VALUE MANAGEMENT: AN EFFECTIVE INNOVATION MANAGEMENT TOOL FOR STRATEGIC MANAGEMENT OF TECHNOLOGY IN THE SERVICES SECTOR – CASE OF A VTI

Dr Arif Sikander,
Lecturer, School of Management and Governance, Murdoch University, Murdoch, Western Australia

Abstract: *The concept of Strategic technology management (STM) places technology in a strategic context. STM did not emerge as a distinct area of managerial and academic interests until late 1980s. The key managers may initiate efforts to gain access to newer technologies, but the question is whether the approach they adopt is strategic or a series of ad hoc decisions [Quinn,1988]. Value Management (VM) has assumed an important role in providing leadership and strategic growth to technology firms. Historically VM emphasized use of alternatives to reduce cost, promote innovation and enhance the performance of products. VM has moved beyond manufacturing and can be applied for strategic decision making in the services sector. It is envisaged the VM can be an effective tool for STM. It should help in generating creative ideas on the most appropriate technologies, examination of alternatives, evaluating the alternatives and developing a strategy.*

A study conducted by the author in the East, revealed that the performance of firms is influenced by the type of strategies developed during the VM process. This result provided the motivation to explore if such strategies are relevant to the managers of the "services" sector and if their performance too is influenced by these adoptions. There is dearth of similar studies in the literature. More importantly, in this age of technology, there is a dire need for management to understand and implement ideas not perceived before. The results could contribute to the literature/management in developing a set of VM strategies which could be termed as "global" and applied to any sector and those termed as "unique" which are specific to firm/service sector. In terms of the services sector, the nearest similarity to the technology intensive firms appear to be the vocational and technical institutions (VTI). The big study sought to identify and analyse the level of awareness of participants on strategy issues and the perception of departments (including those in the Ministries) about STM (and the inherent VM). This paper attempts to present the results on that part of the study which deals with the relationship between the type of the managers/management (gender, qualification, age etc) and the application of developed strategies.

The participants included the staff and heads of departments at a technical college from an oil rich ASEAN country, the senior management at the college and the policy makers at the Department of Technical Education (DTE). The strategy and management data was desired from all the three groups. Data was collected through a questionnaire and analyzed using statistical techniques. A pilot-study helped to refine the questionnaire before it was administered. The study sets the tone to open up discussions and research interest towards applying VM tools in the strategic management of technology in the education sector in a rapidly growing digital world. The type of managers/management revealed as part of this study has implications to the senior planners in the education sector in keeping pace with the technology age by providing valuable inputs to innovate, discover, evaluate and develop strategies to provide value to the stakeholders, decision makers and technology lecturers.

Keywords: *Value, Value Management, Technology, Technology Strategy, Strategic Technology Management, Performance*

I. INTRODUCTION

Technology Strategy (TS) is defined as the pattern of decisions, which sets technological goals and means for achieving these goals in relation to the business strategy and goals of the firm (Harrison and Samson (1997, p. 9). This is the content side of the strategy. On the other hand Technology Management (TM) is about the implementation of the strategy in order to improve performance of the firm. Strategic Technology Management (STM) integrates TS and TM to improve performance of firms. Value Management is about the use of resources in a wise manner so as to achieve production efficiencies, improve the performance of products and meet expectations of the stakeholders. It involves using technologies and innovation in the process of conversion of inputs to outputs. "Applying the principles of Technology Management can change the perception of Information Technology to that of a dynamic partner by changing the dialogue from one about commoditized unit costs to one of strategic growth, investments, and market capture" (Thorp, 2009). It happens when we make the shift from a cost-based culture to a performance-based culture – the basis of VM. VM is assumed to be based on a value strategy (VS). It appears thus, that we could evolve a new concept named Strategic Value Management (SVM) which is synonymous to STM and which integrates VS and VM. Both VS and VM could then be used as tools to measure SVM in firms/service organizations. Few researchers have analysed TS and TM and focused mainly on the firm and that too in the manufacturing sector. Henceforth we will talk about VS and VM and treat these concepts similar to TS and TM since value like performance of technology firms is ultimately expressed by business outcomes like revenue growth, market share, gross margins, customer satisfaction, etc.

