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ICT ASSESSMENT FRAMEWORK: A GENERIC FRAMEWORK FOR ASSESSING AND PRIORITIZING IMPACT OF TECHNOLOGY ON BUSINESSES

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Abstract: Technology today is a major force that businesses can no longer ignore. Today, Businesses of all size are embracing technology to support their business workings. Technology continues to be a source of competitive advantage for businesses and it is this aim – to gain competitive advantage – that prompts businesses to adopt and embrace technology. But the technology landscape is constantly evolving. Cloud computing, IoT, Big data, wearable technology etc. are some of the latest trends dominating the technology landscape. New technological breakthroughs are constantly making headlines. In the face of this constant change, businesses are faced with one major challenge – which technology is right for their particular business? Blindly investing in technology has not worked out so well for many businesses. Businesses require a framework for assessing technological innovations and how it can contribute to the business growth.

This paper aims at providing just such a framework. The framework is based on Business Model Ontology (BMO) developed by Alexander Osterwalder. The BMO is a ontology for modeling businesses. It is a very popular ontology used by Fortune 500 companies such as DELL, SONY, HP and more to model and analyze their businesses. This paper consists of two parts. In the first part, readers are given a quick introduction to BMO fundamentals since it is the grounds upon which the ***ICT Assessment Framework*** is built upon. The second part introduces the ICT Assessment Framework. The aim of the framework is to enable businesses to analyze and prioritize impact of technology on their businesses.

Keywords: Assessing ICT impact on businesses, ICT framework to assess impact on businesses, Assessing and prioritizing ICT impact, BMO and ICT impact on business.

1. INTRODUCTION

Today, technology is an indelible part of business. It has become ubiquitous with business functions. Technology continues to be a source of competitive advantage for businesses. Technological innovations such as the internet has given rise to entirely new business models (Chesbrough, 2010) (Gordijn & Hans, 2001). It has essentially changed how businesses operate, when they operate, who their customers are, who their competitors are, where their markets are and more. Given that technology has become so influential, businesses have hurried to embrace new technology with mixed results. Vast majority of businesses have failed to realize the gains they had envisioned (Forbes, 2016) (Leon, 2014) (Hendricks & Singhal, 2007). While the reasons for such failure are many, one possible reason is their failure in selecting the right set of technology – technology that will create real value for their business. It is this flaw that the ICT Assessment Framework aims to amend. It provides a framework for businesses to carry out assessment before making any investment decision. It examines how the technology will fit and support their

business model. Too many times businesses adopt new information technology solutions without fully carrying out a comprehensive analysis of how the technology impacts their business. We start by examining the Business Model Ontology. The next section introduces the ICT Assessment Framework.

2. BMO OVERVIEW

The Business Model Ontology (BMO) was developed by Alexander Osterwalder. It is a business ontology developed specifically to represent business models. It is focused on modeling a single enterprise. The BMO provides one of the most comprehensive representation of a business. It "describes the value a company offers (what?) to one or several segments of customers (who?) and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital (how?), in order to generate profitable and sustainable revenue streams (how much?)." (Osterwalder, 2004)

The BMO consists of four major pillars.

1. Product
2. Infrastructure Management
3. Customer Interface and
4. Financial Aspects

The four pillars are made of nine building blocks. This is depicted in Table 1.

The nine building blocks or elements are interrelated. Together, they can model any business. The nine building blocks are further divided into sub elements. Figure 1

Table 1
The four pillars and nine building blocks of the BMO

Pillar	*Building Block of Business Model*	*Description*
Product	Value Proposition	A Value Proposition is an overall view of a company's bundle of products and services that are of value to the customer.
Customer Interface	Target Customer	The Target Customer is a segment of customers a company wants to offer value to.
	Distribution Channel A	Distribution Channel is a means of getting in touch with the customer.
	Relationship	The Relationship describes the kind of link a company establishes between itself and the customer.
Infrastructure Management	Value Configuration	The Value Configuration describes the arrangement of activities and resources that are necessary to create value for the customer.
	Capability	A capability is the ability to execute a repeatable pattern of actions that is necessary in order to create value for the customer.
	Partnership	A Partnership is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer.
Financial Aspects	Cost Structure	The Cost Structure is the representation in money of all the means employed in the business model.
	Revenue Model	The Revenue Model describes the way a company makes money through a variety of revenue flows.

