Vincenzo Morabito

Business Technology Organization

Managing Digital Information Technology for Value Creation – The SIGMA Approach

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Foreword

Professor Vincenzo Morabito is a good friend and collaborator of mine. From the first time I met him I really liked his ideas for applied research and I was not surprised to find out that these ideas have been extremely useful for the business world. As Associate Professor at Bocconi University, Vincenzo Morabito has managed to turn rigorous academic research into relevant findings and valuable assets that any company would like to have. Indeed, this book is the results of the scientific activity that Vincenzo has carried out during the last 6 years. The scientific activity has used case studies, surveys and experimentations in active partnership with significant companies and corporations operating in Italy.

This book explains how to manage information technologies in creating business value and competitive advantage. The rapid changes that take place at the technological, organizational and global level have significantly affected the way that companies run their business. During the last decade those companies that have focused on their Information Technology (IT) infrastructure and combined it with innovative ideas or new business models have been successful. It is worth noting that four out of the five more profitable new organizations are worth billions of dollars (e.g. Google, Facebook). This value has been generated in less than a decade with their owners being the youngest and fastest who became billionaires in history. Google and Facebook manage the information that is produced by their information systems in a revolutionary way. They systematically invest on the information that is produced to achieve business value. Information systems' business value is associated with the impact of IT on parameters such as cost, productivity and organizational performance.

To this end, the book aims to analyze and explore the current literature on Information Technology's business value and the strategic use of information. A main goal of the book is also to provide practitioners with an academic-based framework for managing information for value creation in current business scenarios, characterized both by information growth and new dynamic digital business models. Thus, the book seeks to present a strategic tool for managing information as the core asset in the evolution of businesses toward a Business Technology Organization.

The book initially explores the linkages between strategic performance and IT business value. Then, it introduces the concept of information management and the relation between IT and information management, where information and the mechanisms for delivering it are the glue that hold together the structure of businesses. From an academic point of view, the book explores the normative literature on information management, and discusses three main approaches namely the (a) Information Operation Approach, (b) Information Orientation Approach and the (c) Information Evolution Approach:

- Information Operation Approach focuses on how information can be utilized by adding value through customers, reducing costs, minimizing risks, etc.,
- Information Orientation Approach deals with the capabilities and behaviors associated with effective and proficient use of information and
- Information Evolution Approach concentrates at different levels of potential maturity in the business use of information.

In this book, the goal of literature analysis is both at academic and managerial level and provides the theoretical foundation for an organizational *strategic information approach*. The strategic approach encompasses the three above stated approaches in a unified perspective, where IT organization absorptive capacity has a strategic role for business performance. The strategic approach is finally implemented through the Strategic Information Governance Modeling and Assessment (SIGMA) model and methodology that enables organizations to identify and take advantage of IT business value.

The book is a concrete and rigorous example of how scientific work can provide strategic tools for management and business in current digital competitive environment.

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In the second chapter issues related to information management are further analyzed. Initially the role of information as an organizational resource is explained followed by a discussion on information and information management. The need for managing information is presented and issues related to performance improvements, knowledge management and knowledge management practices are explained.

The third chapter moves a step forward and introduces the Information Operation Approach. This chapter explains that information is the responsibility of every manager and presents the Strategic Information Alignment Framework. Moreover it suggests ways to add value, reduce costs and minimize risks.

The Information Orientation Approach is presented in Chap. 4. The chapter goes through the information orientation model and explains issues related to the measurement and management of information capabilities. The chapter closes by explaining practical issues of information capabilities.

In Chap. 5 the Information Evolution Approach is discussed. Initially, the challenges to the existence of organizations are analyzed followed by a detailed presentation of the Information Evolution model and its levels namely operate, consolidate, integrate, optimize and innovate. The chapter closes by explaining the transition from level 1(operate) to 5 (innovate).

The next chapter presents the foundation for an information approach. In doing so, it clarifies how to build a foundation for strategy execution and it defines an organizational operational model. Thereafter, it analyzes the types and the dimensions of the organizational operational model and then it illustrates how to implement this model through enterprise architecture.

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The organizational absorptive capacity and the use of information is well described in Chap. 8. The chapter begins by analyzing the absorptive capacity and its mediation role and it highlights the importance of information systems integration and the significance of the organizational absorptive capacity. The chapter closes by identifying variables for information systems integration, absorptive capacity and business performance.

The last chapter builds on the top of the previous chapters and it introduces the Strategic Information Governance Modelling and Assessemnt (SIGMA) model. In this chapter, the main elements and parameters of the model are discussed and the SIGMA methodology is analyzed. Based on the SIGMA model and methodology a tool was created and presented. Through this tool organizations can identify IT business value and gain advantage.

