PITFALLS OF INFORMATION TECHNOLOGY MANAGEMENT SYSTEMS

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Abstract - In an economy of rapid technological change managers need to be aware of newer technologies and how the adoption of these technologies affects competitive advantages. Information technology management systems are not delivering to business needs. A model is constructed to better understand information technology management systems. This is done using two approaches firstly a) managers information technology preferences are linked to technological benefits, adoption and integration; secondly b) challenges facing managers are identified through a literature survey. Both a) and b) are verified using an expert panel. Important lessons for manager’s wanting to invest in information technology management systems are provided.

Keywords: Information technology, information technology preferences, information technology challenges

I. INTRODUCTION

In an economy of rapid technological change managers are faced with newer technologies, they are challenged to implement newer technologies promising benefits in terms of cost-effectiveness, improved quality, greater speed, dependability, flexibility and more reliable systems and processes. We examine the preference of manager’s to information technologies and see how these preferences link to technology benefits, adoption and integration. A model is constructed to investigate these links.

In order to better understand the links in the model it is also important to understand the challenges facing technology decision makers. Deciding on the best technologies that will suit a firm’s competitive advantages is the responsibility of the technology decision maker. The decisions taken are expected to improve competitive advantages. Even though managers continually invest in newer technologies and systems, some managers believe the investments are not yielding good returns. Therefore in addition to understanding the links in the model a better understanding of the challenges facing technology decision makers are also explained. These challenges are topical and regularly face managers as they endeavour to implement better technology solutions to gain competitive advantages.

II. LITERATURE SURVEY

Theoretical concepts pertaining to information technology management (ITM) are researched through a literature survey, which is broken down into two sections. The first is (A) managers and information technology and the second is (B) the changing technological paradigm. These concepts are used to construct a model linking managers information technology preference needs to technological benefits, adoption and integration. Thereafter important challenges facing managers are identified, and these challenges are then explored. The survey results are tested using an expert panel. Important conclusions are extracted which provide useful lessons for managers. Each of these sections is next discussed.

A. Managers and information technology

To obtain a better understanding of managers and technology it is necessary that different definitions in the information technology area are considered. There are several definitions around information technology (IT), information systems (IS), strategic information systems (SIS), enterprise information systems (EIS) and industrial information systems (IIS). At least the following authors define these terms viz.:

[1] Mallach (1994) defines information systems (IS) as a system that has the purpose to store, process and communicate information.

[2] Marchand (2000) defines information technology (IT) primarily as the technology infrastructure of the firm, relating to the content, quality and use of information necessary for running the firm, such as operational controls, customer services and financial reporting.

[3] Wiseman (1998) defines strategic information systems (SIS) widely as systems that shape and also support the strategy of the firm.

[4] Barker et al. (2001) defines enterprise information systems (EIS) as systems crossing traditional functional boundaries storing records pertinent to multiple organizational functions, maintaining them in a consistent fashion and producing both functional and cross-functional reports. They say typical vendor products encompassing EIS include enterprise resource planning (ERP) and enterprise asset management (EAM).

[5] Billo et al. (2006) describes industrial information systems (IIS) to have been incorporated into almost all facets of industry and these systems include warehouse management, shop floor control, health care, transportation and retail systems.
Although these definitions are open to some degree of interpretation, in the context of this paper it is necessary to level the playing field, therefore for the purposes of this research Information technology management (ITM) is the term which will be used to encompasses at least IS, IT, SIS, EIS, EAM and IIS.

