e-Platform for IT Personnel Development: Addressing the Most Strategic Challenge in the Cyber Domain – People

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ABSTRACT:

The article presents an approach for addressing the human capital challenge given the high demand of businesses and international organisations for IT experts. The author reviews the requirements and the process of developing human capital, outlines the problems in IT education today and reviews existing sources for online IT education. The focus is on the architecture of an e-Platform the business model supporting human capital development and management in the complex environment of national and international IT organisations. The research findings suggest that a digital platform for collaboration and management of IT competencies could be a solution to the challenges in IT training experienced in the selection, development, employment and sustaining of key IT experts.

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Introduction

> *The human mind is our fundamental resource.*
> - John F. Kennedy, 35th President of the United States

The organisational views of personnel as a fully controllable resource as seen by Frederick Taylor in his scientific management paradigm are now a long way back in the 1980s. Today, many businesses consider their human capital as their most important and valuable asset, thus "their fundamental resource" for company success. Perceiving personnel as a "workforce that performs repetitive tasks" [1] is no longer applicable, the notion "has shifted to a new dimension that treats personal issues such as working environment, welfare of personnel, their feelings, creative potential of personnel as high priority."[2]

Furthermore, the human capital is considered to be one of the most important elements that help an organisation to introduce new technologies, to maintain its market position, to develop the know-how of the organisation, to take care of its customers and to maintain a high level of quality in offered services and products.

New concepts such as management by objectives and continuous improvement of processes promote individual responsibility and seek to push decision making through all levels of the organisation. Along with perceptions of personnel, businesses have changed too. Companies became more flexible and dynamic, more customer-focused, effective and efficient. "Human resource management policies started to be integrated with business strategies. The concepts of taking initiative, being energetic, independent, bold, self-reliant, and willingness to take risks were emphasised in enterprise culture."[3]

Organisations can no longer afford to take too long when hiring because high-quality candidates are in demand and difficult to find. Companies have to be decisive throughout the hiring process and they have to act quickly. Times have changed and the tortoise does not beat the hare when it comes to hiring.[4]

Finding qualified and best match employees is hard and, with the continuous development of IT, the introduction of new technologies and IT products, the shortage of qualified IT personnel will continue to grow. In 2018, 68 percent of Human Resource (HR) professionals reported problems when filling positions – up to 50 percent compared with 2013.

While Taylor's beliefs with regards to mental and manual labour are not quite relevant today, his scientific management principles have provided a significant contribution in the field of management practices, i.e. the introduction of systematic selection and training procedures.

In the past 15 years, the IT education and training underwent a gigantic transformation due to the increased need for IT personnel as a result of the enormous use of information and communication technologies in all business sectors such as online platforms, mobile banking, medical services, government services, etc.

Traditionally, before the digital revolution, IT education was a classroom-based instructor-led education. Nowadays, the transformation of the IT education market

led to the development of a number of online platforms that offer technology training to IT organisations and end users, numerous IT educational products, qualifications, and pre-qualifications and certifications online.

The pressure applied by companies that search to demonstrate quick relevance and value to their shareholders has forced the training organisations to continuously adapt their training products, to find new and more effective and efficient delivery methods to meet their customers' needs in a better way.

Undoubtedly, information and communication technologies are a driver for sustainable development. According to International Data Corporation (IDC), 60 percent of all companies will integrate new IT services' digital platform by 2020. IDC identified that the digital platforms to be developed on corporate architecture will create quickly new externally oriented digital products and services that will be aggressively upgraded.[5]

On the other hand, "despite the increasing availability of ICT, many countries are unable to utilise this potential to the full, often because they lack the know-how needed to create an enabling environment for the development of a local IT sector with private sector engagement or because they lack the skills and expertise to apply these technologies appropriately."[6]

In practice, there is an urgent need for the establishment and development of close partnerships with leading national educational bodies representing schools, colleges, universities and research institutes (especially using the model for research-based education and development of highly qualified educators with a practical project-based experience), as well as employers, government and the business sector, in order to enable the creation of an IT knowledge-based cluster, "one-stop-shop for IT resources" to facilitate, organise and initiate access to knowledge, innovation, market, talent, and capital.