I have watched how many of the firms and their senior IS executives have benefited from the ideas and frameworks presented in this book. I strongly believe that this book will have an impact in shaping business technology management practice. I congratulate Professor Morabito on completing this book.

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Part II

Part I

Chapter 1
The IT Business Value

Abstract The role of this chapter is to introduce the reader to the area of Information Technology (IT) business value. IT business value refers to the impact of information technology on the organizational performance and on parameters such as cost reduction and increased productivity among others. In this chapter the role of technology as a critical source of competitive advantage is analyzed. The critical role of IT is investigated and issues related to when IT matters and when IT does not matter are presented. In addition to these, the sources and the impact of IT business value and the association between strategic performance and IT business value is explored too. The last part of the chapter introduces the concept of information management and the relation between information technology and information management. Emphasis and further analysis on Information management is taking place in the following chapters beginning from Chap. 2.

Introduction

IT business value refers to the organizational performance impacts of information technology, including productivity enhancement, profitability improvement, cost reduction, inventory reduction and other measure of performance. Information technology may also contribute to the competitive advantage of the firm. Competitive advantage refers to a distinctive market positioning that allows the firm to obtain above-normal profits, compared to its competitors.

Competitive advantage is associated with uniqueness. When similar companies offer similar products, customers can easily switch their supplying to get the less expensive alternative available on the market as competitors have no choice than competing on price. Price competition, in turn, leads competitors' performance toward zero-profit equilibrium. On the contrary, uniqueness can shield a company against price competition, allowing the firm to get a premium price and a higher performance relative to its competitors.

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Firms differ in their resource endowments as unique resources shape the firm uniqueness. The IT resources may enhance the competitive advantage of the firm, to the extent that their uniqueness is embedded into a company's offering. However, in recent years the contribution of information technology to the competitive advantage of the firm has come into doubt.

A study by Brynjolfsson and Hitt in 1996 provided little evidence of IT impact on supernormal profitability. In particular, the benefits from companies' investments in IT seemed to be seized by customers. The research concluded that "firms are making the IT investments necessary to maintain competitive parity, but are not able to gain competitive advantage" (Hitt and Brynjolfsson 1996).

In another study on 47 major U.S. retail banks was found that the spending on IT capital had neither boosted productivity nor enhanced profitability, as measured by either return on assets or return on equity. They concluded that IT investments do not provide any competitive advantage and have insignificant effect on profitability. Reasons for these surprising results could be rooted in the very nature of the information technology resource.

The Dream Commodity

Technology is an important source of competitive advantage. Many companies along the history have conquered a dominant position on the market due to their technological innovations which served as a basis to gain extra rent.

All of these technologies share a common factor called proprietorship. Proprietary technologies are owned by a single company and are protected against imitation. As long as competitors find it difficult to replicate the new technology, the leader will be able to offer better products at higher prices, thus improving organizational performance relative to its competitors. Therefore, the fundamental characteristic of a proprietary technology is the inherent linkage between scarcity and value since the lower the number of potential users that have access to it, the higher its value.

Not all technologies are proprietary. Infrastructural technologies are technologies whose value increases with their diffusion. Their social value for the business community is so great that strong incentives lead to share them among many different actors.

Most network-based technologies are typical infrastructural technologies. During the history, the value of electricity power plant or railroad technologies increased as long as their technology became widespread among many different companies worldwide. As an example, the possibility of travelling worldwide increased the number of short distance travelling. As a consequence, the value of a localized railroad producer increased as the number of other companies, having access to the same technology, also increased worldwide.

Infrastructural technologies may originate as proprietary technologies. Its inventor has a consistent advantage in market competition. The firm owning the new

technology will benefit from superior performance over competitors, until forces leading to share it will push technology beyond the boundaries of the firm.

In the early stages of its spreading, some companies may still gain advantages from technology usage. The reason for this is that best practices and standards are not yet consolidated, and companies engage in trial-and-error experiments. Those companies that are most effective in pioneering new applications gain advantage over their competitors, and their performance will likely be above-the-average, at least until competitors will not be able to imitate the leader.

During years, an infrastructural technology is subjected to a continuous spreading over many users, losing its original proprietorship. Moreover, to facilitate its diffusion, technology experiences a process of commoditization, i.e., the original technology progressively loses its distinctiveness, and its technical characteristics conform to a universal common standard, which is recognized as the best practice by the many users on the market. Interestingly, the shared standard may not represent the optimal solution. On the contrary, it may be just a satisfying solution, since users may trade higher functionality for easier access and lower costs.

In sum, in the long run infrastructural technologies share a common fate as spreading out among operators and becoming an infrastructural, common base for competition among firms. No company will be able to gain particular, specific advantages from it.