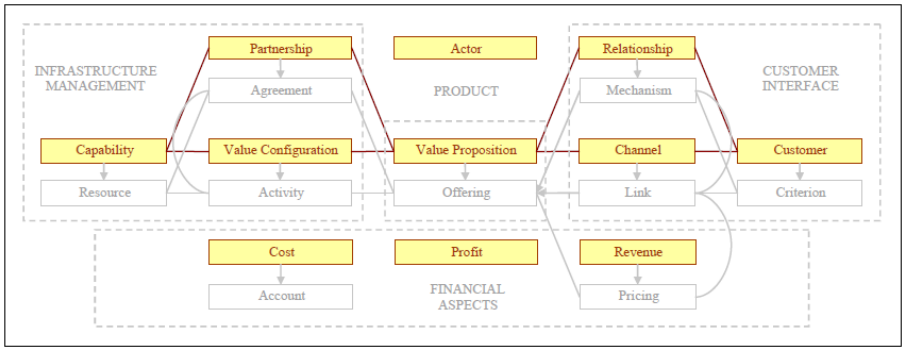

Figure (i): The Business Model Ontology (BMO). Adapted from The Business Model Ontology: A proposition in a design science approach by Osterwalder, A. (2004), Université de Lausanne, p.44.

depicts the four pillars, the nine building blocks, and their sub-elements.

All the nine elements and the sub elements are defined using the set of characteristics shown in Table 2.

3. ICT ASSESSMENT FRAMEWORK

The ICT assessment framework provides a structured method for analyzing impact of Information Communications Technologies on businesses. It is a generic framework and hence can be used by businesses in any industry. The objectives of the framework are as follows:

- Identify ICTs that can be adopted by the business that have substantial impact on business performance. We use the term business performance in its broadest sense encapsulating everything from decision making capability, information dissemination, strategy development, market analysis, quality control etc.
- Prioritize various ICTs based on impact factor.

As stated earlier, the ICT assessment framework is based on Business Model Ontology (BMO). The BMO serves as an excellent tool of analysis for evaluating ICTs. ICTs can be evaluated based on how well they address key issues relating to specific BMO elements. One of the key challenges in developing the framework was defining criteria for evaluating ICT impact on the nine elements of BMO. Table 3 summarizes the various criteria for evaluating ICT impact.

Table 2
Description of a business model element. Adapted from The Business Model Ontology: A proposition in a design science approach by Osterwalder, A. (2004), Université de Lausanne, p.47

Name of BM Element	*Description*
Definition.	Describes the business model element – what it is.
Part of	Identifies the pillar to which a business model element belongs to. BMO consists of four pillars. Alternately, for sub elements it identifies the element it belongs to.
Related to	Identifies other elements and sub elements it is related to.
Set of	It identifies the sub elements to which an element can be decomposed into.
Cardinality	"Defines the number of allowed occurrences of an element or sub-element inside the ontology."
Attributes	Each element and subelement contains unique attributes. These attributes are identified in this section. Attributes can be inherited from one element to another or from a subelement to its parent element. Attributes consists of values. These values are listed between accolades. For example, {VALUE1, VALUE2, etc}. All element and sub-element have two 'standard attributes.' They are NAME and DESCRIPTION. These attributes contain a set of characters as values indicated as such, {abc}.

Table 3
Criteria for evaluating ICT impact

	Value Proposition			*Customer*			*Distribution Channel*		*Relationship*			*Value Configuration*			*Capability*			*Partnership*			*Cost*	*Rev*	
ICT	*Innovate*	*Create*	*Design*	*Reach*	*Acquire*	*Profile*	*Communicate & Sell*	*Deliver*	*Innovate*	*Degree*	*Functionality*	*Innovate*	*Agility*	*Improvement*	*Productivity*	*Share*	*Source & Purchase*	*Collaborate*	*Facilitate*	*Create*	*Innovate*	*Cost structure*	*Earnings potential*	*Total*

While defining the criteria, my aim was to identify broad and relevant criteria. Also, the number of criteria were to be limited to ensure that decision making ability is not diluted. Table 4 provides a description of the above listed criteria. ICT assessment is performed against each criteria. Many of the criteria are further defined using additional parameters.