To create competitive advantages strategic plans are built around areas of operational effectiveness; encompassing integrated ITM systems that synchronise information across the firm and other firms. This is done to achieve cost-effectiveness and efficiency through new systems and processes, thereby reducing cycle time, cost to market etc. Managers have a preference for information technology management tools that prescribe cost-effectiveness, improved quality, greater speed, dependability, flexibility and more reliable systems and processes. However, seldom have these tools been able to sustain their promises, and managers are disillusioned with the success/performance of such tools. For example Norton and Kaplan (1992) emphasises the role of ITM systems in enterprise performance management systems. Others like Badescu and Garces-Ayerbe (2009), Al-Somali et al. (2009) and Kalling (2003) show the critical role ITM systems play in the modern economy. However, at least Whittaker (1999) and Yeo (2002) identify many difficulties facing managers, when implementing newer technologies. Some of these difficulties are:

Firstly, the difficulties facing managers relate to transforming the intangible benefits of technological implementations to financial benefits. One such example where intangible benefits were turned to tangible benefits is cited by Kaplan and Norton (1992), where a department manager in a chemical company was able to translate data from a quality perspective into a ‘dummy’ financial report. This report clearly indicated how the employee activities impacted the financial results of the organisation, and gave visible feedback to employees of their activities.

Secondly, the person implementing the technology is not necessarily the person responsible for the day-to-day operation of the technology. Bloch (2001) says the management of technology must be integrated into the current management structure and processes as seamlessly as possible. He believes it is the responsibility of ‘everyone’ in the organization to manage technology. However the author maintains that certain technological functions like technology strategy, an understanding of technological progress and the methods and tools used in the management of technology should be assigned to a single technology manager. These tasks could include at least knowledge of technology cycles, technological analysis, technological forecasting, technological limits, technology space maps and technology balance sheets.

Thirdly, the technological needs of the organization are not always understood by managers. The responsibility for technological implementations often rests with managers who may be drawn to technological hypes and buzz words and become overwhelmed with newer technologies and are ultimately intimidated into their choice of application and implementations. There is a failure by managers to separate the needs of the firm from the promises of newer technologies. Before implementing newer technologies, the transaction (business) processes required, need to be understood and simplified. Only when these processes are simplified and understood, should technology be used to automate processes. So the logic follows simplify, systemise and automate (Siririm 2007)).

Fourthly long drawn out technology implementations failing to identify shorter milestones in the road map to complementation causes senior executives and other individuals to lose interest in implementations. Rigby and Ledingham (2004), refer to failed Customer Relationship Management (CRM) projects and how firms were able to turn these projects into success. They argue the most important ingredient was the firm’s ability to take a pragmatic disciplined approach to CRM i.e. launching highly focused projects that are relatively narrow in their scope and setting modest goals. The key being shorter delivery milestones, rather than long drawn out project plans.

Fifthly, the potential pitfalls and failures of projects early in the implementation phase are often known by managers. However, these are not disclosed for the fear of being criticised for these failures, (Argyris 1997)).

The above list is by no means comprehensive but gives an indication of possible challenges for ITM implementations. During the last two decades, some progress has been made in understanding the role and function of ITM in firms (Keen 1991, Currie 1989, Walsham 1993, Ferhey, Land and Targett (1995, Remenyi and Money 1991, Ward, Taylor and Bond 1996, Boyle 2003), McAfee (2006), Shpilberg et al (2007) and Badescu and Garces-ayerbe (2009). Others like Davenport (1998) claims enterprise systems appear to be a dream come true. However he questions whether enterprise systems are living up to their firm’s expectations. He says there are a growing number of horror stories, with failed out-of-control projects and therefore managers should certainly pause and take stock. In addition others like Ross and Weill (2002), and Whittaker (1999) claim many ITM initiatives do not deliver on benefits promised. Therefore others like Weill and Ross (2005) claim managers need to become more involved to get more value and effectiveness. Others have questioned user attitudes and management information system use, Robey (1979),
user involvement Robey and Farrow (1982), user information satisfaction (Ives et al (1983), the perceived usefulness, ease of use and user acceptance (Davis 1989, Al-Somali et al (2009), the perceptions of adopting information technology (Moore and Benbasat (1991), and Larcker and Lessing (1980)). Mintzberg (1990) proposes understanding what managers do may provide further insight and help other managers to improve ITM systems Adoption.

