The Impact of Technology in Organizations: An Empirical Review

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ABSTRACT: ***Despite its proven capability as a competitive driver and strategic enabler, companies today are becoming increasingly reluctant to deploy new technology. The hype that has permeated the IT industry for so many years has left many with a pessimistic view of whether technology has ever delivered its promise. The current economic downturn also means many organisations feel they simply can't fund innovation. But few feel comfortable in this state of inertia, knowing that investment in new technology is a major component to creating competitive advantage. Companies can't get a crystal ball, and even if they could it wouldn't be enough. Knowing what revolutionary technology is around the corner is only part of the puzzle – establishing whether it will be right for your business; making it run in parallel with a winning competitive strategy, and financing its deployment, is where the magic lies.***
This paper tends to discuss the impact technology has on organisations, vis-a-vis, cost of business, customer satisfaction, quality, risk management, human resource, functions of management and lead time.

KEYWORDS: Technology, Lead Time, Quality, Customer Satisfaction, Risk Management, Organisations.

I. INTRODUCTION

Technology is the practical application of science to commerce or industry; "the study of or a collection of techniques; a particular technological concept; the body of tools and other implements produced by a given society" [28]. Technology is here and will continue to progress. To understand the role technology plays in today's organisaitons, we first have to understand business technology. According to [26]: "Business technology refers to the integration of computer and communications technologies in support of administrative applications and procedures within an organization. Business technology is constantly evolving. Business technology is required for a successful business".

Back in the early days, the use of technology within an organisation was the preserve of technically-skilled professionals, relegated to the basement and struggling to validate their contribution to the companies' bottom line. But that has all changed. With decades of technology innovation, we can now see that the use of technology is much more pervasive across all parts of the business and the dependency on technology to perform has increased. The advent of e-business has shown that technology should now be a constant consideration on the boardroom table. This is highlighted through the fact that 60 percent of technology investment is now influenced, controlled and determined not by the central IT function but by business executives, and it is true to say the fortunes of modern companies now rise and fall on their wise, or flawed, technology choices.

Why has this shift occurred? With technology's penetration into every business function, executives have seen first hand how it gives them access to well-organised, quality information they can use to make better decisions, and how it now fundamentally supports the day-to-day running of their business. Not surprisingly, they now appreciate that the right choice of technology, coupled with its timely deployment, not only holds the power to solve business problems but improve a company's competitive position. Visionaries such as retail giant Wal-Mart and shipment

pioneer FedEx have used technology not only to solve logistical problems, but to seize new opportunities, open new channels to market and create new business models they have forced their competitors to adopt. Wal-Mart looked to technology to improve supply chain management and steal a competitive edge. FedEx looked to the opportunities technology offered to manage the extent of its growth without finding a way to automate business processes.

At the time, its Super Tracker application cost a massive $100 million to develop but the investment has paid off many times over. As well as immediately reducing the number of additional dispatchers the company had to hire, the Super Tracker formed the basis of the now famed FedEx application that enables customers to track their packages online. What is interesting about these examples is that these companies bet their investment on entirely new technology. Neither were these innovations undertaken in overly cash rich times even in a buoyant economy, FedEx's $100 million project represented a bold investment. Today, however, few companies are prepared to embark on such ambitious initiatives. There are many reasons for this. One is the economic climate. When times are hard it is understandable for companies to focus on cutting costs to ensure short-term survival. Another reason is the fear of the risk involved in deploying new and innovative technology.

II. THE INDUSTRIAL REVOLUTION

When looking at the impact of technology upon organisations, it is possible to look as far back as the industrial revolution for useful lessons to be learned. The birth of industry and the introduction of machine technology into the workplace meant that working people found increased opportunities for employment in the new mills and factories. The consequences for the workforce were strict working conditions with long hours of labour dominated by a pace set by machines. The impact of technology on organisations was a complete restructuring of the labour force and a massive increase in productivity and output. A further consequence of the new technology of the Industrial Revolution was that concentrated labour in mills, factories and mines facilitated the organisation of trade unions, which advanced the interests of working people. An adjacent organisational impact was a significant increase in worker wages during the period 1813-1913.
This study does not focus as far back in history as the industrial revolution, but it is clear that the development of technology has a long history of impacting upon the organisation. Instead 'new technology', [1] put it: 'usually refers to a particular set of changes that have occurred from the 1970's onwards… brought on by the development of microchips.' This investigation focuses on the changes and impacts that technologies have had upon organisations during recent decades.

III. THEORIES OF TECHNOLOGY IN ORGANISATIONS:

A. OPTIMISTS AND PESSIMISTS

The question of how technology impacts humans and organisations has been the subject of considerable debate over the years and it is a subject that Eason tackled in an article written for the journal 'Behaviour and Information Technology'. On the one hand, Eason states, there are optimists such as Englebart [16] who foresee exciting forms of 'man computer symbiosis' in which the power of the computer will augment human capacities to process information.