Table 4
Description of the various criteria used for evaluating ICT impact on businesses

<table>
<tr><th>BMO Element</th><th>Criteria</th><th>Description</th></tr>
<tr><td>Value proposition</td><td>Innovate</td><td>Innovation is a key capability that all businesses value. Here innovation refers to the ICT capability to provide innovative solutions to problems. ICT innovations can serve as value proposition in and off itself. For example, PAYTM is an innovative ICT based solution that enable customers to make cashless purchases. Hence, ICT solution can be evaluated on their innovative capability (Arakali, 2016).
According to Mckinsey consultancy, there are eight essentials that companies must focus upon in order to create an innovative organization. The eight essentials are Aspire, Choose, Discover, Evolve, Accelerate, Scale, Extend, and Mobilize (Jong, Marston & Roth, 2015). Likewise, I have identified three capabilities for evaluating how well a particular ICT supports product or service innovation.
<table>
<tr><th>Capability</th><th>Description</th></tr>
<tr><td>Gathering and analyzing marketing intelligence</td><td>How well is the ICT able to gather ideas, feedbacks, opinions from various sources including customers, employees, suppliers, partners, competitors etc. and how well it is able to discover insights, opportunities and assess risk. This is a reflection of the Aspire, Choose, and Discover elements required of innovative organizations. Customers are a key source of innovation. Many new opportunities can be sourced from the customers which can than lead to business model innovations, process innovations, value proposition innovations etc. Hence, gathering and analyzing marketing intelligence reflects a ICTs capability to support innovation.</td></tr>
<tr><td>Collaborative capability</td><td>Innovation is an outcome of collaboration and teamwork amongst various internal and external stakeholders of the organization (Goldbrunner, Hauser, List & Veldhoen,2005). Cross functional collaboration is key to ensure effective knowledge sharing and experimentation resulting in rapid prototyping, testing and validation of the prototypes (Brands, 2013). This is the Evolve and Accelerate essentials of an innovative organization. Hence, ICTs ability to support innovation can be reflected by how well they support collaboration.</td></tr>
<tr><td>Eco System capability</td><td>Extending the collaborative capability further, those organizations that are able to create and sustain an ecosystem by extending its reach beyond organizational boundaries are more likely to become successful innovators (Brands, 2013). Eco systems can be established with partners and vendors. This pertains to the Scale and Mobilize component of the innovation essentials. Hence, a ICTs capability to create and sustain an eco systems reflects how well it can support innovation.</td></tr>
</table></td></tr>
<tr><td></td><td>Create</td><td>For manufacturing businesses this is of particular significance. ICTs can provide huge advantage in terms of manufacturing and production. Indeed, ICT solutions in this area range from Computer Aided Manufacturing (CAM), Computer Aided Design (CAM) to the latest 3D Printing capabilities (Groover, 2016). Hence, ICTs can be evaluated based on their capability to create products and services.
In order to evaluate ICTs ability to support product and service creation, I have selected new product development process and how well the ICT supports the various phases of this process. New product development process generally consists of the following phases:
(i) Idea generation – pertains largely to market research and market intelligence.
(ii) Idea screening – refers to evaluation of potential ideas based on ROI, affordability, market potential assessment etc.
(iii) Concept testing – testing the concept idea on target customers.
(iv) Business analytics – creating a business case of the potential idea. A business case is a detailed plan of action relating to the new product.</td></tr>
</table>

