Technology Management School: Evolution and Imperative

Aminu Ahmad, Ph.D
Management & Information Technology Programme,
School of Management Technology
Abubakar Tafawa Balewa University
PMB 0248 Bauchi, Nigeria

Abstract

There is rarely a coherent attempt to synchronize contemporary management literature to a solid theoretical base-school of thought, despite the inability of conventional management approach to effectively address organizational needs in many industries. Historically management techniques evolved through a number of approaches and stabilize in conventional school for some time. However, the rapidly changing technology-driven marketplace meant even the sophisticated conventional design falls short of engendering corporate excellence in many markets. Consequently, Digital Equipment and PZ Nigeria records outright collapse and serious erosion of market share in spite of exceptional conventional management design. Hence, the paper traced the height and limitations of conventional management. In addition to historical perspective, a number of overlapping factors meant that technology management is inescapable to managers. These factors collectively underscore the pervasive nature of technology and the need for its formal management. The paper recommends neither theoretical novelty nor conventional wisdom should substitute situational analysis in the choice of relevant management approach.

Keywords: Conventional Management, Innovation, Management Thought Technology Management

1. Introduction

Management approaches and theories continue to evolve in order to deal with the changing environment. However, never before is the corporate world struggling to keep abreast with unprecedented change largely propel by exponential rate of technology innovation. The scenario leads to an increase in governmental, organizational, and societal reliance on different kind of technologies and consequently increased in the number and variety of technology vendors. Thus, making technology an indispensable resource input and increasingly a complicated output that require unique marketing. Traditionally, to excel (in some cases even survive) in the increasingly tumultuous environment requires the delicate application of pertinent management techniques. While management theories and techniques were never in short supply throughout modern history, however, given the rapidly declining life cycle of successful business strategies management problem is not only about what and where but also when and how (Hamel & Skarzynski, 2001). The hunger for management solutions is accentuated by the fact that management is no longer the exclusive concern of profit making organizations, as the evolving environment necessitates supranational, government, NGOs, associations and unions to apply specialise management techniques in order to outrival competitors and/or minimise cost. Management theories and techniques naturally become hot cakes, especially since management thoughts internalise in addition to formal studies, specialists' inference and experience.

There is rarely a coherent attempt towards harmonizing the contemporary management literatures into a solid theoretical base, or put clearly school of thought. Regardless of vast practical and theoretical evidence that reveals the inadequacies of the conventional management approach in achieving corporate success in many markets and industries. As most attempts are individualistic, disjointed and incoherent, despite a sort of consensus that challenges (or at least modify) the very fabric of the conventional management thought. As a result, many management scholars and practitioners still use the conventional management techniques as the pinnacle of management design. Little wonder with rather less than satisfactory result, outright market share erosion, failures and bankruptcies (Bolisani & Gottardi, 2005; Garba, 1997; Hinton & Barnes, 2005). The paper therefore aim to examine the motivation for technology management school; emphasize the obsolescence of the conventional management thought in many markets; highlight the imperative of the technology management; and finally offer guidelines in selecting the right management technique. The next part of the paper briefly summarise the evolution and demise of conventional management thought. The paper concludes with a caution regarding the selection pertinent management approach.

2. The Evolution of Technology Management School

2.1 The Height of Conventional Management School

Conventional Management become prominent when it became clear that internal strategies, however well design cannot guarantee organizational success in isolation. Yet, previous management thoughts (Scientific and Behavioural Schools) had no elaborate solution in dealing with external environmental factors. Similarly, employee needs are neither identical nor stagnant, yet generalization of employee needs is a critical feature of the previous management thoughts. Because of these inadequacies, an alternative management approach emerged, with the conviction that success is a function of both internal efficiency and external alignment. Although conventional management have different branches (e.g. contingency, quantitative and system among others) however the school's cardinal philosophy boils down to the fact that external strategies are as significance as internal strategies. Hence the major technique for superior performance is reacting to the ever changing external environment quicker largely via engaging consultants, exploitation of mathematical tools and implementation of incrementalism.

