

# Information Systems as a Mechanism for Business Risk Management

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## Summary

*A major aspect of IT-supported risk management involves the use of IT to increase flexibility and thus enhance the robustness of an organisation to a changing business environment. This paper discusses risk management and proposes approaches by which IT can be used, within a DSS, as a risk management tool. It considers evidence from small and medium sized enterprises in the UK who are found to be reactive and seldom consider the use of IT to manage business risk. These findings are contrasted by the case of the Hong Kong Jockey Club which has taken a proactive stance based on open systems, in order to be ready for diverse political and economic scenarios following the transfer to Chinese rule in July 1997.*

Keywords: information systems, risk management

## 1 Introduction

While the topics of information systems and technology (IT) and risk management have jointly and separately attracted much recent research, the focus is largely on the use of risk management in the process of IT development. There is, however, a reverse relationship in which information systems (IS) may be used as a mechanism for managing business risk.

IT has become crucial for many organisations and the share of a company's creative and innovative processes that are targeted towards the development and use of state-of-the-art IT applications is growing steadily. The more resources that a company invests in the design and implementation of new IT systems, the higher the risk that these investment might lead the organisation astray.

However, the increased risk that accompanies growing investment in, and focus on, IT is justified not only from the perspective of IT applications turning into competitive necessities. IT applications may become the cornerstone of an organisation's overall risk management approach since they provide the flexibility to react quickly and successfully to a variety of possible changes in the economic, social, and political environment.

This paper discusses risk management and proposes approaches by which IT can be used as a risk management tool. It considers evidence from small and medium sized enterprises (SMEs) in the UK who are found to be reactive and seldom consider the use IT to manage business risk. These findings are contrasted by the Hong Kong

Jockey Club which has taken a proactive stance on IT. This is based on open systems in order to be ready for diverse political and economic scenarios post July 1997.

## 2 Risk Management

The purpose of risk management is to select a course of action which provides a balance between the likelihoods of acceptable and unacceptable outcomes.

### 2.1 Flexibility: the Core of Risk Management

The core component for managing business risk is having the requisite flexibility to handle external and internal changes, i.e. changes in an organisation's or network's socio-cultural environment, its markets (suppliers, competitors, customers), or changes in products, processes, structures, or people.

Eardley et al. (1996) argue that flexibility, and thus proactive risk management, is the ability to change direction at short notice or having room to deviate from a predetermined course of action. As Evans (1991) states, strategic flexibility can be considered as a critical success factor, since most elements of the organisation's environment and systems are in a state of continuous flux. Flexibility may also be characterised as a strategic response to the unseen (Eppink, 1978). According to Eardley et al. flexibility offers three major advantages (Avison et al. 1995). First, if the environment is turbulent, an ability to respond flexibly to forced change may be necessary for basic survival. Second, flexibility may allow the organisation to achieve superior levels of internal efficiency through such activities as business process re-engineering (Hammer, 1990). Third, flexibility of response may give competitive advantage through an ability to develop new performance-enhancing features and to exploit first-mover advantages (Porter and Millar 1985).

### 2.2 Approaches to Risk Management

Griffiths and Willcocks (1995) suggest four key aspects which need to be considered in risk management; governance - the organisation of stakeholders; project management - balancing top-down and bottom up approaches; market need/economic survival as a motivator and; learning.

The stages of effective risk management include (1) risk identification, (2) risk structuring, (3) risk assessment: measurement of the magnitude of the risks, and (4) risk aggregation (Klein, 1994). *Risk identification* is the process which highlights the various risks to which a project is subject. The problem is to generate a set of risks which is complete. A number of risk analysis techniques rely, in part, on participants envisioning and developing scenarios which describe sources of risk or responses to identified risks. In the main, this process is carried out in an informal way: it relies on the experience of the analyst and user. Risk identification assumes that project objectives are broadly understood: a risk has to be a risk to some objective. *Risk structuring* characterises the relationships between risks and may involve classification of risks according to the stage of the project which they threaten, their seriousness, and the kind of responses that may be developed to deal with them. *Risk assessment* considers the seriousness of risks, and, finally, *risk aggregation* combines individual risk assessments into an overall assessment.