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<table>
<tr><th>BMO Element</th><th>Criteria</th><th>Description</th></tr>
<tr><td></td><td></td><td>(v) Test marketing
(vi) Technicality & product development – refers to the actual production and manufacturing process
(vii) Commercialization
(viii) Launch.
(Brands, 2013)
Hence, by evaluating how well an ICT supports any of these listed functions, we are able to assess how well it supports new product and service creation.</td></tr>
<tr><td></td><td>Design</td><td>Here, ICTs are evaluated based on their design capabilities. Design is a very important component of a product or a service. Today the internet enables collaboration capabilities like never before. Customers can custom design their products. For example, T-Shirt companies allow customers to upload their own designs which is then printed by the company and delivered to the customers. Such individual customization is now extending to other areas such as apparels and footwear (Sanders & Stappers, 2008). Hence, ICTs can be evaluated based on their capability to enable design and co-design of products and services by customers and other stakeholders i.e. suppliers.</td></tr>
<tr><td>Customer</td><td>Reach</td><td>One of the biggest advantages of internet is that it allows businesses to reach and target customers in geographic areas that were not possible before. Prior to the internet, businesses were limited by physical geographic boundaries. With the advent of the internet the rules have changed. Technically, businesses can tap the global market. Hence, ICTs can be evaluated based on customer reach capabilities.
Here I am simply measuring customer reach potential of various ICTs. Reach is a simple and self explanatory concept and hence no additional parameters have been defined to assess reach of ICTs. Reach can be measured by quantifying number of potential customers it can reach and also on the basis of location of the customers it can reach – global customers, regional customers, national customers, and local customers (Kotler & Keller, 2012).</td></tr>
<tr><td></td><td>Acquire</td><td>Customer reach is one very important measure of ICT capability. Another very important measure is converting those potential customers to actual customers. ICTs have varying acquisition capabilities. For example, consider the television; while it may have a huge reach, it has a small conversion success rate. Likewise, consider GoogleAd Words; while it may have a limited reach, it has a higher conversion rate (Chan, Wu & Xie, 2011). Hence, ICTs can be evaluated on their acquisition rates.</td></tr>
<tr><td></td><td>Profile</td><td>Success of a business is largely based on how well they meet the needs of their target customers. This requires a very good understanding of the needs and desired outcomes of the target customers. ICTs like Customer Relationship Management (CRM) software, Datamining software, ERP software are very adept at profiling and segmenting customers (Luck & Lancaster, 2003). Hence ICTs can be evaluated on their capability to profile customers.</td></tr>
<tr><td>Distribution Channel</td><td>Communicate & Sell</td><td>ICTs are evaluated based on their communication and selling capabilities. Some ICTs like web portals provide excellent platform for communication and selling.
In order to assess communication and selling capability of ICTs two additional parameters are used (Kotler & Keller, 2012).
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Economic capability</td><td>Channels vary in the level of sales it can generate and costs. Economic capability concerns evaluating channels on these two factors. For example, banks claim that in selling retail banking services, the cost per transaction is $2 (teller), $.50 (ATM), and $.10 (Internet). Likewise the earnings from each of these channels vary. Hence, ICTs can be evaluated on their economic capability by examining their cost and earning potentials.</td></tr>
<tr><td>Reach capability</td><td>Reach is a function of exposure and impact. Exposure refers to the reach of the communicated message. It measures how many individuals it can reach. Impact refers to the impact of the communicated message. Impact measures the actual target customers the message is able to reach. By evaluating the exposure and impact capability, we can evaluate the reach capability of an ICT.</td></tr>
</table>
Hence, using the above parameters, ICTs ability to communicate and sell can be assessed.</td></tr>
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BMO Element	*Criteria*	*Description*
	Deliver	ICTs are evaluated based on their capability for delivery. For example, many digital products (i.e. Amazon Kindle products, software products etc.) and many services (i.e. online banking, hotel reservation services) can be directly delivered to the customers via the internet. For assessing the delivery capability of ICTs, the following additional parameters have been selected (Kotler & Keller, 2012).

Parameter	*Description*
Control capability	Refers to how well the marketing channel can be controlled. Some marketing channels like the company web portal may be 100% under the control of the company whereas other channels such as third party platforms such as MakeMyTrip etc. are not under the control of the company. Control capability can be one consideration in terms of delivery capability of ICTs.
Adaptive capability	Refers to how adaptive the marketing channel is to changing conditions. For example, many of the third party platforms have policies, rules, content requirements, etc. by which all participants must abide by. Such commitment constrains organization's flexibility to react to changing market conditions. Adaptive capability can be another measure of delivery capability of ICTs.
Nature of goods	Perhaps the nature of good itself should be the primary category in assessing delivery capabilities. Physical goods obviously cannot be transported over the internet, at least not just yet, although with 3D printing capabilities today, product specifications could be downloaded from the web and physical products can be manufactured in real time. Digital products such as software, MP3 files, movies, videos, electronic books and a whole array of other products and infinite number of services can be delivered using ICTs.

Hence, using the above parameters, ICTs can be assessed for their delivery capabilities.