In the organisational setting this was seen as empowering people and increasing job satisfaction as computers were used to enable people to realize much more of their potential. By contrast, pessimistic authors in the 1970s predicted 'the collapse of work', a nightmare world in which computers would be used to automate work and replace human labour, throwing large numbers of secretaries, clerks and even managers and professionals out of work. For those who remained at work the

'centralization of power' or 'big brother' hypothesis applied [24], the computer would be used to monitor and control the work of all employees leading to widespread dissatisfaction and alienation. One of the major concerns has been the impact of technology upon jobs, and, since the 1980s there have been two prominent views as follows:

- ***Technical System as Control*** - Technology is seen as deskilling, taking work from people and reducing the remainder to tedious and repetitive work.

- ***Technical System as Tool*** - This view sees technology as enriching, whereby the routine and boring jobs are allocated to computers, which also provide tools to allow people to be creative and handle information in diverse and powerful ways.

One of the most influential technology led models, the 'technological imperative' model examines the impact of technology upon organisational dimensions such as structure, size, performance, degree of centralization as well as dimensions such as job satisfaction, task complexity, skill levels and productivity. This model states that technology exerts an independent, uni-directional and causal influence over humans and organisations similar in nature to the laws of physical sciences. Some technology led theories argue that society itself is entirely determined by technology: 'new technologies transform society at every level, including institutions, social interaction and individuals.

Technological determinism is a school of thought believing that technology is the single most important factor in determining the success of an organisation'. This approach has also been known, in economics and elsewhere, as 'technology push'. It asserts that investing in the latest technology is the only way for an organisation to survive and notions such as 'automate or liquidate' and the fear of being 'left behind' are examples of this approach. In this body of work, studies of technology and information technology examine the impacts of technology on organisational dimensions such as the functions of management, product/service quality, risk management, customer satisfaction, just to mention but a few.

Technological determinism stands in opposition to the theory of the social construction of technology, which suggests that both the path of innovation and the consequences of technology for humans are strongly if not entirely shaped by society itself, through the influence of culture, politics, economic arrangements, and the like. Technological determinism has been largely discredited within academia, especially by science and technology studies. However, it remains the dominant view within most news media and popular culture.

In contrast to technological determinism, there is a school of thought which argues that technology does not determine human action, but rather, human action shapes technology. This perspective suggests that technology is not an external object, but a product of ongoing human action, design, and appropriation. Research focuses on how a particular technology is physically constructed through the social interactions and political choices of human actors. Technology is seen as a dependent variable, contingent on other forces in the organisation, most notably powerful human actors. This perspective does not accept that technology is given or immutable, focusing attention instead on the manner in which technology is influenced by the context and strategies of technology decision makers and users.

Particularly relevant to the strategic choice approach are socio-technical studies, which are carried out in the belief that outcomes such as job satisfaction and productivity of workers can be manipulated by jointly 'optimizing' the social and technical factors of jobs. A similar premise runs through the socio-technical research in information technology. While usefully

demonstrating how the meaning of technologies arise and are sustained, this body of research tends to downplay the material and structural aspects of interaction with technology.

Eason [15] found that technology is very flexible and does not have deterministic effects on organisations. The technology is best regarded as a contributory or facilitating factor in the organisational outcomes that have been found. Three other sets of factors also contribute:

1. *Types of technology and application*. The use of different types of technology may make a difference. Mainframe and dumb terminals might lead to centralised control whilst the use of networked personal computers might lead to decentralization. Management control applications should lead to tighter control whereas computer aided design, decision support systems, etc . . . should 'augment human intellect'. . .

2. *The goals of the user organisation*. A major determinant of impact is the set of goals to which the user organisation aspires when it invests in the technology. If the intention is to use the technology to replace jobs, that may be the outcome. If the intention is to create a monitoring system to control employee behaviour, the same technology might lead to this outcome. As the early socio-technical systems theorists put it, there is 'organisational choice'; the same technology can be used to produce different organisational outcomes.

3. *The response of the user community*. Even the intentions of those investing in the technology are, however, not sufficient to predict the outcomes. Many outcomes are unplanned and unintentional. High failure rates and low utilisation levels are certainly not planned and most staff reduction levels are not actually achieved. The new technical system has to engage with the complex world of tasks, procedures and culture within the organisation; it has to be part of a working socio-technical system

IV. REASONS FOR THE INTRODUCTION OF TECHNOLOGY

There are a number of reasons why organisations decide to introduce new technology. Some of the reasons identified in the literature are:

• To reduce costs;
• To increase productivity;
• To increase quality;
• To reduce dependence on skilled labour;
• Because it always seems a good idea to be up to date;
• Because competitor organisations are also introducing new technology;
• Because new technology is interesting;
• In order to change the relations between various groups in the organisation.

Clearly, those responsible for justifying new technology expenditure may not admit to some of these, but nonetheless, these reasons have been identified in research. Another reason that is often given for continued investment in new technology is the exponential decline in both the price and performance of computers and technology.

In recent years, the development of the internet and the shift towards globalization of economies and industries has served to further drive the organisational investment in technology. Ives & Jarvenpaa [21] found that the Information Systems (IS) related literature often recommends global organisations to utilise IT for increasing control and co-ordination of their business operations and in order to enable access to new global markets and businesses.

