# Information Technology – The 21$^{st}$ Century Business Value Driver

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## Abstract

*One of the most important changes of the 21$^{st}$ century, an information-driven century, is the shift in the paradigm of managing and understanding businesses. Economic value has become more and more difficult to define and understand when looking through the perspective of the information age. The information age has brought information technology "into the spotlight" and transformed some of the classical economics concepts. The qualitative research for this paper has shown that "Information Technology" is a solid 21$^{st}$-century knowledge-based organization and economic- and business-value driver that business organizations have to capitalize in order to achieve Porter's business margin. The paper demonstrates that information technology as a business activity is not only a clerical activity, it has morphed to knowledge based organization and a value driver for the business organizations of the information age.*

**Key words:** economic value, information technology, knowledge-based organization
**J.E.L. classification:** M00, D46, D83

## 1. Introduction

Technology is defined by Porter's value chain model as being part of the secondary activities, that are supporting the business through their contribution to the achievement of margin, the business success factor.

Technology can be defined and understood as follows:

- ✓ "The application of scientific knowledge for practical purposes, especially in industry. Machinery and devices developed from scientific knowledge." (Oxford University Press, 2017)
- ✓ "The practical application of knowledge especially in an area. A capability is given by the practical application of knowledge " (Merriam-Webster, 2017)

Technology can be understood as being the practical application of existing knowledge and information for the creation of machines and devices that support a sustainable and consistent improvement of existing processes, machines and devices.

Technology has been the main driver for development, evolution, and innovation of existing living conditions. The main supporters of technology have been the operation business organizations that have been looking for ways to improve, increase efficiency and succeed. Technology has been the force that enabled the leaps and development of human society. Therefore, technology has accompanied humanity from the very first stages of evolution.

In the context of this research, information technology will be used as a sub-branch of technology as being one of the main innovation factors of existing business organizations of the 21$^{st}$ century, a century driven mainly by the creation, usage, and storage of data, information, and knowledge. Information technology, also known as IT, is an integral part of the today's 21$^{st}$-century modern business organizations that must cope, manage and select business relevant information for their usage out of a huge available volume of data, information, and knowledge to be able to maintain and potentially gain more sustainable competitive advantage.

OxfordReference.com is defining information technology as being "the study or use of computers, telecommunication systems, and other devices for storing, retrieving, and transmitting information" (Oxford University Press, 2017). Merriam-Webster Dictionary is defining information technology as being "the technology involving the development, maintenance, and use of computer systems, software, and networks for the processing and distribution of data." (Merriam-Webster, 2017)

The definitions describe the generic role and scope of information technology within business organizations that used IT as an additional mean in their competition for sustainable business advantages.

## 2. Theoretical background

The 21st century is also commonly known as the information age has come with a lot of technological changes and developments. Besides the many technological developments and breakthroughs, the information age has come also with a major change in business philosophy and management. The information age has transformed the once clerical number processing activity to a potential definitive competitive advantage where data, information, and knowledge are put into the economic and business "spotlight".

Porter, in his value chain concept, has defined technology as support activities that leverage the primary activities towards the achievement of the ultimate goal of any business organization, the achievement of the business margin. Information technology is included in the technology category of Porter's value chain concept and is supporting the business organization. The present paper shows that the 21st-century information age information technology is doing much more than just supporting the primary activities. Information technology leverages and drives the primary activities by beeing one of the businesses knowledge-based organization that is creating economic value that any company can use to grow and succeed in the modern business environment.

The information age, in the $21^{st}$ century, has become much more than a "simple support activity", it includes and illustrates all characteristics of a knowledge-based organization that is creating economic value for its users or beneficiaries.

## 3. Research methodology

The main research methodology used for this paper is qualitative research. Direct free discussions, unstructured interviews, and observations gave very important and insightful facts and findings. The analysis of publications published articles and social and professional media and networks have supported the findings and conclusions of the present paper. Quantitative data have been used only for the indication of perception of the business environment of business support services that support the main objective of the research paper.