Banuls (2008) gives a good overview in terms of fore-sighting key areas in the ITM industry. Moreover Mintzberg (1990) argues managers have been promised the benefits of total information management systems, but these systems are not working, managers are simply not using them to their full potential. He looks at how managers process information and argues this is the key to poor support for information systems. He proposes managers prefer verbal media, telephone calls and meetings to documents. In this paper we explore the way manager’s process information and pose interesting questions in terms of which of these methods are leading to better benefits? Ross and Beath (2002), say “New technologies present companies with opportunities or imperatives to adopt new business models”. These opportunities are next discussed in terms of the changing technological paradigm.

B. The changing technological paradigm

Given the backdrop of section A (managers and information technology) there is a need for managers to be aware of the changing technological paradigm. Porter (1996) argues that developing a strategy in a business that is undergoing revolutionary technological change is a daunting proposition. Carr (2003) says “given the rapid pace of technology’s advance, delaying IT investments can be another powerful way to cut costs while also reducing a firm’s chance of being saddled with buggy or soon-to-be-obsolete technology”. He quotes examples like Dell and WalMart, as firms that stay back from the cutting edge, waiting to make investments until standards and best practices solidify. Other authors like Brown, Hagel and Varian (2003) have provided useful comments to Carr (2003). Some of these comments are summarised next viz.

[1] Brown and Hagel III (2003), argues “Carr is not claiming that IT does not matter; rather, his main assertion is that IT is diminishing as a source of strategic differentiation.” Brown and Hagel III (2003) further comment that Carr views IT as a commodity and says that many executives have started to view IT as a commodity because they have not thought aggressively enough about how IT can bring about new business practises.

[2] Varian III in Brown and Hagel (2003), argues that Carr is right when he says that IT has become commodified and no longer offers a competitive advantage. However, knowing how to use IT effectively is still a relatively scarce skill.

[3] Hagel III, Brown and Davison (2008), describes IT as a shaping strategy that allow firms to reduce their investment in IT infrastructure, they quote firms like Salesforce.com who have opted for software as a service (Saas) model to reduce IT infrastructure investments.

Clearly there are still strategic advantages which can be derived from ITM systems. In addition others Lin and Lin (2008) on determinants of e-business diffusion, Yu and Tao (2009) on understanding IT and IS adoption, and Hernandez and Martin (2008) on implementing IT as key factor for company development show benefits in terms of ITM systems. Therefore it may be argued that technology alone does not provide solutions for competitive advantage it is how one uses technology to competitive ends that matter. From the literature survey the hypothesis and constructs are shown in Table 1.

In concluding the literature survey we pose the following questions viz.:

i How do managers information management preferences link to technological benefits, adoption and integration?

ii Are there parallels between the literature survey and views shared by expert panel in terms of difficulties facing managers described in section (Literature Survey II, A) points [1] to [5].

The research methodology is next discussed.

III. RESEARCH METHODOLOGY

The research consisted of a survey process. An instrument was developed through a literature survey. The instrument was tested using a pre-test and pilot group. The tests are discussed in section A and B. The results were then correlated statistically. Some descriptive statistics are also discussed.

A. Industry selection, questionnaire design and data analysis

Three industry categories were selected; these include the electronics and electrical engineering industry, Information technology industry and logistics industry. The industries that were selected are currently in the forefront of technology arguments and in addition are affected by most forms of technologies.

Firms participating in the research were selected from the following registered authorities: The Financial Mail survey of top 100 companies in South Africa, June 2006 publication; and TOP ICT companies within South Africa, 2006 publication. This resulted in a total sample size of 140 firms. Other researchers utilizing survey type research like Siriram and Snaddon (2005) cite the following authors in terms of sample sizes Rosenthal (1984) used 57 user firms, 38 systems integrator firms and 64 experts, Swamidass and Kotha (1999) used 160 firms, and Choi
and Hartley (1996) used 156 firms. Therefore the sample size of 140 was considered to be adequate. The majority of the questions consisted of seven point Likert scales and a few forced ranking questions were also used. Responses range from 1 to 7 and in each question 1-7 was defined. The response X = Not relevant/Do not know, was also made available.

The instrument is categorised into 4 categories viz. information management preferences, technological benefits, integration and adoption. Factor loadings for each of the categories are calculated.