A dilemma rests at the heart of information technology and raises questions such as:

- Is information technology an infrastructural technology?
- Is the fate of IT to become a shared technology, a common technological base allowing no more than support for operational efficiency?
- Has IT no potential to support strategic differentiation and superior performance?

The answers to these questions may be crucial to understand and foresee how IT may be used in a strategic context to strengthen the competitive advantage of the firm.

In recent years, IT developments seem to have shown a general trend towards commoditization of both hardware and software, which turns IT into an infrastructural technology. PCs were the first hardware components to suffer from commoditization. The battle among Dell Computer and Compaq Computer during the 1990 ended with the incorporation of Compaq into Hewlett-Packard and the increasing leadership of Dell Corp. Michael Capellas, at that time CEO of Compaq, well described the Dell's strategy: "Dell has made this a cost game". For his part, Michael Dell, founder and CEO of Dell Computer, had good reasons for such a choice, stating that "in the long run, all technologies tend toward low-costs standards" (Jones 2003). The Dell vision paid off in the long run.

A few key factors explain the PC commoditization. Given the high potential impact of PCs on efficiency of individual employee's ordinary activities, companies envisioned the opportunity to improve the overall firm efficiency through extensive purchase of PCs. Each employee could have one.

The huge amounts required to acquire a large number of PCs, led companies to save on investments and to target low-cost, standard products. The need to minimize costs related to PC usage, such as the training of the employees, also pushed companies to prefer easy-to-use, standard PCs, a strategy which further accelerated the move toward PCs commoditization. The need for PCs to both interact within local networks and rely on a shared operating system and microprocessor represented another incentive for companies to invest in standardized, low-cost PCs.

The server technology also followed the same pattern towards commoditization. In the early 1990s, the industry was dominated by a handful of producers, such as IBM, Sun, Hewlett-Packard, each of them offering a specialized technology. However, the opportunity to increase efficiency through standardization soon arose. Advancements in microchip technology allowed producers to standardize their offerings. Moreover, the scale economies stemming from purchasing standard solutions were huge and server buyers – once detected the opportunity – immediately changed their supply strategy, abandoning distinctive server technologies in favour of more standard solutions. As a consequence, standard, basic server solutions - using Intel chips and a version of the Windows operating system – spread over the enterprises. General Electric reported that new systems investments fell by 40% moving onto commodity hardware. Beyond GE, Amazon.com and Google represent some first movers in commoditization of server technologies. All of these companies share the same fundamental strategy by choosing cheaper Intel-based machines running Linux, instead of servers with proprietary chips and operating systems.

Storage and networking are also moving toward commoditization. In 2003 EMC and IBM disclosed their agreements to share competence, in order to improve interoperability of their equipment for production of storage products. An even stronger signal of future standardized production is offered by low-cost competitor Hitachi, which started to conquer increasing market shares offering standard technologies with open-source software. Networking technology is experiencing the same trend. In same lines with PC storage, the industry's leaders could well be on the verge of losing their proprietary grip on networking hardware. After spending years on R&D, many IT companies build instructions into networking chips that make available to any interested hardware maker. Not surprisingly, Dell Computer – the low cost competitor – is entering in all of these industries, offering the buyers low-cost standard solutions, i.e., the opportunity to get huge savings with more than acceptable IT performance.

There are three fundamental reasons leading to hardware commoditization. A first reason is technology in nature. IT value is related to the extent to which many users have access to it. Homogeneity in hardware technology facilitates higher degree of sharing among multiple different users and increases its value. Interconnectivity and interoperability become the key technological driving forces towards commoditization. At the centre of commoditization rests the common user, with his/her average knowledge in high tech. Leveraging on IT implies expanding hardware usability and standardizing technological tools. A second driving force

is related to the industry structure. Technological evolution both increases performance and reduces costs of standard products. Intel success is rooted mainly in the huge economies of scale stemming from production of large amounts of microchips. Economies of scale were so advantageous, that companies could not afford to make any different choice than acquiring standard products from external producers. The opportunity for production and sale of standard, low-cost products represents both a strong incentive for buyers to shift from distinctive technology to more standard solutions, and a threat for incumbents to be placed out by new entrants (such as Dell Computer) pursuing cost-based strategies. As a consequence, the structural characteristics of IT industry lead to progressive commoditization of hardware products.

The third determinant of hardware commoditization is related to the *Overshooting Phenomenon*. This phenomenon is defined as the process by which the performance of a technology product exceeds the need of most users, shifting buyer's preference from distinctive to cheaper solutions. In sum, technology suppliers compete on satisfying their most demanding customers, adding new sophisticated solutions to their products. However, each new generation of technological products overshoots the need of some customers. These buyers often respond by switching to cheaper versions of the same product provided by other suppliers. Eventually, as the technology continues to advance, the performance of the cheaper versions comes to satisfy the needs of most customers, and the basis for competition shifts from specifications to prices.