What is Human Resources Management?

Despite the many definitions for human resource management (HRM), the core meaning of term summarises how to manage people or employees in an organisation. In his book "Principles of Personnel Management," Edwin Flippo defines human resource management as "planning, organising, directing, controlling of procurement, development, compensation, integration, maintenance, and separation of human resources to the end that individual, organisational and social objectives are achieved."[7]

HRM includes all processes that enable, guide, execute and control the matching of personnel supply to the jobs required. Furthermore, HRM can be operational or strategic. Whilst *operational* HRM is dealing with individuals, concerning tactical activities—applications are processed, current openings are filled, supervisors are trained, safety problems are resolved and wages and salaries are administered—*strategic* is the holistic approach that manages the personnel, but aligned with the organisational long-term goals, dealing with "having the right number of people in the right places at the right time."[8]

Everything with regard to the definitions and management of processes in HRM is well set and defined, but in today's dynamic market conditions and a great demand for qualified IT personnel, rules are not so well defined. One can take a closer look at hiring personnel as a process consisting of four main stages: a) attracting the right (qualified) candidates for an open position, b) keeping those candidates engaged throughout the process, c) assessing and shortlisting the most appropriate candidates, and d) hiring the top candidate. Breakdowns can occur at any stage of the process. Sometimes, what looks only like a glitch in the process could prevent from hiring the preferred candidate. Having a few glitches diminishes the chance that a company hires its top selected candidate; therefore, the hiring process needs to be as much as possible clean of obstacles, consequential and rapid in order to get on board the chosen candidate.

Naturally, it is interesting why human resource management and these concepts and techniques are so important to all managers. The answer to this question was given by Alan Price in his book "Human Resource Management in a Business Context," where he defined "the ten Cs" of human resources management: cost-effectiveness, competitive, coherence, credibility, communication, creativity, competitive advantage, competence, change, and commitment.[9]

Another good answer to this question comes by listing the things a manager would not like to be dealing with. One of the key points is that no one wants to hire the wrong person for the job.[10] The results of such action would be a rather bad experience for the two parties – for the employer and for the employee. Companies do not like to experience high turnover of personnel, simply because this is costly. Training of newcomers is an investment that would get lost when people leave too quickly an organisation that just provided training on the job to them. Another big struggle for companies is having their employees not doing their best. It is way more difficult to manage low motivated and frustrated employees rather than hiring a new person for the job. No manager wants to waste time with useless interviews or unqualified candidates. Therefore, HR staff need to preselect and shortlist qualified and suitable candidates. HRM follows strictly the rules and policies, as no company likes to be taken to court because of discrimination of candidates.

In recent years, for a number of reasons like lack of expertise within the company, but mainly for operational, technology, and staff cost savings, many organisations have started to outsource HRM services. Many small to medium-sized businesses benefit from outsourcing by not having to go through the frustration of establishing non-revenue gaining activities such as payroll, benefits, and compensation. By outsourcing these activities, they can focus on their core business that generates benefits. "The most outsourced HR activities are legal advice and support, employee payroll, training and development, recruitment, employee assistance, compensation and benefits, human resource information systems, employee relations, policy-making, strategic partnerships."[11]

The Process of Human Capital Development

Employees are a company's greatest asset.
- Anne M. Mulcahy

There is a link between strategic human resource management and human capital development (HCD). HCD is one of the many functions in HRM designed to offer an up to date proficiency among the employees. In fact, HCD is the framework for helping the employees to further develop their personal and organisational skills and knowledge. With the current changes in technology, HCD can be used to support various activities of the organisation in which competence is required.

