business, such as when a state of national defence is declared (RSA 1996: sections 42(5) & 203), but may not be essential all the time. A thorough investigation into the functions of parliament and the services it renders is warranted to determine which parts are strictly essential and when they are so. The determinations must be made on the basis of what parliament actually does and not be influenced by ideology, tradition or rhetoric. It may not be necessary to amend the definition to accomplish this, for the committee can proceed to investigate or determine disputes as to whether parts of parliamentary services are essential (in terms of sections 71 and 73 of the Labour Relations Act). The most preferred option is for the employer and trade unions to conclude a minimum service agreement.

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