We need to explore and understand if these definitions are equally applicable to service organizations. There is a dire need to understand

the role value strategies play and the ways in which they are implemented in the technical education sector. Since VTIs are primarily service institutions, technology strategies must be embedded in their organization strategy. Due to rapid advances in modern technologies, VTIs, especially in developing countries, are assuming an important role. This realization has resulted in the establishment of new VTIs in both the government and private sectors and all are subject to intense competition, not only to secure more funds, but also to survive. A great contribution to the literature on value management would be to highlight the types of VM strategies being applied in the VTIs and their similarities/differences with those in the manufacturing sector. This study addresses this issue.

II. LITERATURE REVIEW

According to Thorp (2009) "the concept of value relies on the relationship between meeting the expectations of many differing stakeholders and the resources used in doing so. The aim of value management is to reconcile these differences…". Technology investments on the other hand are about enabling business change and can bring enormous returns if managed properly. Yet, without effective governance and good management, there is an equally significant risk to destroy value (www.isaca.org/valit).

The literature review focuses on the need for value management. Since the application of VM strategies (technology related) has traditionally been in the areas of business and manufacturing, it is necessary to explore and use them as a starting point for this research, which focuses mainly on the services sector.

The changing and dynamic nature of economies, place pressure on governments to be receptive to such changes and develop policies to adopt such changes. All sectors of the economy need to be developed to achieve a balanced growth. There is thus a need for institutions to remain abreast with the technological changes taking place in and around the region and adopt them to reap their maximum benefit. There are four different technology induction categories, which would enable the fulfilment of these aspirations (Omar 1992, p.38). These are:

1. Those technologies, which facilitate the achievement of goals in basic necessaries of food, housing, *education* and civic interaction.

2. Technologies which help in improving quality of life through the provision of health and medical facilities, clean and safe environment, *good education*, and improved means of transport and communication.

3. Those technologies, which enable significant improvements in standard of living through enhanced production, international competitiveness, and *employment creation* (for matching a nation's supply and demand of labour)

4. Technologies of the new age; that is, new and emerging technologies which enable a nation to move upwards into the class of technological advanced nations (industrialized or high tech nations).

It can be expected that technology induction is equally applicable to the education sector (highlighted in italics above) and provides inspiration to conduct this study. The induction of technology would require a change in the structure of occupation of the work force. This could be met by implementing changes in the vocational and technical training so that the work force in this sector could face the challenges of the technology change. According to Omar (1992), the old theories on favourable exchange rates, cheap labour, plentiful resources and government intervention would not completely be valid in the age of technological change. These theories need to be reconsidered in the light of these changes, which bring new ways of creating national wealth as well as generating some new limitations.

As discussed earlier, closely related to technology is the issue of quality (value). Godfrey and Kolesar(1988) defined quality as "how well a product or service performs its central function". This quality definition could be included in technology to provide a performance measure for SVM. It is thus apparent that technology and quality both relate to products and services. If they are applied to firms, they should equally apply to services.

According to Talonen and Hakkarainen (2008), in an education environment it would be worthwhile to explore if there exists a technology-and-competence strategy. They suggest that the following questions need to be addressed:

- What are our pacing, key and base technological competences—now and in future?

- Which technologies will be replaced and which technologies should we use?

- What are the sources of our technologies and competences (also make-or-buy)?

The answers to these questions can provide us to determine the technology choice as part of the SVM process. This argument provides an opportunity for this research. Though it appears that this argument by the authors is inclined towards the manufacturing industries, it would be worthwhile to explore if there are responses to these questions in an educational environment which could help in determining if the sector has any VM strategy in place.

III. RESEARCH QUESTION

The key research question of this study is: Do different types of managers play a different role in the selection and implementation of appropriate VM strategies (SVM) in a VTI?. The management includes: the staff in the various departments of the technical college, the heads of departments at the college and the senior administrators of the college and the department of technical education.