Impacts of culture, demographic factors, industry life cycle, market structure and interest rates among others become really virulent. Toward these credence strategies and models such as competitive strategy, strength weakness opportunity threat (SWOT), environmental threat opportunity profile (ETOP) and many others emerged. It becomes evident that the processes of strategic management take place in a complex environment of business, economic, technological, social, and political influences. Understanding this external environment, or background, is crucial to strategic decision-makers, and has to be taken into account alongside any assessment of an organization's internal environment (Mintzberg, 1995).

Benchmarking and outsourcing becomes prominent part of organizational strategy given the increasing utilization of external information, skills and competence for corporate governance. Information & Communication Technology (ICT) revolution allows organizations/consultants ample opportunity to acquire, manipulate, use, transfer and store vital information. Powerful and complex database management systems enable consultants and other information brokerage firms to mobilise, analyse and sells as much information as possible about virtually all the key external factors as well as best practice firms. Incisive analyses of successful firms by business magazines alongside employee mobility add more impetus to cross fertilization of knowledge (Hamel, 2001). Information availability and processing ceases to be a problem, not any more.

A number of mathematical tools (such as graphs, matrix, models, maps, case studies and formulae) are put to use to analyse, interpret, communicate, solve, exploit, decides management problems. Some of the notable tools are the BCG matrix, competitive strategy matrix, the experience curve, pert and network analyses. These tools provide managers with unprecedented opportunity in dealing with the increasing complex organizations internal and even more complicated external environment. All these provide an enabling environment for incrementalism, perhaps the single most important strategy of conventional management. By definition incrementalism is a strategy that focuses on continuous improvement of the industry's conventional success factors. It entails continuous upgrading of products key parameters, reducing cost, increasing margin, reacting to external forces faster and better among others.

2.2 Transition to Technology Management School

Conventional Management is by no means the most widely known management thought today in text and practice. However despite its branches and tools, conventional management like prior management approaches is beginning to outlive its usefulness in many industries. Mainly due to the absence of techniques that can effectively manage the unprecedented rate of change amplified by unmatched technology explosion. For example, it was observed that although nineteenth century recorded serious progress in technology but, the exponential growth of technology in the first two decades of the twentieth century matched that of the entire nineteenth century (Kurzweil, 1998). Digitally, the revolution started with radical improvement of microprocessor technology on computing and communications; followed by digital networks for enterprise data communication; internet, wireless and mobile explosion; and biotechnology (Burgelman, Christensen and Wheelwright, 2004). Development in technology is not only affecting organizations, it is changing everything and quite frankly everyone. It become glaring that the pervasive influence of technology on organizational and industrial performance can no longer be ignored or left to trial and error (Porter, 1985; Skinner, 1985).

On the other hand the continuous sweeping advancement in ICT and their convergence pushes the usage of models and other mathematical tools to new heights. However seemingly a good development, it comes with some implicit weakness. First, over reliance on models and analytical tools led to ex-communicating stakeholders with little or no analytical mind. The tools are also put to use even in circumstances where verbal communication would perform better. Likewise, many employees are not trained in using these increasingly complex techniques, just as many management decisions are rarely routine and predictable to be expressed in mathematical symbols and formulas (Bateman & Snell, 2007). Yet part of organizational knowledge is subconscious, difficult to articulate, and usually shared through highly interactive conversation, story-telling and shared experience (Zack, 1999).

There is also another dilemma, most tools are either too simple, easily comprehended and understood but unable to explain the whole intricacies-experience curve is a classical example. Or too elaborate and complex that might have taken into consideration the complex changing and multifaceted nature of organizations, in which case as a mathematical tool they are brilliant, however as a communications tool for the non-mathematician, they are practically impossible to understand and assimilate by vast majority (Dennings, 2001).