## 4. Dawn of information technology

Based on the storage and processing technologies used there are 4 IT development stages identified, pre-mechanical stage (3000 BC – 1450 AD), mechanical stage (1450 – 1840), electromechanical stage (1840 – 1940) and electronic stage (1940 – present).

Each of the development stages has been marked by scientific and technological breakthroughs that have changed the way things have been done previously.

Information technology and information have accompanied human development from the very early stage of existence and progress. Since the beginning, humans have communicated and passed on data, information and knowledge through the means existing and used at the time.

The pre-mechanical stage (3000BC – 1450AD) is the oldest and $1^{st}$ **stage** of development of information technology and dates to the first petroglyphs found in caves. During this development stage the Sumerians, through cuneiforms, have used their form of writing and storage of data and information. In Europe, Greeks have developed the Phoenician symbols that have been picked up and introduced by Romans what is known today as the roman alphabet as a means to transmit data and information. The Chinese have introduced and developed the basics of today's paper that are a

development of the Egyptian papyrus rolls and serve the storage aspect of information technology. Also during this stage, the first basic analog calculator, the abacus, was introduced that has been based on the early numeration systems. The abacus is one of the first documented tools used for data processing.

During the **2<sup>nd</sup> stage**, the mechanical stage, information technology has developed driven by leaps in science and technology. Gutenberg has invented and introduced the printed press that was a big step from the hand-written books and documents of the time. The slide rule of William Oughtred, Pascal's Pascaline, Leibniz's Machine, and Babbage's Engines have raised the bar in understanding and using more complex machines for data processing. The punch card system was introduced by Joseph Marie Jacquard as being the first real-time programs for the operation of machines.

The **3<sup>rd</sup> stage**, the electromechanical stage, is picking up a lot of the earlier discoveries and refining them through the usage of more modern and actual technologies. During the time (1840 - 1940) the handling and management of electricity have changed the way the world was handling and doing things. The introduction of the voltaic battery, the telegraph, the Morse code, Bell's telephone, and radio and Marconi's early "radio" communication have set the foundation of the modern telecommunication technology. During this stage, Hollerith introduced the census machine that used an early form of punch-cards. IBM (International Business Machines) introduces the MARK 1 computer that was using paper taped stored data and instructions.

The biggest evolutionary leaps, regarding information technology, have been made during the **4<sup>th</sup> stage**, the electronic stage (1940 – present). During this time the electronic vacuum tube has made further developments possible and represented the first migration towards today's digital data processing technologies. Soon after the introduction of the electronic vacuum tubes, transistors by using semiconductors and integrated circuits have driven electronic data processing. Alongside the hardware development also the software development has made electronic data processing machines, also known today as computers, more affordable and accessible. The information revolution started in 1990, has enabled a large-scale acceptance and usage of hardware and software. Companies like Microsoft, Apple, Intel have made their mark and established themselves as world-leading information technology companies. Driven by the refinement of software, information got more accessible and affordable. The world-wide-web, the internet, and the smart devices have made information the prime "commodity" of the 21<sup>st</sup> century, where more and more complex technologies emerge and evolve on the hardware and software side.

The massive amounts of data and information that are generated by require more and more processing power, abilities and speed in transmission. The information revolution has changed *classical* concepts and so will information technology, it will transform and innovate *conventional concept*s in all areas of human society. The usage of artificial intelligence will become more and more accessible and reliable for human society the same way that electronic vacuum tubes have been integrated into the development of information technology.

## 5. IT as a corporate knowledge-based organization

"Organizations will increasingly be regarded as joint human-computer knowledge processing systems. A knowledge-based organization is a society of knowledge workers who are interconnected by a computerized infrastructure." (Holsapple & Whinston, 1987, p. 1)

IT is the organization that enables and assures that the business organization can create processes and store data and information. Based on the Knowledge-Based Organization definition from Holsapple & Whinston the future human society is based on interconnected human knowledge workers that must cope and deal with an increasing volume and complexity of data and information. This can only be assured by the usage of the best possible combination of hardware and software that are maintained, managed and improved by the business organization IT as an important part of making a business work.