It is arguments such as these that have contributed to the continued organisational investment in new technologies. Bartlett and Ghoshal [3] claim that 'firms operating in global markets will increasingly be at a serious strategic disadvantage if they are unable to firmly control their worldwide operations and manage them in a globally coordinated manner.'

Within this model, corporations are focusing on more close co-ordination of increasingly complex and global processes and are using technology as the means of management and control.

V. THE PROBLEM OF TECHNOLOGY INSERTION: A BACKGROUND OF HIGH RISK

Technology projects as a whole are notoriously prone to failure. Clegg et al estimate that only 25 to 50 per cent of projects successfully integrate new technology with the business goals of the organisation. Moynihan [36] describes the implementation of an Information Technology (IT) system as a stressful experience, 'it can be the most time consuming, expensive and frustrating part of any IT project'. Similarly, Lyytinen and Hirschheim [29] found that more than 50 per cent of technology system development projects are either partial or complete failures. Hochstrasser and Griffiths [20] found that risk levels are 'heightened when working with new technology as effects on timing, costs and delivery deadlines are exacerbated'.

There are numerous different types of technology, and technology insertion challenges, as well as failures, are by no means limited to IT projects. In fact, the evidence suggests similar patterns and rates of failure occur across many types of technologies, from computers to telecoms, materials, transport and bio technologies to name a few.

Looking at IT failure more specifically, a 1998 review of 100 failed IT projects revealed that 87 per cent exceeded their budgets by more than 50 per cent while 45 per cent of the projects failed to produce the expected results. In fact, it is not unusual for IT projects to be abandoned before a product is delivered. Sometimes IT artifacts are not used and there is evidence to suggest that there is a greater risk of failure in IT projects than any other aspect of business. Indeed, a range of studies show that the IT component adds a different dimension of risk which 'all too often can tip the balance towards project failure, rather than towards project success'.

Interestingly, amongst all of the early predictions of technology's impact on organisations, the high level of system failure was not widely predicted. Consistent figures on the rate of failure are hard to come by, with some, such as Gibbs [17] reporting that the level of operational failure is up at 70 per cent. However, in a review of the literature, Eason [13] states that:

'The rate started at around 40 % and despite vast improvements in the technology, has stubbornly refused to decrease through the many surveys conducted in the past 30 years.'

As Eason [13] also states, these figures hide many variations in success of different types of application but one safe general conclusion can be drawn; the bigger and more expensive the project, the more likely it is to fail. As well as outright failure, the evidence points to high risk of deadline and budget overruns in technology programmes. Many IT projects, for example, greatly exceed their budgets and planned development schedules. Similarly, a study performed in 1995 found that only 26 per cent of all Information Systems projects are completed on time and within budget, with all requirements fulfilled.

Research by Legris, Ingham and Collerette [24] found that 46 per cent of technology projects were over budget, late, and with fewer features and functions than originally specified. The statistics demonstrate a significant and chronic failure in the scheduling and budgeting of IT and other technology projects. Recent research from KPMG suggests that 56 percent of publicly listed firms have had to write off at least one technology project in the last five years as a failure. (*KPMG survey, November 2002).* There are numerous reasons why IT projects fail – inadequate planning, poor scope management and lack of effective communication between the IT function and the business, to name a few – but it is rare that IT can be blamed on the actual failure of technology itself.

VI. IMPACT OF TECHNOLOGY ON ORGANISATIONS

In addition to the risk of failure and of overrun budgets and timescales, the impact that technology has upon organisations continues once the technology has been introduced. This section seeks to summarise the various impacts of technology on organisations. The impact of technology on organisations is a heavily studied subject and includes the domains of organisational and management science, change management, socio-technical systems, computer science, human factors and many others besides. An exercise in the book 'Human Computer Interaction' asks the reader to 'spend a couple of minutes writing the advantages that you think computers have provided to people and organisations . . . then write a second list of the various problems that computerization has brought'. The author then goes on to conclude 'Both lists are endless'. If this is the case for the impact of computers, it is certainly true of the impact that technologies can have upon organisations. In the following section the key impacts that technology has had upon organisations are summarized. The list is by no means complete, as there are simply too many facets to cover in any scoping study; however, the intention is to give an overview of some of the key issues impacting on organisations.

A. PERFORMANCE AND PRODUCTIVITY

Despite the fact that many organisations invest in technology in order to reduce costs and to increase productivity, there is considerable debate in the literature over whether such outcomes have been delivered. There has been much discussion over whether a 'productivity paradox' exists, especially regarding the amount of productivity delivered by information technology (IT). This paradox has been used to describe the evidence suggesting that despite heavy investment in IT for many years, the rate of measured productivity growth has failed to increase, and may have even decreased. Lehr and Lichtenberg [25] argue that 'since productivity is defined as output per unit of input, and computers are an input, we should start by asking under what conditions one would expect growth in computer intensity to raise productivity'.