According to McLean, Osman-Gani, and Cho,[12] the current business environment requires HCD to play a fundamental role while enforcing the organisational strategy. Organisations that invest in their employees' expertise stand a better chance in the current competitive business environment.[13]

When a company encourages and carries out HCD, employees are seen as its most valuable asset. "Human capital development is a long-term goal of a company that includes continuous investments of time and money into recruiting and training people to improve their personal and interpersonal skills."[14] It is believed to be one of the most important elements of a company's success. The process of developing human capital needs creating appropriate environments where employees could learn, develop and apply new ideas, improve their hard and soft skills and acquire new competencies. The main focus areas of human capital development include talent management, change management, performance management, human resources management, learning and development, strategic planning, workforce planning, and knowledge planning.

Human capital development is a holistic process which facilitates strategic objectives through the management of individual capabilities. It suggests that organisational effectiveness is determined through the positioning and development of individuals. All of the HCD process elements require careful planning, human interaction, and measurement, with consistent management review on the effectiveness of the whole. Human capital development is the engine for business growth and success for any company that knows how to develop, organise and use its human capital.

Is there a problem with IT education?

It would be all too comical
wasn't it so deeply sad.
- M. Y. Lermontov

The obvious answer here is: Certainly. Unfortunately, the solution to reaching the ultimate goal of receiving the proper IT education is not that simple. Not today, in the era of cultural mixtures and technological boom trends. The process of IT education from starting to educate one IT specialist to the end stage of getting the person hired on the job is rather lengthy and often the results are unpredictable.

The method of getting complete IT education is protracted and it involves a number of areas that need to be improved. Due to the fast-changing market demands for IT personnel and the slow-paced university education programmes, there is a deep gap for IT experts which companies are experiencing since several years.

In his book "Mental Penguins," Prof. Sardamov "makes a passionate, meticulously-researched and utterly compelling case for reinstating the old-fashioned text-based reading at the heart of formal education." He wrote his view of solving "the mystery of the neverending education crisis." The author states he has not found "any ultimate solution or set of policies and pedagogical fixes for it," but he believes he has come to an understanding "why so much hope and hype, effort, and resources invested in education and educational reforms have failed to produce generations of better prepared high school and college students."[15]

For over a decade in his teaching experience, the professor was observing troubling trends such as the inability of the majority of his students to accumulate knowledge and develop their thinking, yet he has resisted "the temptation to blame and chide students for their learning difficulties." Sardamov has linked these alarming issues to broader cultural and technological trends. According to him, these more general trends can explain why the cognitive anomalies he started to observe among his students are not unique. Since neither his colleagues' theories nor the conventional pedagogical literature could help him untangle this conundrum, he embarked on a quest to find a more credible solution to the educational mystery he confronted. He then reviewed some of the books, interviews, and findings in neuroscientific studies that caught his attention. He refers to the 1990s as the "decade of the brain" with allocated increased funds for brain research that was marked "by a true explosion of clever studies and experiments made possible by the introduction of smarter and more precise scanning technologies," some of which seemed to have had an obvious relevance for the troubled field of education.

Sardamov thoroughly looked into the "limits of neuroeducation" by describing his observations in his teaching practice and the "increasingly frequent cognitive incidents" with his students and himself. In his book, the author summarises his theory of the perennial crisis in education in three main points that have a domino effect and are interconnected: 1) chronic dopamine overload (induced by technological saturation and sensory overstimulation), which has contributed to 2) warped brain plasticity, and thus 3) a crisis of curiosity, motivation, and implicit learning in the majority of students, and growing utilitarian detachment in "the best and the brightest." Sadly, Sardamov concludes that the tide can hardly be turned and the most that could be done is "to try to construct small-scale sanctuaries for ourselves, our students, and our children," unfortunately unavoidable "given the societal and technological pressure cooker in which we live – and in which we need to raise our children."

