# An overview of strategic issues in the evolution of its industry

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**Abstract**. The purpose of this paper is to find a balanced way to analyse IT (Information Technology) industry, from its value perspective, but first we need to know how to define the IT industry, what are its component and the dynamic on global industry. This is an empiric study due to an enormous information quantity – only a simple search on EBSCO platform, looking only for Academic journals, retrieve 183.508 titles where "Information Technology" keywords were used. For same keywords Google Academic retrieve approximately 6.000.000 results in its search. As part of the economy modernization trends, the software industry plays a natural engine role - most of the company's efforts being based on the IT, especially the software component. With the omnipresence of mobile phones and the customers demanding more and more personalized experiences, the software industry continues to stay at the forefront of the business agendas in most of the companies.

## 1. Introduction

The purpose of this paper is to find a balanced way to analyze IT (Information Technology) industry, from its value perspective, but first we need to know how to define the IT industry, what are its component and the dynamic on global industry.

This is an empiric study due to an enormous information quantity – only a simple search on EBSCO [1] platform, looking only for Academic journals, retrieve 183.508 titles where "Information Technology" keywords were used. For same keywords Google Academic [2] retrieve approximately 6.000.000 results in its search.

## 2. Some History

IT was use first time in the context of appliance of semiconductors, after more than 50 years of researches in this area, starting from first discovery of the transistor in 1947 that was built in Bell Labs. That was the very first step in modern information technology era, the transistor is a semiconductor device that encode information in 0 and 1, acting as an electrical switch that commute the position between on and off stages. Starting that moment, the construction of integrated circuits was possible, in 1958, memory circuits and logic chips in 1971 by Intel. In 1965 Gordon More [3] issued the Gordon's law captured the fact that successive generation of semiconductors are faster and better. The chips were used also to equip the computers but also the communication and peripherals, mainframes, storage devices, etc. Jorgenson [4] describe an accelerate drop cost of semiconductors and hardware equipment with the 1/5000 index from 1958 to 1994; the point here is that the decline of computer prices follows the semiconductor prices. The software component starts to become more important than hardware

starting with 2000 when Robert P. Parker and Grimm [5] describe the new estimates of investments in software. Another important moment was 1989 when www was launch and start the internet era.

## 3. IT profile industry

In 1999, Bureau of Economic Analysis (BEA) reclassified computer software as an investment and describe three type of software:

1. Prepackaged – sold or licensed on packages,
2. Custom – created for a specific need of a particular client (including all the services needed to be created beside coding),
3. Own-account – created for a specific application of the user.

This is first classification that was done on software area and is based on the economic value that an asset can have – and defining software as an asset was possible to attach an economic value. There were four direction of analysis made by Jorgenson [4] that capture the whole IT industry: 1. Computers; 2. Communications; 3. Software and 4. Services.

On the other hand, the very first moment of information technology development was the introduction of personal computers by IBM in 1981 [4]. That was the moment when Intel release 8086-8088 processors and the MS-DOS, the product of Microsoft Corporation founded by Bill Gates and Paul Allen, was licensed by IBM, the moment when hardware and software was clearly divided form the usability point of view, so the moment when BEA report the classification of software mark an turning point in investments showing the importance of investments in software area.

IT was defined as the outputs of computers, communication equipment and software [4]. In 2016 in the CompTIA's [6] report the IT is defined as the utilization of computing via hardware, software, services and infrastructure to create, store, exchange and leverage information in its various forms to accomplish any number of objectives. Harvard Business Review [7] define IT the use of any use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data. HBR suggest that an option to classify the IT industry could be: 1. Physical equipment's – all the hardware used: Virtualization and management or automation tools; Operating systems and application (software) used to perform essential functions; 2. Business application include: Databases – SQL Server; Transactional systems such as real-time order entry; Email servers like Exchange, Web servers, Apache; Customer relationship management; Enterprise resource planning.

Another classification provided by McAffe [8] divide IT industry intro three types:

- Function encompasses technologies – application that streamline individual tasks;
- Network IT – help people communicate each other;
- Enterprise IT – let companies re-create interactions between groups of workers or between business partners;

CompTIA's reports [6], [9], [10], [11], on the other hand, have proposed along all four reports since 2016 to 2019 different category.

In the *Table 1* we can see a dynamic in defining IT component due to a lack of clear criteria. From the details of the component we can see the difference in views from 2016 to 2019. Each of them suffered adjustments according with the new trends in every year.

Looking into these efforts to define the IT component we have saw two major constants across all the classification, and these are Hardware and Software. It's very hard to define a hardware component, in this IT area, without a small part of software, and vice versa. This could be a side effect of cost dropping in hardware area, where the pressure to build cheap product it's high, but adding a software component, could add much value to the final product that selling separately. Another explanation could be the higher degree of software re-usage in the case of generic and cheap hardware pieces that could bring. Based on this observation we build the illustration from ***Figure 1*** for IT industry.

Classifying the IT industry in this way, should be much easy to compare different type of products among similar ones, and also, would be much easy to identify the major players in the whole industry but also for specific products positioned into those four quadrants, compare the historical trends for

hardware and software and apply the current technological trends should be much easy to identify further trends – knowing the evolution of hardware, so far, we can observe what kind of products are in the quadrants with high hardware component and predict an high dynamic among products and producers.