Evidence also suggests that it costs a lot of money to rapidly and successfully integrate new software systems. In 1999, Berger [40] found that Microsoft spent $16,000 per annu4for each of its workstations on maintenance and upgrading. Supporters of the productivity paradox view claim that trying to transform the way work is done and simultaneously save money is 'usually a mistake'. In 1990, Solow [45] stoked the debate further by saying that 'We see computers everywhere except in the productivity statistics'. Despite this, there is evidence to support the counter argument that new technologies, including computers and software do improve productivity.

According to Strassman [47] 'most businesses well-endowed with IT lose about *$5000* per year per workstation as a result of the need for futzing'. Futzing refers to 'the time users spend in a befuddled state while clearing up unexplained happenings and overcoming the confusion and panic when computers produce enigmatic messages that stop work'. In recent years, a surge in the number of studies that examine the IT payoff is a testimony to the challenge of measuring whether a productivity paradox exists. One of the counters to the productivity paradox argument is that we may fail to measure productivity gains from computers because there is a substantial time lag before gains are realised. David [12] argues that computers may require substantial changes in complementary infrastructure (such as human and knowledge capital and global communications infrastructure) before the gains can be realised.

B. MANPOWER LEVELS AND ORGANISATIONAL SIZE

As we have seen, a key argument for the investment in technology is in order to achieve increases in organisational productivity. Traditionally, this has been achieved using

machines to replace the productivity of the workforce and to reduce labour costs. In recent years much of the research has focused on the impact of information technologies on organisation size.

There is substantial evidence of a relationship between increased levels of IT usage and smaller organisation size, suggesting that IT systems reduce the level of manpower needed. Brynjolfsson et al [8] found that the overall relationship is robust to a variety of specifications and at least four measures of firm size. However, they argue that 'findings should not be interpreted to apply to all industries and all time periods'. The decline in firm size is greatest with a lag of one to two years following investments in IT, suggesting that the impacts of the new technology are not fully felt immediately. This finding may shed light on previous studies that found little or no impact of IT in the same year that the investments were made. Another possible explanation for why IT might lead to smaller firms is that IT might allow firms to 'outsource' more of their activities. In other words, the use of IT might lead firms to 'buy' rather than 'make' more of the components and services needed to make their primary products.

The obvious conclusion is that in some cases technology support services are sometimes outsourced to consultancies. It is perhaps self evident that these consultancies can range in size from small operations to global companies such as IBM or CSC. A number of studies of the relationship between technology and employment find evidence that IT may actually increase employment. Osterman [38], for example, found that IT investment ultimately resulted in an increase in the number of clerks and managers employed after a lag of several years.

Similarly, Morrison and Berndt [35] found that IT was on balance a complement, not a substitute for labour, especially white-collar labour. Specifically, they conclude: '. . . rather than being aggregate labour-saving, increases in IT tend to be labour-using'. It seems that whilst there are many specific studies showing a loss of jobs, overall assessments such as those made by the US Congress Office of Technology Assessment [14] conclude that 'technology was probably generating more jobs than it was destroying'. It would appear that predicting the impact of manufacturing technologies is much more straightforward. As far back as the 1950s, Woodward [48] developed a measurement scale on which firms were characterised according to the technical complexity of the manufacturing process.

In this instance, high technical complexity indicated that most of the work was carried out by machines, whereas low technical complexity meant that workers play a greater part in the process. Woodward found that the number of management levels and manager to personnel level increased as technological complexity increased. In non-manufacturing industries, where the output is less tangible, the relationship between manpower levels and technology is much less predictable.

C. INFORMATION MANAGEMENT AND POLICY

Within both UK local and central Government, the implementation of new technologies raises new and different information management and policy challenges. It is also found to increase public expectations with respect to information access and service delivery. New information policy issues generated by IT use also influence practices as new legislation and regulations are developed that affect the way organisations collect, use and disseminate information. As government is also a substantial market for the IT industry, its requirements and uses of IT has an effect on industry development of new technologies and applications.

D. IMPACT AT THE INDIVIDUAL AND GROUP LEVEL

It is increasingly accepted that good human factors is critical to ensure that system performance is safe, effective, and efficient.

There are a multitude of impacts that new military technologies have had on individual and group capability. For example the introduction of night vision goggles has meant that military missions can be carried out throughout both the day and night. The impact on individuals and teams has led to improved performance of tasks at night. An associated impact on individuals is that missions extending further into the night may lead to less sleep and increased fatigue. At a group level this might require greater consideration of sleep management issues.

The introduction of new missile technology on aircraft with the capability to target and engage enemy aircraft beyond the pilot's visual range has resulted in several human consequences. The most obvious being that pilots find it harder to successfully identify enemy aircraft. Identification and differentiation, already a difficult task, is made more challenging when engaging beyond visual range. Unsurprisingly, technologies are being developed to try to aid the pilot in this task.

E. IMPACT OF TECHNOLOGY ON HUMAN RESOURCE

Ball (2005) [2] observed that IT has brought a great revolutional change to organisations, but efficient and effective management of human capital management has progressed to an increasingly imperative and complex process. The function of Human Resources Management department is generally administrative and common to almost all organizations but to reduce the manual workload of these administrative activities, a number of organisations began to electronically automate many of these processes by developing and introducing IT–oriented software applications which later led to the development of specialized Human Resource Management Systems (HRMS). As a result of this development, the use of information technology in HRM has grown considerably in recent years and there are now extensive applications across a wide range of HRM activities.

