IT and Computing Professionals Skilled and Prepared for the Digital and Industrial 4.0 Transformation?

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Are IT and computing professionals skilled and prepared for the digital and industrial 4.0 transformation?

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Overview— The human being throughout time has had the need to change in all contexts of his life from the factors of survival to the factors related to economic and industrial activity, which is why the idea of the industrial revolution was born as important events in which individuals have always sought to improve their living conditions based on knowledge and innovation in their daily lives; over the years man has developed such famous inventions as writing and printing for communication, the wheel and the plow to simplify tasks, on the other hand the telegraph, radio and television to broadcast information to thousands of people; As well as the most recent modes of transportation such as vehicles, ships and airplanes that gave rise to navigation and aviation allowing faster transport and at the same time allowing the movement of supplies and raw materials; and as if that were not enough, one of the most outstanding inventions has been the Internet allowing worldwide intercommunication in a matter of seconds, considered one of the most significant inventions of the last century worldwide.

On the other hand, in the late 90's, there has been an increase in research and advances in fields such as big data, cybersecurity, virtual reality, M2M communication, internet of things, robotics, cloud computing, to mention the main areas that have grown as a result of the information revolution and globalization. However, the question is Are IT and computing professionals skilled and prepared for the digital and industrial 4.0 transformation? this is the reason why this research seeks to make a preliminary analysis of this question and to provide a starting point to determine which are the main variables that have caused such significant and notorious changes in recent times in the average profile of the information technology professional and/or worker in Costa Rica, Latin America and the rest of the world.

Key words— Big data, Cybersecurity, Industry 4.0, Digital and Industrial Transformation, Internet of Things (IoT), Artificial Intelligence (AI).

INTRODUCTION

The continuous change in information technologies and globalization is a challenge for professionals and empirics related to these fields, they have been challenged to respond to new tasks and changes in recent years; so that their area of expertise and what is called substantial work have varied over time, as it was very common to see in job offers some positions as software developers, systems analyst, network engineers, support engineers, infrastructure managers, project managers, IT project managers, technology teachers as the main jobs in the late 90s and early 2000s. However, these have suffered important changes over time and have proliferated other more specialized positions such as the so-called QA (also known as quality assurance manager or tester whose task is to run software tests to ensure the quality of software products) on the other hand we have the Database Administrators called DBA that although they are not so recent jobs, they are responsible for all activities related to the maintenance, backup and configuration of databases (Database Administrator given its acronym in English). These and other positions have been the most popular over the years and have given way to the derivation of other workspaces such as full-stack developer (backend and frontend) that are more attached to software development, other positions such as Data Analyst, Cloud Engineer, IT Service Architect, NoSQL Developer, AI Specialist, Cybersecurity Specialist, Forensic Analyst, DevOps, Systems Auditors; to mention some of the new profiles that are currently requested in various companies worldwide.

In summary, the need to adapt to change and keep up to date with new knowledge in the short term means that there is a demand for professionals in these new fields, which forces academies and educational centers to restructure their programs of study to train computer scientists who can compete in these new environments and meet the great demand for IT professionals in the region and the rest of the world. Finally, the self-learning skills of the average computer scientist are also an important factor in dealing with change in the short term.

BACKGROUND INFORMATION

In 2020 as a result of the pandemic by COVID-19 caused that technologies such as Artificial Intelligence, cloud computing, internet of things, Big Data, Cybersecurity to mention the main areas accelerated technological processes that led to several advances on the planet, industry 4. 0 is undoubtedly a before and after in the information age; however, the experience and related knowledge in these areas seeks to transform, automate, and digitize companies based on making it more efficient, effective in an automatic and intelligent way, in simple words Industry 4.0 involves combining advanced technical knowledge using ICT so that companies can produce and operate autonomously and intelligently with no human

intervention and that is done automatically and not manually as assumed by previous industrial revolutions..

This revolution is different from the previous ones because for some specialists, some traditional jobs are at risk of disappearing, causing unemployment and social problems, considering this as the dark side of this fourth industrial revolution. The capacity to automate tasks that were previously performed manually by human beings and that are now expected to be performed autonomously with the ability to make decisions is a controversial topic. Some statistics have shown that robots will make at least 14 percent of jobs disappear in the next 20 years, information from a study performed by the Organization for Economic Co-operation and Development (OECD) estimates that at least 375 million people will have to find another job for the next 10 years as the new jobs resulting from digitization and industry 4. 0 have a direct impact on employment, however it is important to mention that professionals in technological sciences, robotics and artificial intelligence will have very little chance of being part of this statistic because the companies that manufacture products related to this new technological leap are key to the development of robots, intelligent software, home automation projects, among others. The research seeks to determine what skills, abilities and other careers IT professionals need to have in order to develop in these new fields or those who wish to have alternatives in some of the "careers of the future"

Fig 1 *Robot Sofia taken from https://actualidad.rt.com/actualidad/202805-robot-eeuu-sofia-promete-aniquilar-humanidad*

INDUSTRY 4.0 MAIN AREAS

It should be noted that the focus of the research is centered on demonstrating very general theoretical aspects from the professional point of view that are supposed to be of utmost importance to learn new knowledge and be able to respond in the short and medium term to the new IT paradigms. The fourth industrial revolution not only affects production, manufacturing processes, computer systems and supply chain, the role and knowledge of society is important because they will be considered as end users and customers; the emergence of this fourth industrial revolution, combines all production processes through ICT adding it with high speeds to the global Internet network.