Differently from hardware, software reveals an almost unlimited potential for innovation. In principle, there are no limits to innovate software solutions as opportunities for distinctiveness arise continuously. However, looking at the economics of software production reveals the same trend toward commodity. Software delivery entails two different stages: (a) a design/production stage, and (b) a reproduction/distribution stage. The first stage calls for huge investments, since creating a program is very expensive in terms of skilled employees, time, planning, coordination, testing, patent protection. As it is costly to write a program, so it is cheap to reproduce and distribute it to many different users. Compared to companies producing in-house software, specialized software houses can spread out their huge initial investments on many different users, reducing the price of their products.

In recent years, companies found convenient to acquire standard software from outside producers, rather than recurring to proprietary, in-house software solutions. The once in-house made software was substituted by products realized by external producers, already in the early stages of industry life cycle. The savings from purchasing of external standard products were so huge, to outplace the benefits stemming from proprietary software.

The spreading out of PCs during the 1980s, accelerated the process towards the commoditization of software packages. The huge investments in PCs made by a single company, enhanced the pressures toward purchase of standard software solutions and saving on IT costs. Moreover, the larger number of PC users increased the need for easy-to-use, standard software packages, shifting the interest of buyers

from distinctiveness to simplicity and standardization. Finally, the need to install software that could enhance networking and communications among external PCs, further increased the recurrence to standardized software.

Commoditization involved also the more sophisticated ERP system. The launching of the first ERP package by SAP in the 1990s, illuminated the industry need for an integrated enterprise software, which could integrate all of the fragmented existing software that had been acquired during years. Through ERP systems, managers could gain a clear view of how their firm behave and perform.

Tailor-made solutions of ERP systems soon left place to more standard packages, as it became apparent that customized software was rarely worth the effort and the costs needed. As a consequence, buyers increasingly chose to acquire and use default configurations. Moreover, vendors' offerings aligned to standard best practices, determining a commoditization of the ERP systems available on the market. As a result, at the end of the 1990s, customers could not find 5 % difference among SAP, PeopleSoft and ORACLE.

Looking at the underlying forces that drive software production towards commoditization, one find out the same fundamental factors that characterize the commoditization of hardware.

Interconnectivity, interoperability and integration play a major role in software commoditization. The fundamental functionality of software packages is to interconnect many different users as its value is enhanced by widespread diffusion of standard solutions. As the example of PCs diffusion underlines, software package standardization was driven by the need to assure a common language enabling many different users to communicate to each other.

As it happened for the commoditization of hardware, the huge economies of scale of external, specialized production plays a fundamental role in software commoditization. The main source of software house performance is amortization of development costs, obtained through maximization of sales of standard products. The huge initial investments need to be spread out over the maximum number of users. Similarly, when it comes to ERP systems, the integrated enterprise solutions could only come from outside vendors able to spread their development costs over many clients.

Both in specific software packages and in ERP systems, buyers soon realized that the savings from the purchase of standard products from external vendors would significantly outweigh the losses stemming from giving up a distinctive, proprietary solution. Users progressively shifted from distinctive in-house production to external, standard and more effective software, improving both performance and cost savings.

Furthermore, software is also prone to the 'overshooting' phenomenon. Vendors usually offer upgrading solutions to stimulate their demands. However, increasing levels of sophistication and continuous advancements towards empowered functionalities may lead to overshoot actual users' expectations, to the point that these users may not willing to pay higher prices for products exceeding their needs. Overshooting opens the door to cheap, commodity versions of extant software applications. The increasing use of open-source software can be interpreted as a

consequence of the overshooting phenomenon. Open source applications tend to be rudimental in their earlier versions. However, as their user base grows steadily, they also become more widespread and standardized. In this respect, the Internet has greatly favoured the commoditization of software packages, encouraging programmers around the world to collaborate on open-source projects.

The latest frontier of commoditization refers to Service Oriented Architecture (SOA) and cloud computing. Service Oriented Architecture and cloud computing differs from both hardware and software in that they encompass how both hardware and software are meld together. These architectures are promising for business as they seek to integrate existing software and hardware infrastructures. SOA may allow a company to easily integrate its legacy systems. In addition, a company would be able to quickly reconfigure its IT systems by automatically downloading applications from outside suppliers. Emerging trends show the increasing role of vendors on the SOA and cloud computing market. Most innovations come from vendors, and buyers are waiting for standard packages rather than developing in-house proprietary solutions. Again, the future of IT seems to leave no space for differentiated, distinctive and proprietary technological innovations.