In a business environment that is constantly evolving, changing and reacting to current market conditions the business function that is taking care of data and information availability and relevance is the IT function.

Speed is one major factor has impacted information technology massively. In an information society, data and information tend to become obsolete very quickly, consequently, the management of data and information needs to be performed accurately and in due time by the business organizations in order to make the most of the newly acquired information.

The involved staff in managing the IT function must find the best suitable and adequate solution to deploy and maintain a software and hardware business environment that meets the specific needs of the specific business organization. The deployed systems need to reflect the specificity of the business organizations that enables the maximum leverage of obtainable and insurable competitive advantages.

The sustainable competitive advantage can be obtained only by the acquisition, implementation, and deployment of unique software and hardware systems. In the case of IT, the uniqueness of implemented and managed systems is created by skilled, knowledgeable professionals that understand the specific business requirements that are paired with the best available and suitable software and hardware systems.

The continuous and quick development of information technology is the case per se for a *by the book* knowledge organization. There are the tech professionals, the knowledge workers, employed by business organizations that analyze, improve and develop existing systems and deploy new ones that meet the perspective business needs to be defined by the evolving business strategic and operational plans. The created unique solution represents, in the context of the knowledge organization, the created knowledge that is used and exchanged within the business organization.

The rapid development and obsolesce of software and hardware systems transformed some of the IT services into commoditized *yesterday's news*, email, web presence, general acceptance and usage of computers are part of the today's and of the 21$^{st}$-century business requirements.

*Smart* devices and their usage is the new challenge of business organizations, the development of data and information-driven systems that are maintained and managed without human intervention need the utmost involved knowledge.

The 21$^{st}$ century IT systems tend to reflect the new challenges of business organizations that need more and more reliable and accurate data and information. The full-scale implementation and roll-out of artificial intelligence is the next step in IT development. The IT function is getting more and more involved in business actions by making use of specific knowledge and deploying it into the business organization.

The business organization can be regarded as a *classical* learning organization, IT professionals need to permanently learn and stay up to date with the latest technologies. The learning ability and need is an additional attribute of the knowledge-based organization; new knowledge is acquired through the learning of new technologies and applications of the software and hardware ecosystem.

The corporate business IT function and organization are providing to the modern business organizations the tools and systems that it needs to achieve the needed sustainable competitive advantage. The existing systems are maintained, managed and updated based on rapidly changing market requirements by trained, skilled knowledge workers that create and adjust IT business systems that support business knowledge usage, sharing and communication.

The information revolution has started the battle for human intelligence that can develop more and more complex business systems.

"The firm is conceptualized as an institution for integrating knowledge. In contrast to earlier literature, knowledge is viewed as residing within the individual, and the primary role of the organization is knowledge application rather than knowledge creation." (Grant, 1996, p. 1)

## 6. IT as a business value driver

Modern Information Technology provides the business organization the ability to act and react to rapidly changing business market requirements.

Innovation and productivity increase are the foundation of business organizations' competitiveness and profitability that is enabled by information technology development and rapid adoption.

"Without sophisticated IT systems, it would be impossible to create value chains that extend around the world. High-end hardware, upgradable software and global networks have given rise to the evolution of entire industries, the digitalization of virtually every business process and the development of novel business designs. " (Oliver Wyman, 2012)

Information technology is enabling features and abilities of the modern business organization that allow the transformation from a reactive organization to a proactive organization.

Typically, a value driver is defined as being the activity that adds value by increasing profitability to the business organization by managing and reducing risks through the achievement of strategic business goals.

Information technology is creating business value considering two roles, the business support role, and the business driver value creator role.

By meeting the minimal market requirements of modern business, IT is assuring that the business able to compete without having drawbacks. The today's *standardized* IT services like email, web presence, sharing, and storage, IT security, etc. are evolving and developing and enabling the business organization operations without having drawbacks compared to current market requirements. Due to the uninterrupted changing in business dynamics and complexity of the business environment, companies must meet specific market requirements to be competitive. The minimal requirements of IT are simple business support activities that just support proper business operations without being a business driver.