These models and formulae are even use to calculate values and predict future financial figures with amazing 'accuracy,' perhaps no other field than finance and marketing are more guilty of this mathematical fantasy. Formulae abound for virtually all fields of financial analysis from NPV to portfolio theory to assessing the marketability of stocks. In most cases there are multiple, complex and varying elements, and a change in one variable may have far reaching consequences. Little wonder Heller (2004) call long range forecast 'pure fictions'. Similarly, Hamel and Skarzynski (2001 p. 9) observed 'most forecasts are worthless exercises in spreadsheet manipulation….and not just because small adjustments in key variables create wildly different projections over time. The larger problem is that traditional forecasting projects past assumptions forward, providing a sense of false comfort to established companies wedded to existing business models'. All too soon it seems we ignore that intentional and non-intentional errors, distortion and mistakes are inevitable part of mathematical models (Huff, 1954; Jones, 2000; Monmonier, 1991). It becomes quite easy to mislead with well design models, formulae and maps.

However, by far over reliance on incrementalism is the major culprit of the conventional approach. Despite great incentives in availability of sophisticated technologies and cross-fertilization of ideas, incrementalism has reached a point of diminishing returns in many markets. For example, blind implementation of incrementalism makes organizations vulnerable to disruptive innovations, a situation where continuous improvements driven by availability of technology, funds or demanding clients lead to the offering of products beyond the needs, sophistication, or financial ability of the majority of the market (Christensen, 1997). A scenario that creates an opportunity for new and less affluent firms to capture the dominant market, it's no longer secret that great organizations have substantially suffer this way. Similarly, relying on incrementalism in an industry where other firms are reinventing the industry is also suicidal. By definition reinventing the market refers to a truly novel way of doing things, a strategy that challenges rather than confirm to industrial traditional success criteria (Hamel, 1996). Incrementalism also losses its competitive strength when many organizations implement it. It leads to quagmire, price war, low margin and monotonous effort.

This is more so because most organizations possess the same information, leading to a kind of *one tablet treats all ailments* syndrome-the free flow of information hitherto one of the greatest strength of the conventional management approach is dangerously becoming its greatest undoing. Under this circumstance incrementalism becomes a necessary evil, because it does not guarantee a favourable competitive position, however failure to implement it, guarantee an unfavourable competitive position. Yet organizations are searching for antidote for excellence not survival. Incrementalism can also push firms to unfavourable markets where their competencies are worthless. Take the example of a medium size printing firm in northern Nigeria that relied on a temporary competence to improve the quality of their products by radically upgrading its technology inputs. Only to find at the expiry of its competence that it can no longer compete favourably in the new market due to the existence of larger and more technologically advance firms, while its improved output is too sophisticated and expensive to its former niche market. Are segments of films coming from developing countries especially *Bollywood* and *Nollywood* moving towards this path of self destruction? Progressively improving their output towards *Hollywood*!

Additionally, technology has become a key strategic element (Porter, 1985) and hence the need for new management approaches to synchronise technology with business strategy (Mitchell, 1988). However, technology management is rarely given a coherent attention in conventional management (Ahmad & Ahmad, 2006). Likewise, the society is increasingly becoming environmentally and health sensitive. Despite an obvious changing environment, however there seems to be more proliferation of buzzwords instead of new ways of tackling the evolving environment (Mintzberg, 1999). Similarly, while the core cardinal principle of the conventional management is reacting to the environment, it became clear that in many markets reacting to the pace of change is not only difficult, risky and less rewarding but simply impossible. Practically, it appears 'inventing' and creating the environment may be easier and offer better results than responding to what is increasingly intricate and impractical. The phenomenal success of minivan, Walkman, and CNN were as a result of creating rather than responding to the market (Hamel & Skarzynski, 2001). Organizations must therefore focus on innovation and creativity in addition to the traditional incremental subsets of costs, products, speed, and efficiency (Prahalad & Ramaswamy, 2004).