Many approaches to risk management are integrated in project management techniques, for example VAR analysis Liang and Tang's (1991), which comprises value analysis, advantage analysis, and risk analysis. But, it has been argued that risk

management should not be regarded as an 'add-on' to project management, but as a central and integral part of the project management process: the goal of achieving acceptable risk exposure is part of the overall project aims (Powell and Klein, 1996). Risk, once identified, is reduced by other strategies.

### **2.3 Cost-Benefit of Risk Management**

Eardley et al. argue that although flexibility is nearly always seen as beneficial, its costs are not well identified. Avison et al. (1995) suggest that the opportunity costs include trade-offs between the attributes necessary to support flexibility and other system characteristics. These may include political realities, system complexity, effectiveness, and the need for standardisation. Eardley et al. (1996) take this further suggesting that 'this implies that strategic flexibility is a compromise; that optimal achievement of short-term goals should be sacrificed in order to keep open an optimally robust option set. While this makes empiric and pragmatic sense, a really flexible strategy would allow the optimal achievement of both short-term and long-term goals'.

## **3 Managing IT-Project Risk and IT-Supported Risk Management**

### **3.1 Managing Risk in IT-Projects**

The failure rate of IS projects is high. Estimates of success rates are as low as 20% (Mowshowitz, 1976) or lower (Griffiths and Willcocks, 1995), with perhaps 30% of projects becoming completely beyond the control of the developers (Price Waterhouse, 1989). The tendency for IT projects to fail or not to perform to expectations makes imperative the need to manage risk as an integral part of IT project management.

Powell and Klein (1996) argue that interest in risk in IT spans the development of individual applications and the provision of strategic information systems (SIS). There is more recognition of the risks inherent in strategic systems than in lower-level operational ones despite the greater evidence of failure for the former.

For SIS, Kemerer and Sosa (1991) identify a number of risks. For example, potential problems at the feasibility stage include the conception of SIS within the context of a non-supportive corporate environment, a lack of leadership, a lack of vision, and difficulties in inter-firm communication. Inter-organisational systems require inter-organisational co-operation, and there are problems in being at the leading-edge. In addition, systems must be technically feasible, are expensive, and there must be a market. SIS are complex to develop, there are problems of maintaining and adapting them, and systems may be copied by competitors, create over-subscription, need experience to maintain or enhance and create high barriers to exit.

According to Tate and Verner (1990) risk management in IT projects is not explicitly related to the choice of particular development strategies. Prototyping and incremental development is often used to reduce project risks, for example, by knowledge, by breaking the project into digestible bits, by reducing time between specification and delivery, and by reducing the impact of change requests.

Particularly at strategic level, IS developers are usually not in receipt of organisational objectives (Powell, 1994), rather they assume or interpret them from

observed organisational behaviour. Thus, an added risk source is the incompatibility between actual organisational objectives and those upon which the developers build the system.

Typically, attempts to address risk in IT projects are either specific, identifying, usually, a partial set of risk sources, or adopt an all-encompassing categorisation approach. The latter is a more general approach to risk management, but may not allow the system developer to think about risk flexibly, associating particular sources of risk with each stage of risk management as described above. Harris and Katz (1991) suggest that 'investments in information technology represent a major source of business risk and (that) this risk must be managed effectively through the link with the firm's strategy, the structure of the organisation, the measurement and control system, the reward system, and the characteristics of the technology'.

As shown from the above, the focus of IT-related risk analysis is on reducing the likelihood of risks during IS development. Yet, there is an alternative view which considers information systems as mechanisms for reducing business risk. A prime way in which organisations may achieve this is by increasing their flexibility via investment in and use of IS.