When IT Does not Matter

Information technology seems to share all the typical characteristics of infrastructural technologies. During the last decades, it has become more and more widespread and standardized. If information technology is to be considered as an infrastructural technology, then it can hardly support a sustainable competitive advantage.

As information technology matures, it loses much of its potential for competitive advantage, ending up as a standard input that all companies can easily access to on the market. Therefore, it cannot serve as a basis for differentiation among firms. On the contrary, competitors become similar as long as each of them is equipped with the same standard technological inputs and their performance converges. A typical example of this is the use of ERP systems.

In recent years, several events signal the decreasing influence of information technology on firm distinctiveness. First of all, for long time information technology has been a clear source of competitive advantage. In the earlier stages of information technology life cycle, several companies built up their differentiation by developing new IT functionalities and pioneering their alternative applications to the business. It took years for competitors to recover the gap that these pioneers had established. The wide temporal lag allowed the first mover to recover the initial huge investment in information technology and to establish a dominant position on the market. The dominant position, in turn, helped leaders to build structural barriers to competition, such as size (i.e., economies of scale) or a well known brand. Information technology had been a source of competitive advantage for these firms.

However, in recent years, the time needed for the followers to bridge these gaps in IT pioneering investments has become shorter and shorter. Time is crucial and the more time it takes followers to address competition the less power and market share they have. For that reason they focus on catching up with competition as soon as possible. In doing so, followers tend to copy a new technology (technology replication cycle) the sooner they can. The history of IT reveals that the technology replication cycle gets shorter and shorter.

Companies might choose to invest and build a competitive advantage based on IT. However, the high investments and, especially, the fast replication by competitors would make an IT-based competitive advantage to vanish quickly, leaving no time to recover the initial investment. In such a context, structural competitive forces prevent firms from building any competitive advantage on IT. First of all, external vendors realize significant specialization and economies of scale and, as a consequence, internal proprietary innovations in IT would be simply too expensive to be worth the effort. Secondly, fast replication by competitors would erase any possibility to recover the initial, huge investment.

In the IT industry, the follower position is advantageous compared to the first mover position. The first movers (i.e., the technological pioneers) support all the costs and the risks, and have low chances to build a sustainable competitive advantage and recover the initial investment. On the contrary, the followers get all the advantages and support relatively low costs, since they will benefit from the experiences and the best practices realized by the leader, minimize their investments and invest only once the new application has proved to be effective, limiting the risks related on new, uncertain investments.

In sum, the shortening of the replication life-cycle prevent companies from building their distinctiveness on information technology. All companies will naturally converge on low-cost, standard IT provided on the free market by external, specialized vendors.

An even more dramatic effect of IT commoditization is related to the homogenization of internal processes among firms, induced by IT supplying. Not only firms will converge on standardized information technology solutions, but standard solutions also lead competitors to standardize the way IT is used within the firm context, to standardize their managerial practices.

As a matter of fact, investments on information technology also induce a change in a company's internal processes, since employees behaviour need to interact with extant information technology. In recent years, competition among software houses is shifting from technical content to managerial best practices incorporated within the software package. Their objective is to incorporate the most advanced business practices within their software. This phenomenon is particularly evident for software makers producing ERP systems as their activity has progressively shifted from automating specific activity, to automate entire firm processes.

For one part, each firm is able to implement best practices consolidated in the business arena, by buying the software at a relatively low cost from external vendors. However, at the same time the software impose constraints on the process, since it determines how the process is carried out. In the past, companies investing

in information technology would first decide the business architecture, and then would choose a software package to support their proprietary process. However, in recent years, software has become the driver of internal firm architecture. The business often must be modified to fit the system.

This phenomenon further reduces the space for a company to distinguish itself from competitors on an IT basis. Companies are more and more similar as a consequence of ERP systems implementations, IT commoditization is inducing even more homogenization among competitors.

The underlying reason is the trade off between cost savings stemming from purchasing a standardized products and differentiation advantages of a customize home-made IT resource. And cost savings more often come to outweigh the differentiation advantages.

In sum in recent years we are observing a general trend from IT commoditization to a sort of competitor commoditization, a process by which managerial practices become standardized and converge upon common best practices accepted in the business arena.

So, What

Looking at IT as an infrastructural technology reveals how it cannot serve as a basis to build a competitive advantage and gain an above-the-average performance. Moreover, the pervasive use of standard IT in firm processes is driving companies toward homogeneity. The more companies adopt similar systems the more best practices turn into universal practices.

A study documented how the adoption of an ERP package within a multinational company produced convergence of performance over many different indicators. For instance, once the ERP systems had been implemented, differences in lead times among business units located in North America, Europe and Asia suddenly disappeared, and all converged towards the same performance (between 27 and 29 days).