That said, one needs to be creative in finding adequate solutions corresponding to the education needs and issues today. The curriculums at educational bodies need to be urgently revisited and re-shaped for today's market demand. IT education needs to be underpinned at schools at a very early stage in order to produce enough people prepared to fill the market gap. Special attention needs to be given to Information

security and cybersecurity, but in principle a continuous review of the IT/ICT competences taxonomy is required in order to maintain the relevance of education and training, keeping it close to current research and projects in the industry.

IT jobs today become more and more challenging. The IT industry is a dynamic sector with numerous areas of expertise. For example, the cybersecurity jobs market has an excessive demand for skilled talent. Following the trends in IT developments and introducing new technologies, the demand for IT professionals will continue to grow, therefore there is a great need for increasing the potential and developing new opportunities for IT talents.

IT Education Sources Review

In order to respond to the increased demand for IT specialists, many companies and organisations have created numerous training and education opportunities in information technology. This section of the article reviews the biggest IT education and training bodies including some international organisations, academic bodies, research institutes and vendors who represent the world's market leaders for IT education and certification. These companies offer technical and certification training that will help starters to pursue a career in IT, and professionals to accelerate their career path and get a better realisation. Most of these IT training companies offer traditional instructor-led courses, as well as online courses. There are many options for developing new skills and keeping one's knowledge or changing the IT specialty by getting education for a different skill set.

International Organisations

NATO IT Training

The NATO Communications and Information Agency (NCIA) Education and Training section is accountable for the provision of IT education and training services to NATO and its members. NATO IT training is available for military personnel, civilian staff, and nations. NATO offers instructor-led classroom courses and on-demand courses and ADL (distant learning) courses, but those are few and they are mostly pre-study material.[16]

NATO IT training is offered by its specialised bodies in the NATO CIS School (NCISS) in Latina, Italy, the NCI Academy interim facility in Oeiras, Portugal, the AirC2 Training Group in Glons, Belgium, as well as Agency courses held in Mons, Belgium, and The Hague, The Netherlands.

The NATO Communications and Information Systems School (NCISS) in Latina provides cost-effective, highly developed formal training to personnel (military and civilian) from NATO and non-NATO countries for the efficient operation and maintenance of NATO communications and information systems[17].

In 2018, The NCI Academy started to operate as a training facility in Oeiras, Portugal as part of the overall process of streamlining NATO's IT facilities due to the NCIA reorganisation launched in 2012.

The NCI Agency AirC2 Training Group is responsible for facilitating technical training courses related to all NCI Agency AirC2 products. Training of user personnel is one of the key elements of integrated system support.[18]

The NCI Agency training catalogue lists more than 240 courses that cover the entire spectrum of C4ISR (including traditional CIS) and cybersecurity. Training is available on many of the services and systems provided by the NCI Agency.

In addition, the Agency organises International Cyber Security Summer Schools. The Agency's summer school program was put together in collaboration with Leiden University, Europol, The Hague Security Delta and the Dutch Innovation Factory which is a great example of the involvement of different players and stakeholders into the process of covering the requirements and demand for specific IT cybersecurity experts.

The training catalogue, as well as information on how to follow a NATO course, is available at the following web pages:

- NCIA website, https://www.ncia.nato.int/Our-Work/Pages/education-and-Training.aspx
- NCISS website, https://www.nciss.nato.int/
- NPC website, https://npc.ncia.nato.int/Pages/Training.aspx

EUROCONTROL

The European Organisation for the Safety of Air Navigation EUROCONTROL delivers unique high-quality training courses, tools and services in air traffic management (ATM) to various actors in the aviation community. The content of most of EUROCONTROL training products is not offered by any other company since it is industry specific.[19]

EUROCONTROL's dedicated training facility is the Institute of Air Navigation Services (IANS) in Luxembourg that provides a wide range of products – from general introductory courses on ATM concepts to advanced operational training. The curricula covers the full set of network operations training courses as part of the Network Manager's assets in optimising European ATM network performance and facilitating the sharing of high standards of knowledge amongst all operational stakeholders. The training catalogue lists 166 courses in Airport and Environment, Airspace Management, ATC Training, CNS – Communication, Navigation and Surveillance, Data Processing, Information Management, Network Operations, and Security Management.