### **3.2 IT-Supported Risk Management**

Organisations face a variety of uncertain situations regarding their business environment (politics, culture), their marketplace (vendors, customers, world-wide competition), and their own organization (finances, employees, etc.). To be successful in the medium and long term, organisations need to position themselves in such a way that they can react quickly and successfully to different scenarios in the environment as well as to internal changes. In networked organizations involved in global sourcing and selling, most efforts to prepare for internal and external changes are based on innovative IT-developments. The developments may have been achieved by the organisations themselves or they may be accessible or purchasable in the market.

Response to rapid change in the business environment and in technology requires greater flexibility in the strategic process and for this to be supported by flexible infrastructures. Yet, small and medium-size enterprises seldom have formal corporate plans or strategies and are even less likely to have IT strategies. They are not dissimilar to their larger counterparts in that Lederer and Mendelow (1986) identify the disparity between the need for flexibility on the part of top management when implementing strategy and the requirement for a precise definition of future plans to be given to IS developers. As Eardley et al (1996) suggest, this poses a problem for IS planners, as they are trying to develop systems to support business manoeuvres and organisational structures which may not even exist in a planned form. Yet, IS developers require precise and stable specifications in order to deliver working IS. Parsons points out that 'although it may seem obvious that IT applications should be consistent with the business strategy, in too many firms there is a monumental lack of attention given to understanding how IT will influence the firm's competitive position in the industry, or how IT might support a business strategy'.

Lefebvre and Lefebvre (1992) argue that innovation in SMEs is driven by information particularly about the external environment. The use of IT makes small production runs easier and, hence, SMEs will be able to be more competitive as they can introduce new manufacturing technologies quickly. These new technologies, it is argued, enable SMEs to be more flexible and able to respond to customer needs than

large organizations. Quality and variety of products is also seen as being improved by the introduction of new production technologies.

Eardley et al. (1996) suggest that past examples of IT built by large organisations were based on strategies in which the potential for manoeuvre was fixed in the long term and in which economies of scale were important, yet, the trend is towards demassification. 'The runs are getting shorter, the work units are getting smaller, the locations are becoming more disbursed. What it points toward is increased customisation, and...if you go back before the industrial revolution, that is how we produced things...virtually all production was custom production' (Tofler, 1987).

IT is held to be key to the future flexible organisation. Ives and Mason (1990) argue that 'information technology offers exciting opportunities to revitalise customer service by moving a company and its product offerings closer to the customer, thereby recapturing the conditions of intimacy and flexibility that characterised earlier eras' (p.67).

## **4 IT-Supported Risk Management in SMEs**

Storey and Cressy (1995) characterise SMEs as exhibiting attributes of firms in perfect competition. Levy and Powell's (1996) work shows that SMEs tend to have a specific skill in one main product or variants of that product. SMEs believe their expertise lies in that product and they only compete in one market. In general, SMEs have few major customers and there is considerable dependency upon maintaining those contracts, with all the concomitant dangers. SMEs have little power to influence market price by altering output quantities, have small shares of the market and are unable to erect barriers to entry to the industry.

SMEs' survival is often ascribed to their adaptability and speed of response to environmental change; 'a key word often associated with small firms is that of 'flexibility' (Storey and Cressy, 1995). Small firms are perceived of as being significantly more 'flexible' than large firms' (Storey and Cressy) since owners of SMEs have considerable knowledge about the firms' capabilities, management structures tend to be flat and there is an absence of bureaucracy, close management involvement means there is tight control over production processes, and SMEs can respond quickly to changes in demand as their production runs are small. Nevertheless, Levy and Powell (1996) show that SMEs exhibit relative inflexibility in their general approach. A cause of limited flexibility is reliance on outdated machinery and under-investment. Storey and Cressy attribute this to the short termism engendered by the need to ensure survival and the wish to avoid high fixed costs; 'they favour "flexible" over "fixed" investment and those with short rather than long term payoffs'. IT does not seem to provide increased flexibility, but reinforce existing thinking (Levy and Powell, 1996). The key reason is that SMEs view themselves as having a narrow product range used for the benefit of one or two customers. This leads them to consider the purchase of IT to improve the efficiency and effectiveness of current processes rather than considering the capacity of IT to increase flexibility and improve competitiveness.