The business driver value creator role of IT is enabling a business organization to have the specific needed competitive advantage. By being at the edge of technological development, software and hardware, companies can have accurate, rapid, reliable data and information needed for the business decision process.

IT can bring much more value and a specific competitive advantage when "their top management team (TMT) moves from flirting with IT to marriage." (López-Muñoz & Escribá-Esteve, 2017). To profit from all IT benefits the management of a business organization must be ready to adopt change and update and adapt to the latest market requirements.

## 7. Conclusions

IT has evolved a developed from being an aid for certain calculus tools to a real and consistent ecosystem of tools and systems that have decisive business support and driver functions. The 21st-century business organizations must face a huge amount of daily new data and information that might impact or influence their business. To manage all the data and information and turn it into useful business intelligence business organizations must adopt and promote adequate software and hardware solutions that allow them to acquire, process, store and communicate relevant business data and information.

To be able to adapt, act and react to the ever-changing market requirements, business organizations must focus on the actual business support functions, information technology is one of the support / indirect business functions, and reconsider their classical role as indirect productive / business support services. Business support functions have a more and more definitory impact on the business operations by bringing business-relevant information into the focus of the business operations.

Information technology is enabling the untapped resources that business organizations have in their already owned data and information. Software is heavily supported by modern and powerful hardware that empowers business organizations to use data and information insights by using modern technologies like big data, data cubes, analytical data processing, etc. The increased accessibility of modern technology, especially information technology allows business organizations to make the most of available data and information that has been previously remained untapped.

The near future will bring again new developments and breakthroughs that will rewrite classical concepts and will allow companies to capitalize on the new possibilities. IT is no longer a resource-consuming business function, it has transformed into a clear and decisive business driver and value creator. The future developments in IT will allow having even more reliable data and information that can be used by business organizations to gain the needed competitive advantage.

Information technology, used as a very broad term, is the driving force of the information age that has transformed and changed many aspects of human society. The key element of the information age is data and information that are processed and distributed by highly complex and performant software and hardware systems. The essence of information technology (IT) is the management of huge and complex volumes of data that are generated by human activity. The information age has taken the discoveries and developments of the industrial revolution and put them through the next progress step of the information age.

IT has enabled business organizations to become more dynamic and more accurate in their decision processes that led to better and more sustainable business developments. The IT function of a business organization became an integral and decisive factor of competitive and sustainable companies. The more the adoption of IT modern technologies is assured the more competitive differentiation arguments a business organization has.

IT is the pinnacle of data and information management of the 21st century that is based on already commoditized services like basic network infrastructure and services and on business-specific software and hardware systems. The knowledge creation, processing, storage, and dissemination process is digital, it feeds all needed internal stakeholders and should self-adjust to the requirements of the new digital informational markets. Corporate IT became quickly the differentiating factor of the information age. The modern technology has enabled and redefined the means of knowledge management from creation to dissemination.

The IT tools used today are evolving and are re-defining once again the classical concepts driven by the need for better alignment of used systems and tools to the requirements of a dynamic changing market environment. IT has allowed fast access and accurate business data processing that can be used for automation and improved and efficient business processes. The value proposition of information technology is incontestable; the provided possibilities exceed everything that was considered *state of the art* in the industrial age. IT has led business organizations into the 21st century and away from analogic, mechanical, limited means of the previous age.

IT is contributing to the business organization value creation process by highly accurate, fast and complex systems that capitalize on the relevant business information that allows companies to differentiate themselves from other business organizations.

Information technology has enabled and made possible massive developments towards increased efficiency, accuracy, reliability and speed by innovations and inventions of technological means that completely transformed and made obsolete some of the classical concepts like analog communication, fax services, written communication, data acquisition, and processing, etc.

The challenges of modern fast-moving business organizations for the coming years will be the creation and usage of IT tools and systems that allow relevant data query and filtering that enable pattern recognition and reliable future steps models to be created and used for future predictive business management decision process through automated and/or artificial intelligence.

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