IT is reducing the possibility for above-the-average performance, rather than supporting companies to achieve a competitive advantage. Overall, IT and process commoditization pushes companies towards competitive parity, rather than competitive advantage.

In his paper on the Internet, Porter clearly stated how IT may challenge the opportunity for reaching superior performance: “The great paradox of the Internet is that its very benefits – making information available; reducing the difficulty of purchasing, marketing and distribution; allowing buyers and sellers to find and transact business with one another more easily – also make it more difficult for companies to capture those benefits as profits” (Porter 2001).

From this perspective, IT is becoming an even less critical resource, and prescriptions for IT managers de-emphasize investments in IT. However, in order to get a clearer picture on how IT may influence the conquering of a competitive

advantage, one needs to look more closely to business strategy and its relationship with IT.

Business strategy entails choices related to firm positioning on the competitive arena. It differs from tactical initiatives in that whereas tactical initiatives implies higher levels of efficiency/effectiveness in how specific activities or processes are carried out, strategic initiatives – in their deepest meaning – entails the set up of a completely different bundle of activities and processes. For example, IKEA reached its competitive advantage redefining completely the set of activities that a furnishing producer was supposed to provide to its customers. Its unique and distinctive offering was valuable for customers, but its offering is based on completely different value chain architecture. Companies achieving a competitive advantage all base their uniqueness on a distinctive multiple set of activities, not simply on how a specific standard process is carried out. They do not base their competitive advantage on IT basis. On the contrary, their competitive advantage is based on a broader and interrelated set of activities, processes, knowledge, culture, and on a richer set of interrelated resources.

A competitive advantage lay in a complex, tightly integrated and difficult-to-copy combination of processes and activities, and the use of a complex, integrated set of resources, including the information technology.

Homogenization of IT and processes is likely to bring to parity in operating, tactical processes. Commoditization of IT and the related standardization of key firm processes have probably limited the potential sources of competitive advantage, making more difficult for a firm to reach an IT-based superior market positioning. However, the pursuing of competitive advantage has become even more important as IT and operating processes converge to a common shared standard of best practices.

By no means have these trends toward commoditization implied the end of searching for competitive advantage. Commoditization of IT and homogenization of operating processes impose new strategic challenges for companies. In a first instance, company's flexibility and agility are becoming even more important for business success. In a competitive environment (Sambamurthy 2003), company success, and even its survival, rests on its ability to anticipate future trends and to re-define its business architecture through changes in offerings and internal processes.

Sustainable competitive advantage needs to be accompanied by a new concept called the leverageable competitive advantage. Leverageable competitive advantage is defined as a privileged market position that, provides a stepping stone to another privileged position. It can be considered as a way station and not as a destination. But like a sustainable advantage, a leverageable advantage is a manifestation of deep and disciplined strategic thinking. It can be considered as deliberate move that build on the past and prepares for the future. Apple Computer is a clear example of how a company may leverage on its original sources of sustainable advantage (e.g., design competence, integration between hardware and software, a strong and well known brand, innovation) to pursue strategic renewal.

When looking at current trends of commoditization in both IT and firm processes, one may infer that the less dynamic firms are the ones that get the most

benefits from commoditization. They easily acquire both standard technology and best practices from the external providers. Therefore, commoditization is bringing most companies to the highest levels of performance in both a critical input such as the IT and the way processes are carried out. However, such improvements are more related to operating effectiveness and efficiency, rather than to market positioning and to building of an interrelated, difficult-to-copy set of resources. Opportunities for differentiation still exist.

In sum, information technology, by itself, cannot be a source of competitive advantage, as long as standard solutions dominate the market. Moreover, homogeneity of internal processes makes it more difficult to build a competitive advantage. However, both the IT and the process trends reveal the very nature of strategy. Companies purchasing external technologies and best practices are improving their operating efficiency, not defying a sustainable competitive position. The challenge for pursuing competitive advantage is still on the desk. And information technology may still play a role as a key complementary resource.

The Sources and the Impacts of IT Business Value

In order to understand how information technology may improve firm performance, one needs to get a clear picture of IT as a firm resource, and to identify how it is embedded within other firm resources (Melville et al. 2004).

The IT firm resource includes both the Technological IT Resource (TIR) and the Human IT Resource (HIR). The technological IT resource includes both hardware and software. It can be further categorized into: (a) IT infrastructure, i.e., shared technology and technology services across the organization, and (b) specific business applications that utilize the infrastructure, i.e., purchasing systems, sales analysis tool and so on. The technological IT resource refers to the physical technology of the firm. The human IT resource refers to firm's human capital and it includes both technical and managerial knowledge. Technical knowledge, in turn, includes application development, integration of multiple systems, maintenance of existing systems. Managerial knowledge refers to the ability to identify appropriate projects, marshal adequate resources, and lead and motivate development teams to complete projects according to specification and within time and budgetary constraints. It is important to note that the Human IT Resource may be associated with the entire technological infrastructure of the organization or may reside locally within business units.