3. The Birth of Technology Management School

Companies such as Digital Equipment and PZ Nigeria records outright collapse and serious erosion of market share respectively, despite the implementation of exceptional conventional design (Christensen, 1997; Garba, 1997). These realities clearly demand a different management approach. The decreasing importance of experience becomes apparent, since experience is only relevant where the future will be similar to the past. Conversely, where the future is different from the past, experience becomes irrelevant and even dangerous (Hamel, 1996). Yet experience curve is a major thrust of conventional school, with multiple and varying categories of business organizations and unparallel rate of change, even highly sophisticated theories such as circumstance-based theory may offer very little in matching past experience with evolving environment (Christensen & Raynor, 2003). Additionally, the business landscape is so complex and impractical for a single entity to offer end-to-end solution making collaboration as important as competition (Paavilainen, 2002; Porter, 1987). However, conventional approach over-emphasizes competition at the expense of collaboration. At the risk of over simplification the cornerstone of technology management school revolves around technology management, innovation and societal strategy. Where a change in a dimension of technology can radically alter corporate performance; decrementalism, in addition to incrementalism is required to manage the pace of change; and effective societal strategy is a key strategic issue no longer a mere social responsibility.

Technology has become a resource of paramount importance to many organizations which require integration into firm's strategy (Burgelman, Christensen & Wheelwright, 2004). Although technology is increasingly becoming a major driver of business change but organizations cannot readily exploit the advantages provided by technological innovations unless they are combined with some sort of organizational restructuring (Khalil, 2000; Pateli & Giaglis, 2003). Similarly, even though innovation is not new in management literature, however, most firms have a very narrow idea of innovation brought from outside and targeting optimization instead of imagination (Shapiro, 2002; Hamel, 2001 & 2003). Along this line Christensen (2001), developed a useful framework that allows organizations to determine whether they can exploit innovation with current capabilities or otherwise. Consequently to institutionalize innovation, organizations should respect in addition to political authority, intellectual and moral authorities as well as the power of three constituents, often under-represented; new comers, young employees, and staff domiciled outside corporate headquarters (Hamel, 1996 & 2001). Correspondingly Mintzberg (1996) argued that organizations need to recognize and leverage two types of innovators within the organization, the rare genre that 'sees the world we don't' and humane managers that can get extra-ordinary performance from ordinary employees. Innovations simply become a prerequisite for excellence in many market.

Another area that merits a different orientation is organizations relation with the environment. Dealing legally, ethically and morally with organizational stakeholders should be a natural way of managing a firm in the new environment (Roddick, 2000). Corporate change of focus from serving shareholders to stakeholders is a necessary success requirement (Kotler, 2003) hence most organizations include social responsibility report alongside annual financial report (Idowu & Towler, 2004). Although there is inconclusive evidence on the relationship between societal responsiveness and financial performance (Griffin & Mahon, 1997), but the contrasting predicaments and fortunes of *Shell Nigeria* and *Enron* on one hand and that of *Body Shop International* respectively are clear examples of what the future holds.

4. The Imperative Technology Management School

In addition to historical perspective, a number of overlapping factors meant that technology management is inescapable to managers. These factors collectively underscored the pervasive nature of technology and the need for its formal management in the new environment. The factors include the operational scope of technology management, its innovative and competitive potentials. Others are technology's omnipresence and ambivalent impacts. The factors are summarizes as follows;

The wide operational scope of technology management follows that managers have to constantly take decisions relating to its management. Traditionally there are two broad technology continuums base on range and depth i.e. the technology-resource vs. technology-product continuum (Ahmad & Ahmad, 2006) and the macro vs. micro continuum (Khalil, 2000). Zayglidoupolous (1999) described technology resource as the codifiable and non-codifiable information and knowledge that is embedded partly in the manuals and standard practices, partly in the machinery and equipment, and partly in the people and social organization of a particular organization. Two important conclusions from the definition are; technology resource has three (3) elements: machines (tools, structures, and equipment), manpower (skills, expertise, knowledge etc) and method (relationship within and between men and machines) and all organizations (profit, non-profit, government) require technology resource to operate. Technology products are reusable products whose consumption does not lead to their exhaustion (Ahmad & Ahmad, 2006). Technology product has two elements, tangible (TV, laptop, car) and intangible (software, GSM service, satellite signals) similarly, not all organizations produce technology product, i.e. while all firms require technology inputs (resource), only some offer technology products (output). While the later continuum will be look into later, suffice it to say that managing technology is imperative to virtually all categories of managers.