Factor loadings are used to check that the constructs are related to the categories selected. Thereafter a pre-test and pilot test was used to check the validity and reliability of the instrument.

The pre-test consisted of a sample of 15 respondents selected to test the design of the instrument. The pre-test was used to determine whether the instrument was adequately structured so respondents understood and interpreted the questions correctly. The participants consisted of CEOs, executive directors, strategy managers, managing directors, business development managers and other functional specialists involved in technology management. The respondents were contacted telephonically to set up an appointment. Thereafter respondents were emailed a document giving an overview of the research. Individual interviews were then set up. During the interview process they were asked to review the instrument and comment on the language and clarity of each question as well as the overall format. Input to the survey was gained through interactive, structured interviews, which was a helpful way in improving the instrument with respect to wording, clarity and relevance. This group was too small to perform any CITC (correlated item total coefficient) or Cronbach alpha tests. Secondly a pilot test was used to check the reliability of the questionnaire, The Cronbach alpha test was utilised only for the main group. Cronbach alpha values above 0.6 were deemed to be acceptable, [Krause (1999)].

B. Analysis of results

The results of the pilot test were included in the final run. 47 responses were received i.e. 33.57% response rate. The response rate was deemed to be acceptable. Non-response and industry bias were tested using t-tests. For non-response the respondents were categorised into early responses and late responses. For early responses, the first 20 firms were selected and for late responses, the last 20 firms were selected. The responses from these firms were then compared using t-tests. It was found that for randomly selected variables there were no differences between early responses and late responses. The responses from the latter could be viewed as the same as non-respondents. Hence, it may be concluded that there is no bias as a result of non-respondents. The results also show there is no bias from multiple responses. Responses were aggregated and then compared, to the un-aggregated variables these two categories were then compared using non parametric tests. It was found that there was no bias between the aggregated and un-aggregated variables. Hence firms that responded more than once did not introduce bias into the results. Having completed the tests for multiple responses, the research results are discussed next. Cronbach alpha values are well above accepted norms for the combined group 0.959, the factor analysis for the groups are information management 0.683, technological benefits 0.874, technological integration, 0.932 and technological adoption, 0.973. The industry response rates are electronics and electrical 2.40%, information technology 31.91%, logistics 10.64% and others 10.64%. There were a total of 140 responses. From a respondent category perspective Chairman/CEO/COO/CFO 10.64%, Executive Directors 8.51%, non-executive directors, 29.79% and others at 51.06%.

IV. RESEARCH RESULTS

The results were first analysed using statistical analysis thereafter an expert panel was used to comment on the results. Regression analysis was used to test the model. Since the significance level of the F-Statistic is less than 0.05 the variation in the model is not due by chance. R the multiple correlation coefficients are large indicating a strong relationship. The R = 0.875 and R^2 =0.766 were obtained and the regression and residual were at 468.063 and 439.639 respectively (approximately 50% of variation is explained by the model), others have used similar models, Molina-Castillo (2009) used a model explaining 40% of the variation. The standard error of the estimate is at 2.21018, is lower than the standard deviation indicating that the regression model is a better predictor. The F value was quite high at 25.116 and 0.00 level of significance. The condition indexes are less than 30 which, implies that there is some issues with multi-co-linearity, however the data may be used in its current form. Checking for co-linearity all variance inflation factors (VIF) were within acceptable ranges and condition indexes were within acceptable ranges.

Next basic statistics using Pearson’s correlation coefficient are used to correlate the categories of information management preferences (IMP), technological benefits (TB), technology adoption (TA) and technology integration (TI). Statistical correlations are depicted as r α. It must be noted that r α in each case is the average correlation for the group concerned. The correlations are reflected in Figure 1.