Beyond the IT resource, the firm resource endowments include also complementary organizational resources. Complementary organizational resources are those resources that – together with the IT resource – jointly generate synergies and create value. Complementary organizational resources include non-IT physical resources, non-IT human resources, and other organizational resources such as organizational structure, policies and rules, workplace practices, culture and so on.

Both the IT resource and the complementary organizational resources apply to business processes. Applying IT resources and complementary organizational resources to firm processes may lead to performance improvements. Performance improvements can be measured for both single processes (business process performance) and the entire organization (organizational performance).

Two different levels of performance exist: (a) the operational performance and (b) the strategic performance. *Operational Performance* relates to efficiency or effectiveness improvements stemming from how firm processes are carried out. Operational performance is often associated to single processes improvements, and it includes quality improvements, customer satisfaction, flexibility, inventory management, time to market. Operational performance may also be associated with organizational performance, i.e., improvements for the entire organization, including productivity, efficiency and profitability. The adoption of best practice may lead to operational performance. For example, the increase of product quality or the reduction of production rejects, all represent improvements of the operational performance, which may be gained through adoption of best practices.

Strategic Performance is defined as superior firm performance compared to average industry performance, and it is related to the attainment of a competitive advantage. Competitive advantage may be temporary or sustainable. In both cases, the measure of performance relates to the entire organization. Moreover, it is a relative measure of performance, i.e., performance compared to competitors. Improvements in strategic performance entails changes in firm positioning on the market, and it may require dramatic changes in the firm architecture. At a minimum strategic performance may require structural changes in the way the firm uses its resources and in the way it is organized. IT business value should be valued at both the operational and the strategic firm performance.

The IT Business Value for Operational Performance

Published studies examine how information technology may improve operational performance. It has been proved that the technological IT resource may improve business value within computerized reservation systems and ATM networks. Other studies have documented how the implementation of technological IT resources impact on cost reduction, whether in the context of production data management system in the clothing industry, in the context of supply chain management in the food industry, or within the jewelry appraisal processes. Moreover, it has been proved that the adoption of innovative IT and transaction processing systems positively influence operational performance. Human IT resources also positively influence operational performance. For example, it has been proved that enhancement of human IT resource improve operational efficiency.

All of these studies show how IT leads to improvements of operational performance. IT allows improving specific company processes, increasing their efficiency and/or effectiveness. These improvements stem from effective redesigning of

process architecture, better coordination among separate departments and offices, identification of weaknesses along the chain of activities, minimization of errors through automatic processing, early detection of errors and so on. In particular, the adoption of ERP systems allows a single company to benefit from best practices consolidated in the industry. Companies may gain significant improvements in their operational performance as investments in IT may result in cost efficiency and or better quality products, which in turn may boost the overall financial performance.

Operational performance is not a secondary objective. Even thought pursuing of strategic performance, i.e., competitive advantage, remains at the top of every firm's priorities, operational performance is still worth consideration.

First of all, investments in IT may result in dramatic improvements of operational performance for those firms which are late on the path toward managerial best practices. Secondly, the achievement of operational performance may be considered as a prerequisite for conquering of superior improvements in strategic performance. Aspirations to competitive advantage are first tested in the context of operational performance as companies not able to improve operational performance, will hardly be able to realize the more radical organizational changes required to achieve a competitive advantage. Finally, given the increasing competition in many contemporary industries, operational performance is becoming a necessary condition for survival. Commoditization of ERP systems has made access to best practices easier and cheaper, leading to increasing homogeneity among firms. The spreading out of ERP systems push all the companies to invest in these systems to reach the minimum standards required to compete on the market. A company not willing to maximize operational performance may be placed out of the competitive arena in the long run. In sum, not only commoditization of ERP systems and best practices lead to increasing homogeneity among firm processes. Firms have no choice but investing in ERP systems in order to keep pace with competitors.

Pursuing operational performance is not an easy job as:

- It entails identifying key processes within the firms (i.e., those processes that significantly influence organizational outcome, or those having the higher potential for operational improvements)
- Defining the ultimate process objective and the key performance process indicators
- Redesigning the process flow
- Training employees
- Integrating IT resources within the process

Organizational inertia may characterize initiatives aimed at improving how processes are carried out within the firm. Such initiatives should be taken considering the cost – benefit trade off. Investments should be recovered in subsequent years from the expected economic benefits stemming from smooth and efficiently redesigned processes. It is important to note how industry structure may significantly impact on the possibility for a focal firm to recover its investments on operational performance. Highly competitive industries push competitors to

immediately transfer value improvements to customers, making it more difficult to gain a significant return on IT investments.