According to Ruel et al, (2008) [43] the term e-HRM was first used in the late 1990's when e-commerce was sweeping the business world. e-HRM is internal application of e-business techniques to add value to the management through more effective and efficient information flow and is a way of doing HRM. As information technology improves, organizations could manage an increasing number of HRM processes in an effective manner, thereby contributing to the availability of information and knowledge. This in turn has help HRM professionals to play a strategic role in attaining improved competitive advantage. This interaction and intersection between IT and HRM leads to the emergence of HRMS, a term used to describe the systems and processes at the intersection between human resource management (HRM) and information technology (IT). It merges all HRM activities and processes with the information technology field while the programming of data processing systems evolved into standardized routines and packages of enterprise resource planning software. This has been developed since their increased visibility in the late 1990s and were largely used for administrative and data recording purposes and have presently metamorphose into HRM supporting applications for recruitment and selection, flexible benefits, development, e-learning and so on.

Human Resource Management System is any system that helps an organization to acquire, store, manipulate, analyze, retrieve and distribute information about an organization's human resources. While the term 'e-HRM' is used to express the use of information technology within the HRM function. Martin et al (2005) [31] provides the main areas in which HRM practitioners have traditionally introduced IT capabilities. Additionally, the HRM function may also be involved in organizational development and change management. CIPD (2005) [10] observed that human resource is one of the most sensitive departments in organisations and that the success or failure lies in its HRM capability. There is no doubt that the

introduction and implementation of information technology within the human resource departments is a complex matter and that the requirements for the implementation and the impact of the technology differ according to the nature of the organization's human resource management strategies and of the technology.

Martin et al (2009) [30] opined that the use of ICT can establish more virtual customer relationships within the organization thus enabling it to provide strategic value. Through social networking, it can also improve employee voice. While Wachira (2010) [48] conclude that HRM in Africa should be concerned with application of internet and web based systems and increasing mobile technologies to change the nature of interactions among HR staff, line managers and employees. However, the introduction of information technology to human resource management activities is usually driven by potential improvements such as in the speed and efficiency of processes, cost savings, enhanced customer satisfaction, increased accuracy of data, improved transparency and consistency of processes, increased availability of information and the facilitation of a change in the role of human resource managers. The design of a human resource management system normally involves some trade-off between using the solution and customizing it to fit with the human resource management and organizational needs.

Consultation with human resource managers on the design and development of the system is essential in order to map out processes and to ensure that the system will be usable. This must be considered carefully, as should the branding of the solution, which should fit with the human resource and organizational brand. Finally, extensive testing of the system with human resource managers is essential in order to produce a product that is usable and effective. This will have a major positive impact on human resource management processes by making them faster, more efficient, cheaper, more accurate, more reliable, more transparent and consistent. Information technology has enhanced the ability of human resource managers to produce reliable data via a human resource management system; this in turn allows human resource professionals to make data-driven decisions and to provide other managers with consultancy based upon this data.

Finally, with regard to the human resource management role, it is apparent that human resource managers may be able to adopt a more advisory or strategic role due to the increased availability of reliable human resource management data. Many organisations have gone beyond the traditional functions and developed human resource management systems that support recruitment, selection, hiring, job placement, performance appraisals, employee benefit analysis, health, safety and security. The recent areas of implementation of human resource management system include:

- Payroll
- Work Time
- Benefits Administration
- HR Information management
- Recruiting
- Training/Learning Management System
- Performance Record e.t.c

The payroll module automates the pay process by gathering data on employee time and attendance, calculating various deductions and taxes, and generating periodic pay cheques and employee tax reports. Data is generally fed from the human resources and time keeping modules to calculate automatic deposit and manual cheque writing capabilities. This module can encompass all employee-related transactions as well as integrate with existing financial management systems. The work time gathers standardized time and work related efforts. The most advanced modules provide broad flexibility in data collection methods, labor distribution capabilities and data analysis features. Cost analysis and efficiency metrics are the primary functions.

The benefit administration module is a system for organisations to administer and track

employee participation in benefits programs. These typically encompass insurance, compensation, profit sharing and retirement. The HR management module is a component covering many other HR aspects from application to retirement. The system records basic demographic and address data, selection, training and development, capabilities and skills management, compensation planning records and other related activities. Leading edge systems provide the ability to read applications and enter relevant data to applicable database fields, notify employers and provide position management and position control. Human resource management function involves the recruitment, placement, evaluation, compensation and development of the employees of an organization. Initially, businesses used computer based information system to:

- Produce pay checks and payroll reports;
- Maintain personnel records;
- Pursue talent management.

Online recruiting has become one of the primary methods employed by HR departments to gather potential candidates for available positions within an organization. Talent Management systems typically encompass:

- Analyzing personnel usage within an organization;
- Identifying potential applicants;
- Recruiting through company-facing listings;
- Recruiting through online recruiting sites or publications that market to both recruiters and applicants.