IV. RESEARCH METHODS

The data for this study were obtained through a survey questionnaire. The survey questionnaire was pre-tested in a pilot study to assess the clarity of its direction and the questionnaire items. The final questionnaire developed after the pilot study had three versions - one for the heads of departments, one for the instructors and one for the administrators at the college and at the department of technical education. The possibility of integrating the dimensions for these participants in the same questionnaire was considered but was dropped after conducting the interviews during the pilot study. The reason for having different versions was that corporate level issues are not presented to instructors who have normally not come across them and also policies developed at the Ministry level sometimes never reach the heads of departments.

The survey could have included all the teaching institutions, but only technical institutions were chosen because it was assumed, just as in the manufacturing sector, that technology-intensive institutions are more likely to have technology strategies and it is, therefore, easier to observe the relationships of interest. There are six vocational and technical institutions in this country. This study was restricted to the largest technical institution and to the department of technical education. Out of the 150 respondents surveyed, 10 were heads of departments, 103 were instructors and 37 were senior administrators at the college and at the Department of Technical Education.

Five types of data as used by Herman (1998) were gathered for the study: individual's profile data, departmental profile data, technology data, operative environment data and technology policy (strategy and management) data. The data were gathered on five strategy and five management dimensions. Individual profile and department data were used to check for response bias and content validity. Technology data provided the existence of technology policies in the institution and the level of knowledge about technology of the respondents.

Value Strategy (VS) Dimensions(Technology Focus)

1. Technology posture (firm's propensity to use technology proactively as a competitive weapon and a key-positioning factor).

2. Technology level (sophistication of the technology employed by the firm).

3. Product development intensity (number and rate of new product introductions).

4. Technology timing (firm's propensity to lead or follow competitors in introducing new products).

5. Manufacturing and process technology (degree to which new technology is incorporated into the firm's manufacturing plants and processes).

Value Management (VM) Dimensions (Technology Focus)

1. Technology awareness (firm's scanning processes).

2. Technology acquisition (methods by which firms acquire technology).

3. Technology and product planning (formal planning processes that firms utilize to select and manage R&D programs).

4. R and D organization and management (methods firms employ to organize, empower and motivate research and development personnel).

5. R&D investment (methods by which firms fund R&D).

Based on the suggestions of executives at the Department of Technical Education, the instructors, heads of departments and administrators at the college were given the questionnaire by the principal of the college. The executives at the Department of Technical Education received theirs through their research and development officer. There was no need for follow-up letters, as the response was very encouraging.

V. HYPOTHESIS

To investigate the various relationships between the factors of VS and VM dimensions and the demographics of the respondents the following hypothesis was proposed as part of this study.

> ***H1: Application of Value Management Strategies in an educational setting is correlated to the type of executives, heads and staff (in relation to qualification, age, etc)***

VII. DATA ANALYSIS

The results showed that the majority of the instructors, heads of departments and the executives at the Department of Technical Education were quite senior in their specialist fields. The positions held by technical teachers start with Technical Assistant (TA) and move through Assistant Technical Instructor(ATI), Technical Instructor(TI), Senior Technical Instructor(STI), Education Officer(EO), Senior Education Officer(SEO), Assistant Director and finally Director. Amongst the staff who responded to the survey, the majority of them (67%) were either senior technical instructors or technical instructors. These two positions are achieved after at least five years service for locals and at least ten years for expatriates. The position of senior technical instructor in the case of expatriates is assigned to teachers having a Bachelor's Degree and around 15 years of experience. Of the nine heads of departments who participated in this study, six (67%) were senior technical instructors and the remaining three were education officers. At the Department of Technical Education, eight out of 25 (32%) were senior education officers and six out of 25 (24%) were education officers. This figures indicated a high senior level of experience.

Relationships between Background Variables and Extracted Factors

The four VM technology related extracted factors included 'R&D emphasis', 'technology awareness', 'market and technology planning' and 'foreign technology acquisition' The three VM extracted factors included 'R&D emphasis', 'market and technology planning' and 'foreign technology acquisition'.