However, one should take into account not only the economic pay-off of such initiatives. On the contrary, one should incorporate also the organizational costs that such initiatives brings about and, more importantly, the competitive implications – in the long run – of not aligning the firm to the best practices spreading out within the competitive arena.

IT Business Value for Strategic Performance

The linkage between IT and strategic performance is under closer scrutiny among researchers (Luftman and Kempaiah 2007). Several studies have shown how the IT resource may enhance the strategic performance of the firm (Melville et al. 2004 and Sambamurthy 2000). One approach to assess the influence of IT on strategic performance entails measuring the extent to which strategic information technology systems and firm performance are associated. An empirical study has shown that stock market reacts positively to announcements that firms are using strategic information systems. More importantly, in the years following the announcement, these firms are more productive and more profitable than their competitors. Other studies have shown that firm making investments in strategic information systems achieve competitive advantage, and that their established technology base represents an important source of sustainability.

There is also some empirical evidence that human IT resources are valuable and contribute to development of competitive advantage. Achieving competitive advantage represents the most desirable objective for a firm. It entails conquering a unique market position, based on a unique set of activities and of difficult-to-imitate resources. The general achievement of a competitive advantage needs to be disentangled into its specific components. For a manufacturing firm, the strategic performance of the firm may be disaggregated into three different strategic objectives: (a) cost reduction, (b) quality improvement and (c) revenue-growth.

Information technology may support competitive advantage for each of these strategic objectives. For example, it may support product and service differentiation or the innovation rate. In order for a company to leverage on IT and build a competitive advantage, it must identify the key processes and the business process capabilities, i.e. the key, distinctive capability that the organization needs to develop within a critical process. Business process capabilities include, as an example, innovation, efficiency, flexibility.

Information technology may support the development of business process capabilities. However, the degree to which it can enhance the business capability and support a competitive advantage, depends upon its contribution to create a unique bundle of difficult-to-imitate resources.

In order for a resource to confer a sustainable competitive advantage, it must be valuable, rare (i.e. few firms have access to it), competitors do not know what

factors lead to success and what to imitate – and there must be no readily available substitutes. In sum, the four conditions necessary for a resource to confer a sustainable competitive advantage are value, rareness, inimitability and non-substitutability.

Specific resources examined in the literature include entrepreneurship, culture, routines, invisible assets, human resources. These resources are those factors that sustain differences among competitors, and support performance gaps in the long run. Different performance among competitors ultimately rest on differences in their resource endowments. Superior performance in the long run is supported by proprietary resources which are valuable, rare, and difficult to imitate and to be substituted.

Valuable and rare resources confer only a temporary advantage, since other competitors will soon replicate the leader's set of resources. Therefore, performance gaps will be soon or later fulfilled. However, as long as the followers experience difficulties to imitate or substitute these resources, and long time is needed to complete the replication process, temporary advantages may be significant and valuable, since the firm may get significant return on the initial investments.

Notwithstanding the extant empirical research on the IT strategic business value, the causal relationships that allow the information technology to confer a competitive advantage are still unclear. Some scholars argue that only managerial IT expertise confers a competitive advantage. Since the technological IT resource and the technical-human IT resource are imitable, these latter resource may confer only a temporary advantage. However, with the increasing maturity and institutionalization of IT service markets, even these managerial and technical competence can be sourced externally. Therefore, in order to get resources difficult to imitate and to be substituted, a company should not develop technological IT resources or human IT resources by itself. Nor the technological IT resource neither the human IT resource confers a competitive advantage by itself, since each is subjected to strong imitative processes. Competitive advantage may result from a unique combination of both technological and human IT resources. Even if strong incentives do exist for a firm to completely externalize purchase of ERP systems and acquire the consolidated best practices, a possibility still exist to shape internal business processes and differentiate internal practices compared to competitors' ones.

Complementary organizational resources may further strengthen the achievement of competitive advantage. Managing teams of IT and non-IT resources together may generate greater value than they can do separately. Published studies have shown that IT resources are associated to non-IT resources. Association of IT and non-IT resources establishes a unique organizational context that allow superior performance in the long run. In particular, extensive use of IT resources is associated with team work practices, decentralization and wider breadth of job responsibilities. The association among these factors leads to higher market valuations. Culture is another resource that may lead to the achievement of a competitive advantage. In the retail industry, it has been shown that complementarities between IT and other human and business resources such as culture lead to