The significant cost incurred in maintaining an organized recruitment effort, cross-posting within and across general or industry-specific job boards and maintaining a competitive exposure of availabilities has given rise to the development of a dedicated Applicant Tracking System, or 'ATS', module. The training module provides a system for organisations to administer and track employee training and development efforts.

The system, normally called a Learning Management System (LMS) if a stand-alone product, allows HR to track education, qualifications and skills of the employees, as well as outlining what training courses, books, CDs, web based learning or materials are available to develop which skills. Courses can then be offered in date specific sessions, with delegates and training resources being mapped and managed within the same system. Sophisticated LMS allow managers to approve training, budgets and calendars alongside performance management and appraisal metrics.

F. IMPACT OF TECHNOLOGY ON QUALITY

The relative influence of service quality, product quality, and price on a buyer's assessment is an issue in need of systematic empirical research (Parasuraman, Zeithaml, and Berry 1994b) [41]. However, case studies and anecdotal evidence strongly suggest that achieving sustainable competitive advantage in the marketplace will be very difficult with just superior products and reasonable prices. Regardless of whether a company's core offerings are products or services, superior service quality is essential for excellent market performance on an enduring basis (Berry 1999) [5]. The primary rationale underlying this conclusion is that service quality is much more difficult for competitors to copy effectively than are product quality and price. Early research (Gronroos 1982 [19]; Lehtinen and Lehtinen 1982 [21]; Lewis and Booms 1983 [27]; Sasser, Olsen, and Wyckoff 1978 [44]) has suggested that customers assess service quality by comparing what they feel a seller should offer (i.e., their expectations) with the seller's actual service performance. This depiction of service quality found strong support in an extensive exploratory study (Parasuraman et al. 1985) [42], which also identified various specific attributes on which customers might assess the expectations-performance gap.

Building on this study and on the basis of findings from empirical research in several sectors, Parasuraman et al. (1988) [39], Parasuraman, Zeithaml, and Berry (1991) [40] identified five generic dimensions that customers use as criteria in judging service quality:

- Reliability: Ability to perform the promised service dependably and accurately
- Responsiveness: Willingness to help customers and provide prompt service
- Assurance: Knowledge and courtesy of employees and their ability to inspire trust and confidence
- Empathy: Caring, individualized attention the firm provides its customers
- Tangibles: Appearance of physical facilities, equipment, personnel, and communication materials

Currently, business managers and engineers perceive computer-aided design (CAD) as a tool to assist engineers in designing goods. CAD uses computer technology and a graphic display to represent physical shapes in the same way that engineering drawings have in the past. It is used in the metalworking industry to display component parts, to illustrate size and shape, to show possible relationships to other parts, and to indicate component deformation under specified loads.

After the design has been completed, the engineer can examine many different views or sections of the part and finally send it to a plotter to prepare drawings. This capability greatly reduces engineering time and avoids routine mistakes made in analysis and drawing. It significantly increases productivity and reduces design time, which allows faster delivery and improved quality. Applications of CAD systems are not limited to producing goods. While it is true that services do not have physical dimensions, the equipment and facilities used to produce services do. For example, the service stalls in an automotive center or rooms in an emergency medical center have physical characteristics that can be represented by the interactive graphics capabilities of a CAD system.

G. THE IMPACT OF TECHNOLOGY ON FUNCTIONS OF MANAGEMENT

Functions of management including planning, organizing, analyzing data and making decisions regarding both goals and employee motivation or direction. These functions apply to most management jobs and can affect how successful a manager is. The higher the level of management, the broader functions tend to become, even as managers continue to specialize in particular areas. There are few factors that affect these management functions across the board like technology and technological improvements, especially regarding the development of online communication.

The following is a discussion of the impact of technology on some functions of management:

a) Training

Training is a vital part of many management positions. Managers need to pass standards and experience down to other employees on a regular basis. Thanks to new technological developments, many managers can use online programs to train employees even when they cannot meet them in person. Managers can also organize online databases of training information for employees to use whenever they need to. This is known as e-learning, a rapidly growing field with many different facets that is changing the way many organizations train employees.

b) Field Communications

Managers must often be in direct contact with employees to give them updated information or instruction on their current tasks. This is especially true of sales managers and other positions where action is important and decisions can affect the success of the business. Technology has allowed these managers to communicate effortlessly with employees across

long distances through mobile applications. Sales teams can now talk to managers in the field and also send relevant documents by text, instant message and email through their phones.

c) Collaboration

Collaboration is one of the key aspects of cloud computing in service-oriented businesses. Once managers had to gather teams together and pass documents around from person to person to receive input. Now employees can all log into a single program, work on a document at the same time and send it along to the next step. These programs contain detailed log-in information so managers can trace mistakes properly and correct problems with greater accuracy.

Technology has revolutionized the way managers analyze data and make decisions based on it. Computer applications can now immediately produce results on sales, marketing plans and the business's relationship with consumers whenever managers want the information. Data management systems are more complex and more intelligent than in the past. More and more managers are using online systems to track not only their company but also their competitors and to learn what consumers are saying using applications like Twitter and Facebook and other social platforms.