This section includes the analyses of relationships between the 'extracted factors' and background variables. There were a total of 32 items, 16 each for exploring the dimensions of value strategy and value management. Factor analysis revealed four factors each for VM and VS but in each case there was one significantly dominant factor. The dominant factor amongst the four VM factors was 'R&D Emphasis' having an eigen value of 6.49 whereas 'Program Production and Timing Emphasis' was the dominant factor amongst the TS factors having an eigen value of 7.29. The relationship between the background variables of gender, local/expatriate, qualification, industry experience, years last professional course completed, teaching experience, understanding of technology, understanding of quality and the department in which employed and each of the eight extracted factors is discussed in the following sections.

A one-way analysis of variance (ANOVA) was performed with each of the VS and VM factors as the dependent variables and the background variables as the independent variables. Since F-scores are uncorrelated because varimax rotation was employed, it is appropriate to use univariate analysis of variance. Significance between the factors and background variables was tested at p-values of 0.01 and 0.05. Homogeneity of Variance was tested using Levene's statistics at 0.05 test level. Taking the mean of relevant variables, which loaded heavily on the factor, developed the VM extracted factors. These extracted factors, which comprised the mean values, were treated as continuous variables.

The results show that there are three significant relationships between the background variable of department of the respondent with each of the two VS technology related factors namely: VS factor 1(Program production and timing emphasis) and VS factor 3(Program development intensity emphasis) at 0.05 level of significance. Levene's test for homogeneity of variances was not significant for each ANOVA analysis of these factors and the background variable, hence post-hoc analysis using Tukey HSD test was employed

to locate the sources of the differences. There were many significant mean differences at the 0.05 level. For factor1, building, design and construction department had the highest group mean indicating that this department valued production of new, low cost and flexible programs at the right time The mean differences between the various departments on VS factor3 were not very significant, however, language and communication department scored the highest group mean. It indicates that language department was inclined towards increasing the types of programs and improving them continuously. The significant relationships are summarized in Table 1 below:

Table 1:
ANOVA for VS Extracted Factors(significant relationships)

Y	X	F value	Significance
VS Factor-1	Qualifications	3.215	0.010
VS Factor-1	Department	2.352	0.017
VS Factor-3	Department	2.149	0.029
VS Factor-4	Quality	2.429	0.025

The results show that there are three significant relationships between the background variable of department of the respondent with each of the three VM technology related factors namely: VM factor1 (R&D emphasis), VM factor3 (Market and technology planning) and VM Factor 4(Foreign technology acquisition emphasis) at 0.01 level of significance. Levene's test for homogeneity of variances was not significant for each ANOVA analysis of these factors and the background variable, hence post-hoc analysis using Tukey HSD test was employed to locate the sources of the differences. There were many significant mean differences at the 0.05 level, however, in all the three cases, the building, design and construction department had the highest group mean indicating that this department valued R&D, market and technology planning and foreign technology acquisition. Emphasis on three of the four VM factors, indicated the inclination of this department towards value management. The significant relationships are summarized in Table 2 below:

Table 2:
ANOVA for VM Extracted Factors(Significant relationships)

Y	X	F value	Significance
VM Factor-4	Local/expatriate	6.33	0.01
VM Factor-1	Department	2.59	0.009
VM Factor-3	Department	3.29	0.001
VM Factor-4	Department	2.77	0.006
VM Factor-4	Technology definition	2.52	0.02

The background variables were analysed after the data was entered in SPSS. Factor analysis was used to transform the variables into a new set of linear combinations called the principal components.

The extraction using PCA for the technology strategy variables revealed that three components accounted for 71.3% of the total variance. The factors were named as: *technology positioning*, *technology leadership* and *up-to-date plants and processes*. The extraction using PCA for the VM variables revealed that four components accounted for 83.2% of the total variance. The factors were named as: s*trategic R&D*, *technology consciousness*, *formal planning* and *external technology acquisition*

Correlation analysis revealed the association of SRG with *strategic R&D*, *technology positioning*, capital investment and number of employees, and between capital investment and number of employees.