Innovate

The internet has transformed all spheres of business. One of the most remarkable impact of internet has been on the intermediary channels. The internet has enabled customers to directly interact with the market cutting out the middle men. It has resulted in disintermediation (Bakos, 1998).For example, in the pre-internet era, financial investment services used to be handled exclusively by brokerage houses and investment firms. Today however, customers can directly perform financial transactions (buying, selling etc.) over the internet (Clemons & Hitt, 2001).

In evaluating the ICT capability for innovation, the following parameters have been selected:

Parameter	*Description*
Virtual integration (MaRS, 2011)	Refers to the ICT's capability in enabling strategic collaboration with suppliers. Such collaboration often involves opening and sharing of company's production schedules, sales forecasts and plans for new products with its suppliers. It is based on JIT principles.
Logistics and Data interchange capability (Musso, 2010)	Logistics is a very important consideration concerning supply chain management. It refers to both physical flow of goods and information flow as well. The need is for greater coordination, integration and improvement in the logistics flow. Hence, ICTs can be assessed in how well they meet these business requirements.
Collaborative Planning Forecasting and Replenishment (CPFR) (Muso, 2010)	CPFR is a 'methodology for the joint purchasing management between retailers and their suppliers. It consists of jointly making sales forecasts and procurement schemes, and includes all activities that pertain to the management of assortments, such as promotions and the introduction of new products. The CPFR encourages the sharing of market information and collaborative planning for the establishment and management of optimal assortments.' Hence, ICTs can be evaluated in their CPFR capabilities.
E-procurement, E-sourcing capability	Refers to 'management of supplies via the Internet.' According to Musso, e-procurement is a broad term that encompasses 'all possible e-solution adopted, to improve the flexibility and speed of the supply chain, especially the inter and