There is far reaching consensus that innovation is a key requirement for corporate success, hence one of the cardinal of technology management approach. Yet innovation itself relies on technology. Accordingly, Hamel (2001) placed evolving technology (new, incremental, convergent and disruptive technologies) among the three drivers of successful innovation. He observed that Ted Turner wed two technological developments-the shoulder-held minicam and more affordable access to satellite transmission to innovate the concept of a continuous news format. Tele-surgery becomes realty after the existence of fiber-optic cable, high-speed internet and robotic technology. Similarly, e-business, e-banking, virtual banking and m-commerce innovations are only possible with developments and improvements in a number of technologies. The two other drivers of innovation according to Hamel (2001)-changing market characteristic and engendering the right climate are equally influence by technology. Internet, extranet, intranet, video conferencing and multidimensional database are very central to how organizations source and share vital information-making idea management more effective. It therefore becomes imperative for managers to monitor evolving technologies for (internal and external) innovation potential. Anthes and Mitchell (2003) observed that monitoring of disappearing technologies, is essential task for technology firms' in order to avoid last minute expensive changes.

Technology affects competitiveness on two important but intricately link fronts, macro and micro levels. On the macro level for example it was observed that collective technology product improvement strategy of a country significantly affects the performance of the economy (Christensen, Craig, and Hart, 2001). Additionally, positive correlation between economic growth and telecommunications penetration was established since 1960's through the economic theory of Gipps Curve (Nxele & Arun, 2005). Muller (2003) argued that the British radar (national technology) completely change the outcome of Second World War. He therefore concludes that the development of technology base is crucial to national economic performance. At micro level for example it is argued that internet accentuated industrial competition (Porter, 2001). Similarly, Porter (1985) underscores this point by pointing out that technology not only affects firms' competitive position but also the overall industry structure. Technology management becomes even more important given its unique competitive potential.

Corporate change of focus from serving shareholders to stakeholders is reality of corporate governance in the new economy (Kotler, 2003). Technology is increasingly changing the stakeholders' landscape, for example the continuous accessibility of internet, satellite and mobile technologies to customers have completely altered their sophistication. In a nutshell, technologies enabled customers to be well informed, active, connected with one another and have a global view like never before (Prahalad & Ramaswamy 2004).

On the other hand, the continuous infiltration of computer, communication and surveillance technologies in the workplace is bringing in a whole range of new workplace challenges such as employee privacy issues (Alder, Schminke, Noel & Kuenzi, 2008; Smith & Faley, 2001; Stanton and Stam, 2003). Invasion of privacy become quite easy, profitable, and effective with technology (Turban, Leidner, Mclean, & Wetherbe, 2008). In fact technologies have ruined many firms via automating inefficient operations (Domingo, 2000). E-waste and e-crimes are constant reminders that technology's impacts are not only positive.

5. Conclusion and Implication

The emergence of Technology School does not render all the conclusions of conventional school null and avoid. On the contrary it reveals the existence of markets where conventional management approaches are worthless. Just as the evolution of Conventional School does not led to the extinction of all the techniques of classical and behavioural school, besides conventional like Technology school is also a situational approach. In the same way strategic management becomes even more important with new orientation and additional alternatives especially in the areas of technology management, innovation, collaboration and societal responsiveness. It is imperative to emphasize that situational analysis not theoretical novelty or conventional industry wisdom should be the guide for choosing the right management technique. Toward this end Christensen and Raynor (2003) offers invaluable guide on using management theories:

- Beware of theories that imply that their findings are applicable to all companies in all situations. There is the need to define where, when and why things must change but also what should remain the same. Most new theories don't completely overturn established thinking. Rather, they bring new insight into how to think and act in circumstance-contingent ways.
- All conclusions are modifiable; hence the discovery of circumstances where the theory did not accurately predict an outcome is a triumph, not failure. Management theory advances by explaining why previous theories failed to work in certain situations.

As the business world continues to witness unprecedented change, there is the need for organization to relax their clutch with conventional ways of attaining success, and explore new methods. Hence organization should aspire to create, not only respond to their environment. Strategic management of innovation, technology and environment offers great prospects in many markets today.

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