VIII. LIMITATIONS OF THE STUDY

To keep this study manageable, the effects of technology policies on performance were not explored. In determining the various factors affecting the management of technology, some exogenous variables like culture, financial structure and nature of courses offered were omitted. The study was also limited to one technical institution, albeit the biggest one, in terms of the courses offered and the number of staff employed. The study also used the items from prior research, which were evolved for manufacturing firms in a different cultural and technological environment.

REFERENCES

Chester, T. M. 2006. "A roadmap for IT leadership and the next ten years". *EDUCAUSE Quarterly,* 29(2): 56-60.

Clarke, K., Ford, D., Saren, M. (1989). Company technology strategy. *R&D and Management, 19,* 215-229.

Claver, E., J. Llopis., G. Garcia, and H.Molina. 1998. "Organizational culture for innovation and new technological behaviour". *Journal of High Technology Management Research, 9(1) :* 55-58.

Dussage P., S. Hart, and B.R. Amanantsoa . 1992. *Strategic Technology Management.* John Wiley & Sons

Friar F., and M. Horwitch. 1985. "The Emergence of Technology Strategy". *Technology in Society,7:* 144.

Fredrick, B. 1993. *Strategic Technology Management*. New York: Mc Graw Hill.

Gillespie, D.F., and D.S. Mileti. 1977. "Technology and the study of organizations: an overview and approach". *Academy of Management Review, 4(1):* 7-16.

Godfrey, A.B., and P.J. Kolesar. 1988. *Role of Quality in achieving world class competitiveness.* Global Competencies, New York.

Grant, R.M. 1995. *Contemporary Strategy Analysis: concepts, techniques, applications.* Blackwell: Massachusetts-Cambridge.

Herman, S. 1998. "Technology Strategies in the US Electronics industry". *Dissertation Abstract International,* (UMI No. 9834862). Doctoral Dissertation, Portland State University, 1998.

Harrison, N.J., Samson, D.A. (1997). *International best practice in the adoption and management of new technology (*p.9). Department of Industry, Science and Tourism, Canberra, Australia.

Hugos, M., and J. Stenzel, 2007. "Managing for returns on IT investments." In J. Stenzel (Ed.), CIO best practices: Enabling strategic value with information technology (p. 321). Hoboken, New Jersey: John Wiley & Sons, Inc.

Kashiwaga, K. 1999. "Implementing TQM in Educational Institutions". *Proceedings of SEAMEO VOCTECH, Feb 99:* 1-8.

Omar, A.R. 1992. "Achieving the industrial targets of Vision-2020". *The Science and Technology Perspective,* Prime Minister Department, Malaysia, 38-44.

Pfeffer, J., and R.I. Sutton. 2006. "Evidence-based management". *Harvard Business Review*, 84(1): 62-74.

Probert, D.R., S.W. Jones, and M.J. Gregory. 1993. "The make or buy decision in the context of manufacturing strategy development". *Proceedings Institute of Mechanical Engineers, 207(B4):* 241-250.

Randolph, W. 1981. "Matching technology and the design of organizational units". *California Management Review, Summer*.

Sahlman, K., and H. Haaspasalo. 2009. "Elements of strategic management of technology: a conceptual framework of enterprise practice". *International Journal of Management and Enterprise Development,* 7(3)" 319-330.

Strassman, W.P. 1926. "The manufacturing experience of Mexico and Puerto Rico". *Technological Change and Economic Development.*

Thorp, J. 2009. "The information paradox: Realizing the Business Benefits of Information Technology". McGraw-Hill Ryerson.

Talonen, T., and K. Hakkarainen. 2008. "Strategies for driving R&D and technology development". *Research Technology Management.*

Val IT Framework for Business Technology Management. (www.isaca.org/valit) retrieved on 21Feb2015.

Economic restructuring, technology transfer and human resource development. Toronto: Sage Publications.

Virmani, B.R., and K. Rao. 1999. *Economic restructuring, technology transfer and human resource development.* Toronto: Sage Publications.

Weiss, M. 2010. "An Evidence-Based Approach to Improving Chief Information Officer Performance". *Ph D dissertation* University of North Carolina at Chapel Hill School of Information and Library Science. Chapel Hill.