Secondly the results of these tests were further explored through structured interactive workshop involving the expert panel. The expert panel consisted of 8 senior managers from IT, Finance and Services. The correlation model was tabulated to the expert panel and the following points were raised viz.:
The research focused on manager’s preferences in terms of information technology sources and how these preferences link technological benefits, adoption and integration. In addition difficulties faced by managers when implementing ITM systems are investigated. A limitation of the research is that a comparison between industry sectors could not be made due to the limited number of
firms per category i.e. Electronics and Electrical 11, Information and communications technology 15, and Logistics 21. In addition it would have also been interesting to compare the different respondent categories i.e. CEOs, CFOs, CIOs, COOs, etc. The model constructed represented 50% of the variation. It is suggested that other constructs be incorporated into the model to improve the model variance. It is also suggested the model perhaps be expanded to other industry sectors as well as other countries; for example comparing South African firms to other African countries, Europe, US and Asian countries.

VI. FURTHER RESEARCH AREAS

Further research areas may include the following viz.:

[1] Conducting the research in other industry sectors.

[2] Expanding the research to include firms involved in the complete technology adoption cycle i.e. visionaries, innovators, early adopters, late adopters and laggards.

[3] Including different constructs for information management, technology benefits, adoption and integration.

[4] Comparing the views between the different respondent categories i.e. CEOs, CFOs, CIOs, COOs; other executive directors, general managers and technology specialists.


[6] How to better diffuse the responsibility of technology through the hierarchies of the organization.


VII. CONCLUSION

In terms of the research questions set out in Section B [i] information management preferences and [ii] parallels between the literature survey and expert panel, two areas are identified. Firstly information management preferences highlight linkages in terms of ITM systems showing at least six correlations. Secondly the difficulties that managers are facing have been correlated between the literature survey and the research conducted with two exceptions viz.:

[1] The expert panel does not believe managers have sufficiently diffused the responsibility of technology down the hierarchies of the organization and,

[2] The research shows managers do not believe that ITM projects lack a long term plan the expert panel differs from this point of view, as they see ITM projects lacking in terms of having a long term plan.

The model represented catered for 50% of the variation. The model constructed shows various links in the ITM process; important lessons for managers are highlighted. The research has highlighted important links which may allow a better understanding of ITM systems thereby enabling better technological benefits, adoption and integration. Further research could investigate other constructs for information management preferences and usefulness some of these may include organizational learning, knowledge management, relationship management, and culture and climate etc. Furthermore [1] and [2] show additional research opportunities in terms of obtaining a better understanding of 1) How to better diffuse the responsibility of technology down the hierarchies of the organization and 2) Long term planning for ITM systems.

REFERENCES


3. APPENDICES

Table 1: Comparison of key literature survey focus points and research results

<table>
<thead>
<tr>
<th>Topics of Focus from literature survey</th>
<th>Research results</th>
<th>Expert panel</th>
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<tbody>
<tr>
<td></td>
<td>P value</td>
<td>Agree</td>
</tr>
<tr>
<td>1. Difficulties facing managers is to transform intangible benefits from technological benefits to financial benefits</td>
<td>0.175</td>
<td>N.S</td>
</tr>
<tr>
<td>2.1. Managers responsible for the technology are not responsible for the day-to-day operation of the technology.</td>
<td>0.109</td>
<td>N.S</td>
</tr>
<tr>
<td>2.2. Managers have diffused the responsibility for technology implementation down the hierarchies of the organization.</td>
<td>0.155</td>
<td>N.S</td>
</tr>
<tr>
<td>3.1. Managers are not able to understand the technological needs of the organization.</td>
<td>0.056</td>
<td>N.S</td>
</tr>
<tr>
<td>3.2. Managers are hasty in adopting newer technologies without understanding their full impact</td>
<td>0.082</td>
<td>N.S</td>
</tr>
<tr>
<td>4.1. Long drawn out technology implementations failing to identify shorter milestones often force senior executives to lose interest</td>
<td>0.292</td>
<td>N.S</td>
</tr>
<tr>
<td>4.2. IT implementations lack a long term plan</td>
<td>0.292</td>
<td>N.S</td>
</tr>
<tr>
<td>5. Managers involved in technology implementations are often aware of potential failures but are for fear of criticism do not disclose such pitfalls.</td>
<td>0.09</td>
<td>N.S</td>
</tr>
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</table>