More information on available courses, tools, and support services can be found on EUROCONTROL's Training Zone at the following webpages:

- https://www.eurocontrol.int/training
- https://trainingzone.eurocontrol.int.

Academic Bodies

Massachusetts Institute of Technology (MIT)

The Massachusetts Institute of Technology is a private research university in Cambridge, Massachusetts. Founded in 1861 in response to the increasing industrialization of the United States, MIT adopted a European polytechnic university model and stressed laboratory instruction in applied science and engineering.

The MIT Open Courseware website offers a wide range of free online IT training in computer science to include algorithms and data structures, artificial intelligence, computer design, and engineering, computer networks, cryptography, data mining, graphics and virtualization, human-computer interfaces, operating systems, programming languages, software design and theory of computation. Everyone can benefit from all free course materials at the following web address: https://ocw.mit.edu.

Harvard University

Harvard University is a private Ivy League research university in Cambridge, Massachusetts, with about 6,700 undergraduate students and about 15,250 postgraduate students. On the University's webpage it is announced that they have over 6 million registered learners, offer 417 courses in 193 countries in all subject areas. The university provides 22 online IT courses in computer science, data science, and programming. All IT courses are free to follow without certification on their platform edX. There is a requirement for students to earn a satisfactory score on 9 problem sets (i.e., programming assignments) and a final project, thus become eligible to receive a verified certificate from Harvard.

Harvard University IT Academy provides training through instructor-led courses and self-paced activities to Harvard-wide IT staff who have an opportunity to deepen their subject matter expertise and broaden their knowledge of Harvard's unique technology landscape and service-focused environment, and to become a "T-shaped professional."[20] T-shaped professionals are in high demand in today's workplace and are characterised by their ability to collaborate across functions and innovate across disciplines (the horizontal bar), and their deep knowledge in at least one area (the vertical bar).

A description under the Course Catalogue encourages all Harvard IT professionals to complete Level I of all the courses listed in the horizontal of the T-Shaped Professional to obtain a breadth of knowledge relevant to all IT regardless of their role. The vertical of the T-Shaped Professional represents training specific to their IT Job Function. The Academy is currently building its training library for all IT job functions and creating Job Function badges.

Harvard hosts its IT courses at the following web addresses:

- https://www.edx.org
- https://itacademy.harvard.edu
- https://online-learning.harvard.edu
- https://harvardx.harvard.edu

Stanford University

Stanford University, one of the world's leading teaching and research institutions, is a private research university in Stanford, California. It is dedicated to finding solutions to big challenges and to preparing students to make meaningful contributions to society as engaged citizens and leaders in a complex world.[21]

The Stanford School of Engineering offers over 75 free online IT education courses available to the public to include internet technologies, computer programming, network and security, cyber security, blockchain and cryptocurrency, scientific computing, cryptography, databases, design, and analysis of algorithms and many more. All courses can be found at the following address: https://online.stanford.edu

California Institute of Technology (Caltech)

The California Institute of Technology is a private doctorate-granting research university in Pasadena, California. Known for its strength in natural science and engineering, Caltech is often ranked as one of the world's top ten universities. Caltech online learning opportunities are available through Coursera and edX, educational technology platforms that offer online university-level courses in a wide range of disciplines to a worldwide audience at no charge to include big data analytics, circuits and systems, quantum cryptography and others. These free study materials are available at the following web page: http://online.caltech.edu/.