### **4.1 IT Investment in SMEs**

Investment in IT in SMEs is characterised by incrementalism. Hasmi and Cuddy (1990) find that SMEs move to automation by investing in a single area and then later expanding into others. This leads to SMEs having a number of incompatible systems

which are difficult to network. However, because of the high cost of investment already made, the SMEs are unlikely to redevelop their systems. Generally, SMEs view investments in IT in the same way as they view their production systems. They expect them to last for a considerable time. Hence, SMEs are not particularly adaptable as they see themselves continuing in their chosen market. They do not tend to apply their IT to reduce the risks and the volatility of their business environment.

SMEs tend to have systems which provide them with information about day-to-day operations and these systems develop incrementally. Bili and Raymond (1993) find that SMEs are only in the initiation stage of Nolan's Stages of Growth (Nolan, 1979). Investment had been made in automated production systems before considering information systems. Meredith and Hill (1987) show that the focus on standalone systems provides an emphasis on efficiency and tangible benefits. However, the impact of the systems is likely to be local, with minimal organisational-wide impact. The risk involved in implementing these systems is slight. They contrast this with integrated systems which emphasise effectiveness across the whole system, where intangible benefits are more important and there is likely to be considerable organisational impact. Most SMEs have not integrated their systems and are therefore unlikely to achieve full benefits, though Naylor and Williams (1994) disagree.

The major interest for SMEs is to manage their operations more effectively, to minimise wastage and improve stock control. Planning for IT focuses on improving the existing operations with which senior management are familiar. Hagman and McCahon (1993) find that competitiveness is not an issue in IS planning.

The technical infrastructure in SMEs is typical of the third-generation, incapable of running many newer applications or to be applied in proactive risk management. These systems are typically developed by the traditional methods such as structured systems analysis or ad hoc by the self-taught. Structured methods are inadequate for modelling future requirements, and the models and specifications produced are rendered obsolete by minor changes in business process (Eardley et al, 1996, Fitzgerald, 1990). The methods produce systems lacking in the flexibility to cope with future change. This is shown by the prevalence of corrective maintenance which tries to modify software to cope with unforeseen changes (Eardley et al, 1996). There is little evidence of IT being linked to risk management and investment being made to support risk management.

## **4.2 Customer Influences**

A crucial component of risk management is continuous customer satisfaction. SMEs are driven by the needs of their customers. Just In Time manufacturing is becoming the norm for major manufacturers and SMEs are becoming warehouses for their customers. The industry value chain is of critical importance to SMEs. As Kanter (1994) argues, it is the concept of collaborative advantage that is important. This is driven through value chain partnerships which depend upon openness, good communication and a willingness to share information. While customers drive SMEs to produce quality goods at a minimal price, the decision to promote one or two SMEs has ensured that the relationship has to be two way. In other words, the customer may not be able to find an alternative source quickly.

There are three key areas in which customers influence IT in SMEs. First, they seek evidence of quality in both product and production process. Second, order processing is done automatically and third, there is integration in design of new products. SMEs' few customers exert considerable pressure on them to perform to

specified standards. Customers place substantial emphasis on evidence of both quality processes and products. The purpose is to maintain preferred supplier status. The carrot held out to the SME is one of more open book management and a mitigation of the price reductions demanded by the customer.