H. IMPACT OF TECHNOLOGY ON CUSTOMER SATISFACTION

Customer satisfaction has been traditionally studied in marketing area as one of the critical attitudinal variables that may influence customer behavior. Most of the studies of satisfaction in marketing literature are based on the disconfirmation theory. It postulates that, the feeling of satisfaction is a result of the comparison between perceptions of a product's performance and expectations (Oliver and Swan, 1989) [37]. This theory, representing psychological evaluation processes, provides an understanding of expectations, desires, experiences, and performances that may affect customer attitudes. Based on this theory, McKinney et al.'s [33] study suggested that the difference between expectations and actual performance on system quality and information quality is likely to determine Web customer satisfaction.

Similarly, Khalifa and Liu [22] posed that confirmation/disconfirmation of pre-adoption expectations and desires, upon adoption, could influence overall customer satisfaction. While the disconfirmation theory has been supported by many researchers, it is hard to operationalize the theory consistently for all product categories [9]. Several approaches have been employed to assess satisfaction as noted by Giese and Cote [18] and Spreng et al. [46]. Especially, Giese and Cote [18] summarized more than definitions of satisfaction from prior studies in the marketing area. They criticized a lack of consensus about the process leading to satisfaction and the satisfaction construct, and favored the development of context-specific satisfaction measures. These approaches rely on a customer's affective or emotional response as forming the basis for the measurement of customer satisfaction specific to a context, rather than assessing disconfirmation.

Information systems research has also employed a related construct as user satisfaction. Marketing based views consider an Internet shopping store to be a type of shopping store, and suggest obtaining higher customer satisfaction through improvements in conventional factors such as delivery, store image, and service quality. According to Lee et al. [23], some variables related to satisfaction in traditional stores may not be relevant in online stores, such as interpersonal interaction and the physical environment. Information systems research related to e-commerce has viewed users' satisfaction with the interaction in terms of system quality and information quality, and adapted them to assess satisfaction with an online store. This approach typically treats customers as information systems users, and focuses primarily on user satisfaction with websites. However, it overlooks issues related to the shopping context. A few studies also examined some other predictors of satisfaction

in online stores, such as intelligent support, Internet expertise and entry guidance. Thus, most of the prior studies have looked at only a subset of issues related to customer satisfaction in online shopping.

"Service encounters are critical moments of truth in which customers often develop indelible impressions of a firm". Bitner et al. [6] defined service encounters as face-to-face interactions between buyers and sellers, and identified the three categories of service encounters (e.g. Service failure, special customer needs, and unprompted employee actions) as antecedents of satisfaction/dissatisfaction in industries such as hotel, airline, and restaurant. It is generally accepted that the encounters would affect customer satisfaction. Further, Bitner et al [7] proposed the concept of technology infused service encounters, while emphasizing the growing role of technology in service encounters. The authors named this situation as self- service technology (SST).

Due to continuous improvement in technology, many parts of the face-to-face interpersonal dynamics between sellers and customers have been replaced by technology -based interactions. Meuter et al. [34] identified 'technology failure', 'process failure', 'poor design', and 'customer-driven failure' in self service technology as incidents leading to customer dissatisfaction, and 'solved intensified need', 'better than the alternatives' and 'did its job' incidents as leading to satisfaction. Further, Curran et al. [11] found that attitude toward technologies affected intention to use the technologies based on a study of automated teller machines (ATMs). With the advent of Web-based information systems, many direct interactions between sellers and buyers have been replaced by Web based interfaces. This Web-based Environment has been called the 'market space', which is "a virtual realm where products and services exist as digital information and can be delivered through information based channels".

For such online market place, Massad et al. [49] developed taxonomy of the antecedents of customer satisfaction/dissatisfaction with service encounters in the online shopping context. Massad et al.'s [32] taxonomy includes core service delivery failures, customer's situation before encounter, employee characteristics and behavior, information technology interface, and trust. He suggested that these factors can be employed as antecedents of satisfaction in future research. In the evaluation of the online service encounters, prior research has examined factors that influence customer satisfaction, i.e. information quality, system quality and service quality, reduction in time spent, shopping enjoyment and convenience, trustworthiness, privacy concerns and site values, and cost and time saving.

I. IMPACT OF TECHNOLOGY ON RISK MANAGEMENT

Risk Management is a qualitative exercise which, if supported appropriately by the right data and information, can add real value to businesses and other organisations by improving decision making. But we believe in the maxim that 'what you can't measure, you can't manage'. For This reason, it makes absolute sense to put in place the best risk management technology you can, but it makes equal sense to recognize its limitations. So, how can technology help risk management in business? There are four main areas where it has a role to play in my view:

- Data collection and storage
- Risk analysis and modeling
- Risk monitoring and control and
- Risk information and communication

The starting point is good data, and lots of it - enough to provide a sound statistical basis for effective decision making. Collecting data requires good front-end systems, an effective system and data architecture with limited human intervention, and good database and business intelligence technology. But, it also needs people – the right type of people with the right culture, attitude and processes to: (a) capture and log the data accurately, and (b) to analyse the

data effectively. Business processes have to balance the ability to capture data effectively with what it is used for. Companies operating call centers, for example, can miss the opportunity to capture useful business intelligence by the pressure they place on operators to handle a certain volume of calls. Data analysis can take many forms but actuarial techniques of stochastic modeling recognize that there is no single quantifiable answer to any risk. It is a combination of the probability of a risk occurring; the potential impact or impacts; and the mitigating effects of controls.