University of Oxford

The University of Oxford is the oldest university in the English-speaking world. It is a collegiate research university in Oxford, England. The online and distance learning at Oxford University offers a new way of combining innovative learning and teaching techniques with the interaction between tutor and fellow students from around the world. The IT online courses cover IoT, circuit and system design, database applications, cyber security and artificial intelligence, blockchain software engineering, cloud robotics, computing with R and Stata, access and SQL, styling for the web, object-oriented programming with Java and C++, networks and many more.[22]

The free courses are available at the following web pages:

- https://www.conted.ox.ac.uk/about/online-courses
- https://www.conted.ox.ac.uk/search#/?s=computer&sort=relevance

Vendors

The vendors review has been based on the top vendor IT training and certification for 2018.[23]

Oracle University

Oracle University offers in-person (instructor-led or private event) courses and online training which can be delivered via Oracle Learning subscriptions, training on-demand, live virtual class or self-study courses. Additionally, Oracle offers guided learning that provides in-application guidance to help employees accelerate Oracle cloud adoption. The Oracle University teaches more than 200 courses with certifications on application software packages, Oracle database and data warehousing, Java programming, virtualization technology, ERP and supply chain management solutions. The website of Oracle University is at this address: https://education.oracle.com

Microsoft Learning and Microsoft Virtual Academy

Microsoft Learning is probably one of the biggest training organisations today. They offer numerous sources and certifications with a great taxonomy on their website. Their courses can be followed online or in a classroom via one of the Microsoft partners. The Microsoft Virtual Academy for IT professionals offers numerous free online courses on Microsoft technologies delivered by world leading experts. The courses are free, yet the certifications are paid and can be achieved after examination at a Microsoft partner centre.

Microsoft Learning website resides here: https://www.microsoft.com/en-us/learning/default.aspx.

Microsoft Virtual Academy website's address: https://mva.microsoft.com.

Cisco Learning Network

The Cisco Learning Network is the place for Cisco products training and certification. The company certification programs range from the entry-level CCENT and CCT to the Cisco expert-level certifications CCIE, CCDE, and CCAr.

The Cisco Learning Network can be accessed at the following address: https://learningnetwork.cisco.com/welcome.

Red Hat Training

Red Hat Training offers instructor-led and online training and certification programs for Red Hat Enterprise Linux OpenStack Platform including load balancing, security, systems management, cloud computing including OpenStack and high availability, virtualization including Docker and Kubernetes, JBoss Middleware. Red Hat students can use the online virtual labs to train on various Red Hat products via console access to a virtual training environment.

Students receive hands-on training without having to deploy these products at home or within an IT organisation. The Red Hat Training website resides at https://www.redhat.com/en/services/training.

InfoSec Institute

InfoSec Institute provides in-depth training for IT security professionals. It offers instructor-led and self-paced mentored online training. Outside infosec training, the Institute offers the Project Management Professional (PMP) certification, Information Technology Infrastructure Library (ITIL) credentials and others. It also covers vendor-specific certification programs like Cisco, Microsoft, EC-Council, ISACA, VMware and more. Their training offerings are grouped into career paths for computer forensics, security pro, and IT audit tracks. The InfoSec Institute also offers a specialised training topic labelled 8570.1 that covers certification requirements for IT experts working for the U.S. government, U.S. Department of Defense or related contracting companies. The InfoSec Institute can be found at the following address: https://www.infosecinstitute.com.

IBM Skills Gateway

IBM provides its huge training portfolio for analytics, cloud computing (integration and development, cloud platform, hybrid and private cloud), security (QRadar SIEM, BigFix, Guardium), systems (storage fundamentals and software), and Watson platform. IT training courses are provided on demand, as well as live technical training that can take place anywhere in the world. IBM offers professional certifications and badge programs. IT professionals can display their badge in email signatures, social networking, and professional sites and, most importantly, to prospective employers who can easily use those badges to verify credentials. IBM's gateway offers search of training either by course name, job role or training path. The IBM Skills gateway can be reached at this address:
https://www-03.ibm.com/services/learning.

Skillsoft Training

Skillsoft offers instructor-led and online courses, books, virtual labs, and practice tests on IT topics to include SysAdmin and DevOps, Software developer, Security training, Data, Cloud computing, Networks, Programming and operating systems.