It is important to understand the impact of this fourth industrial revolution since, in addition to affecting industrial and manufacturing processes, it will have a direct repercussion on society, since they will be the end users and customers of these latest technologies.

a) Artificial Intelligent (AI).

Considered the main area of Industry 4.0, its objective is the process of learning from input information to be processed autonomously from some variables, in short, it is to imitate human and/or animal intelligence by computers and how they solve problems based on experience. The wide algorithmic analysis, the advanced logic-mathematics for its implementation are just some of the factors to be considered for those who wish to get involved in this science together with other factors such as visual-spatial intelligence, engineering, among others considered as inherent to this science.

b) Robotics

Some authors define this science as a product of the combination of other disciplines that brings together several technological fields with the objective of designing robotic machines capable of performing automated tasks or simulating human or animal behavior, intrinsically based on software. The type of intelligence that one must have is the logical-mathematical intelligence because in order to develop an acceptable learning curve it is considered important to have this intelligence because in addition to this, motor intelligence, spatial analysis, mathematical operations and reasoning for decision making, mechanical science, electronics and mechatronics are careers that the IT professionals of the future should know or those who are not necessarily in the IT area should deepen their knowledge.

c) Simulation and augmented reality (AR)

In computer science it is defined as the means by which computers and machines are used to mimic behavior by modeling a real and/or hypothetical system in an attempt to predict behavior from the variables it is performing. It can be deduced that the skills required are: Visual-spatial intelligence to transform what you create in your mind and as far as possible make it reality, extensive research capabilities in software and hardware, statistics and prediction. Augmented reality practically supports the production chain in making decisions based on the input information received to allow having a wide spectrum of possible alternatives to provide, as well as having the ability to mimic reality as much as possible in a fictitious environment.

d) Horizontal and vertical integration system

This is related to the integration of information systems and the relationship that these factors have in the supply chain, starting from production to delivery to the end user of the product or service and the production chain that this generates, optimizing processes efficiently and effectively using technology. The analysis of this information implies that the IT professional should have knowledge in administrative and industrial areas in order to provide an adequate management and optimal management in the chain of goods and services, which would be combined with computer science for its implementation. Inevitably, he/she must possess a logical-mathematical sensitivity in his/her performance and knowledge in industry, administration and wide perception of supply chains.

e) Internet Of Things (IoT)

The Internet of Things or IoT for its acronym in Internet is a mechanism that works connecting various devices with a network adapter that allows you to connect to the Internet and thus allows users to connect and interact with the terminals to perform certain tasks. Electronic science undoubtedly fits the profile of the IT professional who wants to work in this area because the implementation, configuration and commissioning of the hardware is high and its combination with the development of software that makes these so-called autonomous devices work.

f) Cybersecurity

This field of computer science is considered by HR and IT experts as the career with the highest demand at present and that in the short term will be greater, due to the proliferation of more devices connected to the internet and the implementation of systems that require higher levels of protection, privacy and security, which is why cyber security is on the list of alternatives for the future, the linguistic-verbal training that is developed given the large number of existing terminologies in the area, wide spectrum of computer science in general; as well as the inter and intrapersonal relationship to be able to understand other people, facility of speech, oral and written communication, decision making in conflictive situations are the main skills and knowledge that must be possessed together with the ability to analyze and synthesize and ultimately the ethics and commitment in the management and administration of confidential information are the main inherent factors that must have the future specialists who value this alternative as their career in the short term.

g) Cloud computing

Choosing to outsource SaaS, Iaas and PaaS services leads companies to opt for hardware and software services from companies in other geographic locations to offer computing services over the Internet and to be accessed through the network, In addition to the cybersecurity specialist in skills that have many similarities, these should have a wide knowledge in the administrative spectrum as they need to visualize the future growth and expansion that the organization may have, as well as the adaptation to change that practically IT professionals should have as the main scenarios in addition to other qualities that technologists and IT professionals should have.

h) Big Data

It is considered the second most demanded career after cybersecurity in the short term. It involves a combination of the above mentioned since it seeks process optimization, efficiency and effectiveness, prediction, from large volumes of data and thus have a large number of probabilities for decision making, before, during and after industrial, technological, administrative, commercial, logistical and productive processes in areas that have a lot of structured and unstructured information. They must have extensive knowledge of statistics, mathematics and the use of software in data mining to perform without any problem.

i) Others

There are also more areas where these divisions intersect leading to Blockchain, drones, digital twins, Machine to machine (M2M), 3D printing, to name a few other areas that combine together.

Fig 2 *Digital Twins taken from https://www.bbva.com/es/que-es-un-gemelo-digital-y-para-que-sirve/*

CONCLUSIONS

The proposals presented in this scenario are centered on a general perspective given the extensive research in each of the topics of Industry 4.0, the research plans to have a "little touch" in each of the areas and at the same time propose some elements that are cataloged as key for current professionals and other areas should know; they assume in very general terms some inherent aspects that should be deepened, but may be variants for some specialists. The proposals presented here are a beginning for discussion and analysis, but they involve general aspects to be introduced in the areas known as Industry 4.0.

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