#### 4.2 A Framework for Analysis of Strategic Flexibility/Risk Management

One way to demonstrate the lack of actual or potential flexibility, i.e. risk reduction/management in SMEs is to use a framework devised by Evans (1991) and discussed in an IT context by Eardley et al. (1996). Evans' work identifies two aspects of strategic flexibility; temporal and intentional. The temporal aspect may be *ex ante* which implies preparing in advance for an unpredictable future change or *ex post* which involves making adjustments after an event has occurred. The intentional aspect may be offensive or defensive. Evans uses these to develop a framework of four manoeuvres - pre-emptive, exploitive, protective, and corrective.

A *pre-emptive manoeuvre* allows a firm to take advantage of possible future events and is most useful where the future is unpredictable and where the exploitation of innovation is a tool of competition. Heidegger (1977) describes the actions of firms which create a domain into which new products, distribution channels or business methods can be introduced as 'enframing', implying that a framework of options is set up, from which a future choice can be made. This is a robust policy (Rosenhead et al, 1986) - creating and leaving open options. A robust decision has the maximum number of reachable outcomes and it will absorb changing circumstances and cater for the objectives of the decision maker not being fully formulated. According to Eardley et al. pre-emptive manoeuvres imply that some tactical action will be taken in the future. There is very little evidence of the use, or the ability to use, this tactic by SMEs who are too constrained by customers and product lines.

Whereas pre-emptive tactics are employed before an unforeseen trigger, *exploitive tactics* are deployed after. Exploitive manoeuvres capitalise on opportunities created by chance or from pre-emptive tactics. A firm's ability to use IT to exploit such opportunities depends on its ability to identify appropriate situations to use its IT skills and to develop the right type of IT quickly. The lack of investment and skills in IT exhibited by SMEs suggests that this, too, is an unlikely scenario.

*Protective manoeuvres* applied in advance of unpredictable events are contingency plans which seek to limit the damage caused by unknown future events. Insurance against a strategy being unsuccessful is given by a choice of options. Evans includes the installation of buffers, such as large inventories, as part of this tactic. It is significant that applications of IT, such as JIT systems are aimed at supplanting these by improving the firm's use of information. Yet, SMEs do invest, perhaps for the wrong reasons, in large stock holdings. This gives them some protective cover. A further protection is barriers to entry. There are numerous, mostly unsuccessful, examples of the use of IT as a barrier to deter rivals from entering a market. However, due to the nature of technology, these barriers are usually temporary. In SMEs the nature of the market prohibits use of barriers to entry.

*Corrective manoeuvres* are used when other tactics fail. Clearly, all businesses engage in these, though the high failure rate of SMEs suggests that their ability is limited.

Analysis using Evans' framework suggests that SMEs cannot, or do not, use most of the range of tactics which might give flexibility. This, in turn, suggests that their total flexibility is low compared to organisations which can employ such tactics.

Hence it may be the SME sector rather than the individual firm that is flexible due to organisational birth and death. Alternatively, it is the whole value chain that has flexibility not any component part, or perhaps any value chain is more flexible at the customers end than at sub-assembler level. Also, the evidence is that IT does not provide flexibility for SMEs. The literature on computer integrated manufacturing promotes it as a means of increasing flexibility and improving quality control (Ayres, 1991). However, there is very little evidence of integration of design, production and management information systems which constitute CIM. This is largely due to the incrementalism which is a key feature of information systems in SMEs. This may all be encapsulated in the IT-flexibility paradox to which Lucas and Olson (1994) point - technology can contribute to organisational flexibility since IT is inherently more flexible than its predecessors, but since technology ages so rapidly and becomes hard to maintain flexibility is quickly lost.

The above analysis of SMEs suggests that they do not use risk management as part of their IT development processes nor are they proactive in their use of IT as a mechanism for reducing business risk by increasing flexibility. However, this need not be the case. Organisations may use IT as such a tool, as exhibited by the Hong Kong Jockey Club.