**Table 1** The IT industry components 2016 - 2019, from CompTIA's perspective

| IT category | | | |
|---|---|---|---|
| 2016 | 2017 | 2018 | 2019 |
| Software – apps for productivity, business, network, systems, security, mobile apps. | Software – applications, system infrastructure software | Software | Software |
| Services – deployment, integration, custom development, break/ fix, managed services | Services – planning & implementation, support services, operation management, training | Services | Services |
| Information – data, documents, voice, video, images, social streams | Telecom services – fixed voice, fixed data, wireless voice, wireless data | Telecom services | Telecom services |
| Hardware – computers, servers, storage, mobile devices, printers, network equipment, etc. | Hardware – servers, personal computers, storage, smartphones, tablets, network equipment, printers & other peripherals | Devices + infrastructure | Devices + infrastructure |
| Digital business – commerce, communication, collaboration, automation, governance | | Other emerging tech | Other emerging tech – such as IoT SW/ HW/ connectivity, SaaS+ PaaS, robotics/ drones, AR/ VR, AI platforms, etc. |

| Software | | | |
|---|---|---|---|
| | High | II. education, e-commerce, administer data bases, fintech, social network, collaborative platforms, online markets/ marketplaces, augmented reality, | III. databases administrators, CAD project builders,<br>Enterprises service providers,<br>AI, Blockchain, Cryptocurrencies,<br>Big data, Machine learning,<br>Infrastructure providers for content producers and/or content administrators,<br>Defense industry, |
| | Low | I. very dedicated devices,<br>smart phones, smart devices,<br>home appliance, | IV. robotics,<br>e-heath, IoT, Drone<br>3D printing<br>Space equipment, |
| | | Low | High |
| | | Hardware | |

**Figure 1** The IT industry classification based on HW/ SW components

The *Table 2* it's rather an overview of IT industry (or ITC – Information Technology and Communication like EU described) in both major area, US and Europe, based on NAICS and NACE

classification than a comparative description. In both cases the IT industry cover all areas described above.

**Table 2** Codes for IT in Europe and US

| US codes<br>According to NAICS [12] | EU Codes<br>According to NACE rev.2 [13] |
|---|---|
| Information technology (IT) services | ICT manufacturing industries (operational) |
| Computer systems, design & related services: 541511, 541512, 541513, 541519 | Manufacturing: 261, 262, 263, 264 |
| Computer training: 611420 | ICT services industries: 58.2, 58.21, 58.29 |
| Repair services: 811211, 811212, 811213 | Telecommunications: 61.1, 61.2, 61.3, 61.9 |
| Manufacturing: 3341, 3342, 3343, 3344, 3345, 3346 | Computer programming, consultancy and related activities: 62.01, 62.02, 62.03, 62.09, 63.1, 63.11, 63.12 |
| Software publishers: 511210 | Repair of computers: 95.11; 95.12; 95.21 |
| Telecommunications services: 517110; 517210; 517911; 517410; 517919 | |
| Internet and data services: 518210, 519130, 519190 | |
| Distribution and wholesale: 423420, 423430 | |

The IT industry is estimate by CompTIA [11] for 2019 at 5 trillion US dollars globally, where 31% represent US, 26% Asia-Pacific region, 19% Europe, 7% Far-East region, 6% South America, 5% Africa, 3% Central and Eastern Europe, 2% Canada. Form components point of view, the biggest percent is registered by Telecom service with 30%, followed by Devices and infrastructure with 22%, IT and business services 21%, Emerging tech 17% and Software with 11%. In the US the strongest component is IT and business services with 30%, and software have 18%, with one percent greater than Devices and infrastructure. The 2018 PREDICT report [14] analyze three dimensions of the European IT industry: Value added (VA) of the industry, employed numbers and business expenditure with R&D (BERD). At the EU level in 2015 the ICT sector report a VA to 581 billion euros, 5.8 million people employed and 30 billion euros BERD and those represent 3.9% of the EU VA, 2.5% employment and 15.7% of total BERD. In 2015 the ICT sector was more dynamic than the whole EU economy. The distribution by component of the VA is 8,6% for ICT manufacturing industries, 45,7% ICT services, 15,8% Telecommunication and 29,9% for Computer and related activities (software is included here). The Atradius's [15] report, citing sourcing like Macrobond and Oxford economics, present a 2019 forecast for some global key players in the ICT industry – Table 3

**Table 3** The ICT sector growth

| | China ICT | Germany ICT | Japan ICT | UK ICT | US ICT | Australia ICT | France ICT | India ICT | Italy ICT | The Netherlands | South Korea | United Arab Emirates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GDP growth % | 6,0 | 1,8 | 0,9 | 1,7 | 2,4 | 2,6 | 1,9 | 7,0 | 1,1 | 1,7 | 2,6 | 3,8 |
| Sector VA growth | 6,1 | 3,4 | 1,0 | 3,4 | 3,0 | 4,3 | 3,4 | 8,7 | 3,4 | 2,8 | 3,0 | 4,5 |

Beside China and India, we can easily observe the growth of ICT industry in United Arab Emirates and Australia, countries where there is no tradition in developing technology.

## 4. Conclusions

The ITC evolution could not be ignored anymore. Follow the very first development steps, we could see the trends in whole area where the hardware component of the industry competes the software component in term of the value and importance. The rapid development and innovation input in the

computer world, the society was transformed from producing culture to information exchange [16 - 18]. As part of the economy modernization trends, the software industry plays a natural engine role - most of the company's efforts being based on the IT, especially the software component. With the omnipresence of mobile phones and the customers demanding more and more personalized experiences, the software industry continues to stay at the forefront of the business agendas in most of the companies. As Steiniger [19] noted, this is not a new revolution - the IT started to change the business landscape 50 years ago. Furthermore, Steiniger notes that IT (and software in particular) is generating „waves of technological disruptions "in a periodical manner. The software industry is as prevalent as a growth engine, that one can barely open any business magazine without a reference to it - be it direct or indirect. Thus, both research and empirical evidences broadly agree that the software industry and its offerings are becoming more and more a daily part of the business operations in most sectors.

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