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<tr><th>BMO Element</th><th>Criteria</th><th>Description</th></tr>
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<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>(Muso, 2010)</td><td>intracompany synchronization.' It includes all front end and back end business activities. E-sourcing is part of value chain of e-procurement. It concerns activities such as searching for suppliers, evaluating suppliers and negotiating with them. These than are very important capabilities that ICTs can support.</td></tr>
<tr><td>Market Research Capability (Perner, n.d.)</td><td>Innovation is largely fueled by data and research. The internet allows businesses to conduct market research like never before. While data collected via internet can be suspect, none the less capability offered in this regard by the internet is immense. Internet based ICTs can greatly aid businesses in carrying out market research and hence act as a source of innovation.</td></tr>
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<tr><td>Customer Relationship</td><td>Degree</td><td>Refers to the intimacy of customer relationship that an ICT can offer/support. Degrees can be translated into following types:
• One to one relationship – Today, social networking offers this type of relationship (Baird & Parasnis, 2011).
• One to many – Business to Consumers (B2C models) models are a prime example of this type of relationship where a single seller can reach a large number of buyers. For example, FlipKart has tens of millions of customers across India and global customers as well.
• Many to one – This type of relationship exists in Business to Business (B2B) models where there may be a single buyer and large number of suppliers. For example, Toyota sources parts and supplies from hundreds of different suppliers from across the globe. Likewise, WalMart has network of suppliers that span across the globe (Thorne & Quinn, 2016).
• Manyto many – Customer to Customer (C2C) models are an example of many to many relationship. For example, companies such as OLX and Ebay provide a virtual platform and mechanisms that enable customers to directly sell and purchase products from other customers. Hence, it brings many buyers and sellers together.
Hence, ICTs can be evaluated on how well they can support customer relationships by examining the degree of relationship it can support.</td></tr>
<tr><td></td><td>Functionality</td><td>Functionality refers to motivation behind the customer relationships. Motivations can be classified into the following categories:
• Customer acquisition
• Customer retention
• Upselling/cross selling capabilities (Osterwalder, 2004).
Hence, ICTs can be evaluated in terms of how well they support/fulfill the above functions.</td></tr>
<tr><td></td><td>Innovate</td><td>ICT innovations are transforming how information is gathered and used by businesses. For example, innovations in embedded and wearable technologies are transforming the healthcare industry (Lee & Shim, 2007). Likewise, innovations in social media technologies are transforming how businesses are gathering and using customer information. In order to assess how well ICTs are able to support customer relationship related innovations, ICT capabilities can be assessed against the following parameters:
<table>
<tr><th>Parameters</th><th>Description</th></tr>
<tr><td>Business intelligence</td><td>Idea generation (product conceptualization) capability. Gain insights into customer tastes and evolving needs, track customer preferences, learn about customer preferences in real time etc.</td></tr>
<tr><td>Brand building</td><td>Ability to communicate value, 'be known for creating value' (Booz Allen Hamilton, 2014).</td></tr>
<tr><td>Internal ecosystem</td><td>Ability to create an environment of 'originality, creativity, intellectual curiosity, inclusion and passion' through community ownership, idea sharing, crowd sourcing, online collaboration with internal and external stakeholders etc. (Booz Allen Hamilton, 2014).</td></tr>
</table>
Using the above parameters, ICTs can be assessed on their capability to innovate customer relationships.</td></tr>
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<table>
<tr><th>BMO Element</th><th>Criteria</th><th>Description</th></tr>
<tr><td>Value Configuration</td><td>Agility</td><td>Agility refers to the capability of businesses to quickly design and create new processes and workflows and to automate processes. In the manufacturing sector, companies such as IKEA, Toyota have become global leaders due to their ability to automate their manufacturing and related processes (warehousing, distribution etc.) (Bider & Jalali, 2014). ICTs such as Business Process Management (BPM) packages provide tremendous capabilities in terms of designing and creating new processes in the workplace. For example, organizations implementing BPM solutions can design, test, automate and roll out processes and workflows within hours streamlining the entire design and automation processes that previously took days and weeks.
Listed below are various parameters to access the capability of ICTs to support process agility (Bizagi, 2014).
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Process modeling capability</td><td>Refers to whether an ICT is capable of modeling processes.</td></tr>
<tr><td>Process automation capability</td><td>Refers to whether an ICT is capable of process automation. For example, software such as Bizagi are capable of modeling and automating process on the fly.</td></tr>
<tr><td>Collaboration capability</td><td>Refers to whether an ICT can offer collaborative capability.</td></tr>
</table>
Hence, ICTs can be assessed for agility using the above parameters.</td></tr>
<tr><td></td><td>Improvement</td><td>Today there exists infinite number of software packages that are capable of designing, developing and improving processes and workflows. Software packages such as SMARTDRAW, BizAgi, etc. are all capable of designing workflows and even automating processes on the fly. Hence, ICTs can be evaluated in terms of how well they support process analysis and improvement functionality (Bizagi, 2014).
The parameters for assessing ICT capability to support process improvement initiatives are the same as business agility parameters. The only difference lies in the weightage allotted to each parameter.</td></tr>