## 5 The Hong Kong Jockey Club

### 5.1 Management of IT-Risk at the Hong Kong Jockey Club

The Hong Kong Jockey Club (HKJC), founded in 1884, manages all betting activities in Hong Kong. Since its foundation, the Club has experienced steady expansion. It is a company limited by guarantee obtaining its earnings from racing and betting (Jelassi and Loebbecke, 1993). The amount remaining after deducting prize money, taxes, operating costs, and investments to maintain and improve the racing and betting facilities is donated to charities and community projects. In 1994/95, the Club's betting turnover amounted to US\$9.4 billion, of which US\$150.4 million was donated. This is 10% of government revenues or 40% of Hong Kong's personal income taxes.

The HKJC is heavily dependent on IT for its operations. Consequently, the Club has made substantial investments in its IT systems, making the Club one of the largest and most innovative IT users in Hong Kong, and one of the most intensive IT users in the entertainment industry.

The Club's *IT Strategic Road Map*, developed during 1992 and officially introduced in September 1992, provides a reference point for all technical policies (see Figure 1). It has been endorsed as the Club's top-level policy for decision-making and IT-risk management. The Strategic Roadmap is the rationale for a technical strategy document called the 'IT Technical Framework'. Three major assumptions underlie that framework: (1) in the future IS will change the way in which people work and in which organizations will be structured, (2) the Club must have a coherent IT infrastructure capable of supporting collaborative work, organizational design, and business re-engineering, and (3) distributed and open systems will be core in any coherent infrastructure providing the required flexibility.

The main focus of the framework is to present direction on how to achieve the planned transition to an open systems environment; it is therefore centered on a model of distributed and *open systems*. Further, the Technical Framework is intended to



provide guidance by considering technological trends and product availability and to develop a flexible *distributed computing* environment that will enable the IT Division to respond rapidly to the changing business and information needs of the Club. A distributed computing environment is considered as an inter-connection of open systems that function seamlessly. The IT infrastructure targeted with the framework is diverse, manageable, and extensible, and also transparent so that the complexity is hidden from the user. It requires open systems based on standards. All applications will be designed for a client server architecture and they will conform to a consistent user interface style and be supported by on-line and help functions and a consistent set of data attributes.

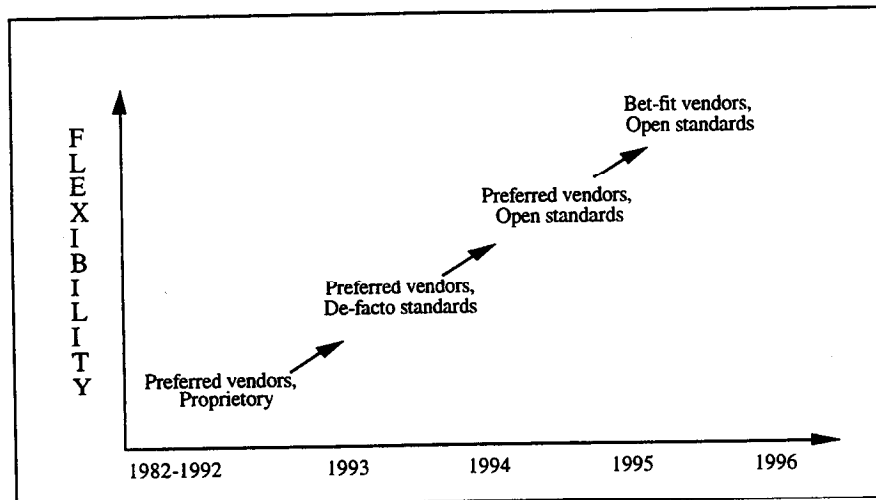


Figure 1: IT Strategic Road Map at the Royal Hong Kong Jockey Club

In 1992, the Club began to investigate the use of *object oriented (OO) technologies* by joining several research programmes and by visiting users of OO technology in Europe. The Club's executives were persuaded that it was time for direct involvement. They established Internet connections with various information providers and joined the Object Management Group as well as X/Open and the Open Software Foundation. The latter two proved invaluable in providing early information about emerging standards. The Club believes that membership of these groups allowed it to evaluate more effectively proposed standards and their timely adoption. To further facilitate information exchange with other users the Club joined the Object Interest Group in 1993.