At the extremes, any one risk or combination of risks, however seemingly unlikely, can bring a company down. Increases in computer power have meant that this type of modeling – often including hundreds of thousands of scenarios – is much more effective and efficient than it used to be and can be brought to bear more readily to assist business decision making. It's easy to get carried away with technological capabilities but, also remember, the type – and complexity - of modeling should be appropriate, not only to the nature and materiality of the risk, but also to the amount and quality of data available. Otherwise, it risks giving an unrealistic view of the robustness of the model outputs and potentially will lead to a false sense of security. Technology and the access to information it affords, has made it far easier to monitor an organization's continuing risks.

It would be almost inconceivable for risk management to work effectively without the storage and processing capabilities of modern computers and the almost instant ability to communicate data-rich material around the globe. Furthermore, computerized controls play an ever increasing part in reducing risk.

J. IMPACT OF TECHNOLOGY ON COST OF BUSINESS

Technology drives the cost structure of organisations in three ways: it enables economies of scale, supports sustainable process optimization, and makes labor arbitrage possible by connecting and controlling remote location workflows. With the right software, organizations can balance their needs for personalization and standardization of outsourced processes by creating the capacity to design process and IT implementation jointly. In addition, software is the key enabler for integration between buyer and service provider, both on process and IT levels. Finally, the software choice has a substantial long-term impact on cost as it influences the organization's flexibility to accommodate changes in scope including process coverage and regional scope, or scale; allow for organizational developments, such as reorganization or merger and acquisition activities; and cater for potential changes in sourcing strategy.

K. IMPACT OF TECHNOLOGY ON LEAD TIME

The recent trend in the high-technology industry of introducing products in an increasing order of performance indicates that additional factors may be at work in making the product introduction. In particular, the concurrent development of technology places limits on the earliest time by which a product can be introduced. The following indicates how some organisations have reduced lead time via the use of technology;

a) Personal Computers

The PC is offered in a wide specification range. Production has become simple and quick over the last decade by virtue of modularization. Dell is a leader in short lead times. They offer a wide product specification range to be built to customer's individual choice and delivered in the UK in 3 days. A 3day PC has been achieved through:

- Direct sales to customers via the internet
- Full integration of supply chain information systems between the customer, computer assembler, component suppliers and transportation/distribution.

Dell has achieved a 40% growth per annum recently, compared with 15% growth for the total market.

b) Photographic Development

The industry processes a unique film for each customer. The resizing of machinery into mini-labs has enabled the development process to move from large centres to retail outlets. Kodak pioneered this change, but all major players now offer a one hour service. Lead times are differentiated by price - the longer the lead-time, the lower the price for the same quality service. There is clear segmentation in lead-time requirements, particularly related to customer age.

c) Optical

Spectacles are produced for each individual to a prescription, in a wide range of frame and lens type and material. The computerization of lens grinding has simplified the process and enabled "production" to be carried out at the retail site. The leading exponent of a short lead-time is *Vision Express*, who produces spectacles against individual prescription in one hour. Nonetheless, customers are expecting a shorter lead-time service. Lead times have fallen during the 1990s and are expected to fall further over the next decade. The table below shows the trend in lead time reduction in the aforementioned companies:

(Lead time in days)	1990	2000	2010
Personal Computer	14-21	3	2
Photographic Development	5	3	1
Spectacles	7-14	3-4	1-2

Source: Williams et al. (2000) [49]

In all three industries, advances in production and information technology have been critical in cutting lead times. Technology that de-skills and simplifies the process of production enables it to be shifted closer to the customer. The latest communication and middleware technology facilitates short lead-times by passing information in an integrated, instantaneous fashion. It also reduces the number of players in the supply chain, cutting delay, bureaucracy and inefficiency.

VII. CONCLUSION

In this paper, I have empirically reviewed the impact of technology on organisations. It was found and thus affirmed by many related works that technology though costly, has positively impacted on organisations leading to improved service/products, profitability and performance. As we work our way through the economic downturn, companies need to learn from past successes and failures in business transformation.

Companies that have truly revolutionized their industries haven't followed the herd or waited to see which technologies seem safe to adopt. They've defined a ground-breaking business strategy and sourced emerging technology to support it. It is now possible, through a new model of strategic consultancy, to address business issues, strategy and technology in a focused, coordinated manner so that they work in parallel with each other. It is possible to identify and predict what emerging technologies will be right for your business, and fund that proactive innovation with prudent reallocation of technology spend whilst still in the current economic downturn.

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