<tr><td></td><td>Productivity</td><td>One of the key reasons behind ICT adoption is the improvement in productivity. Productivity here is defined as improving efficiency (achieving the maximum output with minimum input) and effectiveness (doing the right thing) of employees. Enterprise solutions such as Enterprise Resource Planning (ERP) packages and various functional systems such as CRM packages, SCM packages are designed to improve overall productivity of the workforce. Hence, by evaluating how well ICTs are able to improve efficiency and effectiveness, we are able to assess the overall productivity capability of an ICT.</td></tr>
<tr><td>Capability</td><td>Share</td><td>Although the overall capability of an organization is reflected by many sub-capabilities such as process optimization capability, leadership capability etc. Ultimately, it is about sharing knowledge capability gained from these different sub-capabilities. Therefore, sharing refers to leveraging existing capabilities, particularly knowledge capital, of the organization. ICT solutions such as Knowledge Management Systems (KMS) and Expert systems have tremendous capability in terms of capturing, codifying, and disseminating knowledge within the organization (Awad & Ghaziri, 2003). For example, SAP Business Engineering Centeris a prime example of how SAP is leveraging implementation expertise of SAP solutions to its global subsidiaries (Vinay, 2014).
The following parameters have been identified to evaluate how well the knowledge sharing capability is supported by a particular ICT. The parameters are based on the Knowledge Management Systems Development Life Cycle (KMSLC) (Awad & Ghaziri, 2003).
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Knowledge creation</td><td>Knowledge in an organization is created in many different context. Knowledge creation is generally a result of team performing a given task and gaining new knowledge from the performance of that task. This new knowledge is incorporated by the team the next time it executes a job (Awad & Ghaziri, 2003) (Choi & Lee, 2002). Here, ICTs capability to support knowledge creation is assessed based largely on collaborative support the ICT can provide.</td></tr>
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BMO Element	*Criteria*	*Description*
		Parameter / *Description*
		Knowledge acquisition: Knowledge can be acquired (captured) in multitude of ways. The most popular method for knowledge capture are interviews with experts, direct observation of expert performing a task and various other methods such as Delphi technique, Nominal Group technique (NGT) etc. Hence, ICTs can be evaluated on how well they support the knowledge capture process (Awad & Ghaziri, 2003).
		Knowledge codification: Knowledge codification refers to the process of transforming captured knowledge into a usable format that can then be disseminated and utilized within the organization. The outcomes of knowledge codification may be tables, charts, graphs, maps, directories, process flow charts, knowledge base etc. (Awad & Ghaziri, 2003). Hence, ICTs can be evaluated on how well they support the knowledge codification process.
		Knowledge storage: Not all knowledge outputs are paper based outputs. Most knowledge are transformed into knowledge base and expert solutions using knowledge heuristics such as Production Rules. (Kankanhalli, Tanudidjaja, Sutanto & Tan, 2003). Hence, ICTs can be evaluated on how well they support knowledge storage.
		Knowledge dissemination: The final aim of knowledge management systems is dissemination and use of that knowledge within the organization. Dissemination can take place in multitude of ways. One most popular method of knowledge dissemination is via the knowledge portal (Kankanhalli et. al., 2003). Hence, ICTs can be evaluated on how well they support knowledge dissemination.
	Source& Purchase	Many times businesses need to source and acquire capabilities from external third parties. For example, the Business Process Outsourcing (BPO) industry is based on having this capability (Source One Management Services, LLC, n.d.). Sourcing refers to seeking resource providers. The ability of firms to seek and locate preeminent quality expertise providers (in the form of raw materials, components and parts, services etc.) can be a source of competitive advantage. In today's networked economy organizations derive competitive advantage by creating networked ecosystems (internal and external). Such networked ecosystems primarily enable organizations to share, source and procure expertise from third parties. For example, consider the FedEx ecosystem consisting of hundreds and thousands of corporate and commercial clients. The FedEx provides the necessary tools for its customers to be part of the FedEx delivery network. Customers can track packages in real time and obtain precise location of packages as they are being delivered to their destinations (Bodine & Hagen, 2013). Likewise consider Ebay ecosystem that enables millions of buyers and sellers to meet, negotiate, and engage in business transactions (Partnering Resources, n.d.). Hence, ICT's can be evaluated on how well they can support sourcing and purchase activities.
	Collaborate	Capabilities are a result of collaboration and teamwork. Employees and other stakeholders must be able to collaborate on the performance of projects and tasks. Video conferencing, teleconferencing capabilities enable stakeholders to collaborate regardless of where they are physically located. Likewise online collaboration packages such as GoogleDocs, PbWiki, MS Share Point etc. provide excellent collaborative platforms for teams situated across geographic areas. Hence, ICTs can be evaluated in terms of how well they support collaboration.
Partnership	Facilitate	Facilitate here refers to collaborative capabilities offered by ICTs. Generally, partnerships are based on collaboration. Such collaboration are required for sharing of resources and activities. Today partnerships have acquired new heights. Gone are the days when manufacturers had to place order for parts and components via telephone or fax machines. Today internet has enabled collaboration beyond organizational boundaries (Cooke, Guha & Filsoof, 2013). Take for example ERP II solutions that extend beyond the organizational walls to mesh with the supplier information systems. Such collaboration have enabled organizations to move from JIT inventory to stockless inventory (Leon, 2014). Perhaps the best example of collaborative partnership is the evolution of the Software As A Service (SaaS) industry and the Cloud computing industry.