In essence, the Club considers IT risk management - as imbedded in the technical framework - a crucial ingredient to successfully implementing any new technology. Especially in the case of object orientation, knowledge of forthcoming software developments has proven to be useful in assessing and managing the risk of migration, and has thus led to a 'competitive advantage'. This knowledge is acquired from the membership of various consortia which the Club can afford because of its non-profit status. Nevertheless, Club officials have stated repeatedly that the principal value of membership comes from personal contacts developed within these groups.

## **5.2 IT-Supported Risk Management at the Hong Kong Jockey Club**

Although the Club has a monopoly, it faces competition along two dimensions: 'leisure dollars' (money spent on non-gambling activities and lotteries coupled with other activities, such as insurance, mail order shopping, or saving) and 'leisure time' (video on demand and, eventually, virtual reality gaming) (Markwell, 1994). That is, an increasing number of alternative leisure attractions may reduce either the money or the time that customers will devote to betting and attending horse races. The idea of the Club is to develop and implement new IT applications that either tackle the upcoming competition in Hong Kong or allow to spread the current business and expertise into other regions of the world (China, neighbouring countries, or worldwide, electronically connected race courses and/or households).

On July 1, 1997, Hong Kong will become a Special Administrative Region of the Peoples' Republic of China. This transfer of sovereignty has given rise to many risks concerning the future of Hong Kong, including a few that directly concern the Club: to what degree the Club will have to change its business practices in Hong Kong, and to what degree will it be allowed to expand into China?

With regard to the first, betting is currently illegal in China, but several provinces have established betting facilities, and the central government in Beijing has quietly allowed this to take place. While the legal status of betting in Hong Kong after 1997 is not clear, the current practices in the provinces and the 'one country, two systems' policy suggest that the Club can make a good case for allowing it to continue its current operations. In addition, the central government will face many far more pressing problems elsewhere in China, and the Club estimates that it will take ten years for the question of gambling in Hong Kong to become of concern to the leadership in Beijing.

With regard to the expansion of the Club's operations into China, matters are less certain. There are three ways such an expansion might take place: (1) people in China may be allowed to bet on Club races either directly via telebetting or by eventually cross-betting at other tracks in China, (2) the Club may be allowed to establish its own tracks and betting facilities at certain locations in China, and (3) the Club might be allowed to sell or lease its software to other tracks in China. Although it is not clear whether any or all of these events will occur, the open systems approach adopted by the Club should provide the flexibility needed to facilitate these operations.

Here the circle closes again: the open systems policy, which allows IT-risk management to provide the cornerstone of the Club's overall risk management approach. Although everybody seems to have an opinion about what will change after July 1, 1997, the Club considers its future unpredictable. However, the top-management believes that the best way forward is to prepare it for as many possible scenarios as affordable. Thus, they consider the IT Strategic Road Map as the Club's main tool to provide the necessary flexibility to react fast and with high-quality to whatever the new business environment will impose or offer - the need to leave current sites, a huge new market or any temporary solutions in between.

## **6 Conclusion and Further Research**

This paper has contrasted the alternative roles for IT and risk management. In the SMEs, a reactive approach to investment in IT has led to reduced flexibility. Conversely, the Hong Kong Jockey Club has grasped the nettle and is using IT

proactively as a means for reducing business risk. Thus rather than seeing IT as a problem to which risk management tools might be applied, IT itself may become part of that tool kit.

Although, the two groups clearly have different characteristics and environments, the paper has demonstrated the lack of technological determinism in the use of IT. It may be risky, or it may be a mechanism for risk reduction. Further work is need in order to investigate the extent to which this difference is contextual.

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