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<table>
<tr><th>BMO Element</th><th>Criteria</th><th>Description</th></tr>
<tr><td></td><td>Create</td><td>Many ICTs have the potential of creating new partnerships through shared data. For example, American Airlines and Citibank pioneered strategic partnership based on data sharing capability. Citibank being one of the largest banks in the US has millions of credit card users. By going into a strategic partnership with American Airlines where each Citibank customers can avail 'one mile for every dollar spent on the card' while flying with American Airlines (KonsynskiF & McFarlan, 1990). Since then plethora of such strategic partnerships have evolved. Konsynski and McFarlan have identified four different kinds of information partnerships: joint marketing partnerships, intraindustry partnerships, customer-supplier partnerships, and IT vendor-driven partnerships.
Hence, ICTs can be evaluated based on their ability to create partnerships through shared data and take advantage of scale opportunity.</td></tr>
<tr><td></td><td>Innovate</td><td>ICTs have different capabilities that enable organizations to innovate their existing partnerships. Recent developments in the ICT industry have given rise to different types of business models such as subscription based models, SaaS model, Cloud computing etc. These models offer unique opportunities for innovation. It is technically feasible (infact one of the key drivers behind technology adoption amongst small and micro enterprises) for companies to avail of IT products and services without them having to invest in technology hardware, building human resource capabilities, having inhouse IT teams etc. through subscription based models (IBM, 2009).
The following parameters have been identified to assess ICT innovation capabilities:
<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Cost reduction</td><td>Can the ICT help the organization reduce cost by engaging in partnership initiatives? Cost reduction can be achieved through joint marketing and promotion programs, research and development programs, channel sharing programs as in the case of FedEx. Alternately costs can be reduced through provision of IT services as in the case of SaaS model. Business customers are spared from making expensive and heavy on site hardware and software installments.</td></tr>
<tr><td>Risk reduction</td><td>Can the ICT help reduce risk to the business by engaging in partnership initiatives? Reverting back to our earlier SaaS example, other than cost overheads customers are also spared from maintenance and operation cost, up gradation cost, data back up and system failure costs. These are risks borne by the vendor.</td></tr>
<tr><td>Convenience</td><td>Can the ICT increase convenience for customers by engaging in partnership initiatives? Consider the grocery chain store that enters into a partnership program with e-commerce providers such that they are able to sell their produce online to local customers. Consider the PayTM cashless payment model where businesses can accept cashless payments from customers facilitated by PayTM vendor.</td></tr>
<tr><td>Flexibility</td><td>Does the ICT offer flexibility? Does the business incur heavy sunk costs? Customers of subscription based models have the utmost flexibility. If they are unsatisfied with the services of a particular vendor, they can easily cancel subscription.</td></tr>
</table></td></tr>
<tr><td>Cost</td><td>Cost structure</td><td>Cost is a very important consideration for organizations. Any investment by businesses must be evaluated in terms of cost and potential returns from the investment. ICT costs will vary widely. While setting up a web portal may not pose much of a challenge, adopting enterprise wide solutions such as ERP solutions, SCM solutions, Data mining capabilities carries significant cost for an organization. For ICT based solutions the major cost components can be divided into the following components:
Initial investment in information technology – this constitutes the hardware and the software costs
• Licensing costs
• Operational cost
• Maintenance and upgrade cost
In addition other cost components include
• Consultation costs
• Initial slowdown in productivity as employees adapt to the new system.
Network Alliance. (n.d.).</td></tr>
</table>

(*Contd...*)

BMO Element	Criteria	Description
Revenue	Earnings potential	Here ICTs are evaluated in terms of their earning potential. While some ICTs can directly generate revenues (such as online payment systems), many other ICTs do not directly generate revenues but nonetheless play a fundamental role in revenue generation indirectly through improved customer relationships, improved employee productivity, more agile manufacturing processes etc. In the latter case, organizations must develop key performance indicators to measure and quantify the earning from these systems. For example, while evaluating returns from ERP solutions, organizations use 'diagnostic measures' such as inventory turnover rate, number of back orders reduced etc. (Leon, 2014). Hence, ICTs can be measured in terms of earning potential.

4. CONCLUSION

Technology has permeated all industries. All businesses must adopt technological solutions in order to ensure their success. However, businesses are faced with one major challenge. How are they to evaluate and select technological solutions from the constantly changing technological landscape? The ICT Assessment Framework detailed in this paper is a holistic framework that enables businesses to assess how various technologies impact their business. It is based on Business Model Ontology– an ontology developed to specifically design business models. Hence, ICT solutions are evaluated by taking into consideration all aspects of a business. The aim of the framework is to ensure that businesses make the best choice and realize significant benefits from their IT investments.

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