Skillsoft partners with IT certification vendors to provide training on important exams, including AWS, CompTIA, Google, Linux, Microsoft, Oracle, RedHat, and SAS. What Skillsoft offers, different than other training companies, is developing and delivery of personalised training content for companies worldwide. The company offers Percipio, an intelligent online learning experience platform for organisations that want to develop their own training materials while utilising a proven course development framework. Skillsoft's services can be found at the following web address: https://www.skillsoft.com.

Digital Intelligence

Digital Intelligence has a tiny but vital market share. It offers super specialised IT training and certification for computer hardware and software forensics. Their courses are instructor-led and online training courses and include Digital Forensics (basic and advanced), Digital Forensics with FRED, KNIFE – Known Network Intrusion Forensic Investigations, CryptoCurrency Investigator, EnCase/DFFEN, DFF-NUIX – NUIX Foundations, Windows 10 Advanced Forensics and more. The Digital Intelligence website is https://www.digitalintelligence.com.

InfoPro Learning

InfoPro Learning is a global training company that offers their own eLearning platform to big companies that want to develop their own corporate training or use embedded material from corporate training providers. The company helps its partners to bridge their workforce's skills gap, organisational development and succession planning. They offer a variety of training modes – from instructor-led, virtual and eLearning to mobile. Their website and services are available at the following address: https://www.infoprolearning.com.

Global Knowledge

Global Knowledge offers multiple IT training courses along with certification preparation classes. The company offers training in cloud computing, networking, virtualization, and big data. In total, Global Knowledge lists more than 1,500 class offerings via instructor-led, online, self-paced and on-site delivery to include courses for Cisco, Microsoft, Avaya, Citrix, CompTIA, VMware, Red Hat and Amazon Web Services (AWS) technologies and certifications, and partners with more than 30 companies to provide excellence in learning solutions. Their website is at this address: https://www.globalknowledge.com.

There are many other platforms that offer IT training the most popular ones are Coursera, Udemy, edX, CourseDot, SumTotal, Pluralsite, CBT Nuggets, Grovo, Skillshare, Degreed, Cornerstone OnDemand, Simplilearn, New Horizons Computer Learning, and SuccessFactors, among others. Yet, the question remains, if the current organisation of IT education and training is going to provide for the growing gap on the IT market.

Is There a Digital Solution to Manage IT People Cluster?

Imagination is more important than knowledge.
For knowledge is limited, whereas imagination embraces
the entire world, stimulating progress, giving birth to evolution.

\- Albert Einstein

Description of Possible Solution

Following the main objective of this article and after the provision of the review of the current situation in IT education and HRM, the research moves forward to offer a possible solution. The paper suggests that a digital platform should be developed and implemented to train, educate and re-certify IT professionals in an online collaborative and user interconnected environment. The platform should be an *interactive System for IT Education and Cooperation* (iSITEC) and it should be able to welcome its stakeholders: students, teachers, universities, employees and employers.

Furthermore, the article describes the idea for software platform as a possible solution for creating an IT people cluster, analyses and evaluates the main (vendor, academic and international organisations) sources of existing IT education systems/ websites for training and development of IT professionals. The proposed solution suggests that capacity and competitiveness of IT specialists to work for national and international organisations would be increased by creating a common bank to store IT people data that could be accessed by companies and universities. The solution is also oriented towards career starters and graduates, as well as for youngsters deprived of parental care who will be entitled to free IT training. The overall benefit of creating iSITEC is seen as stimulation and support of collaboration in the IT industry.

The interactive System for IT Education and Cooperation (iSITEC) will provide an environment for online collaboration that provides many options for getting IT

consulting, training, and opportunities for the realisation of its users. The platform will provide for a close symbiosis between employers, teachers, students, and professionals.

Specialised IT courses will be developed for preparing IT professionals and executives of international organisations such as NATO, Eurocontrol, UN, and the European Commission in accordance with their specific requirements. In addition, iSITEC will offer IT products such as consulting and training for disadvantaged people and children, deprived of parental care, access to which will be provided free.

iSITEC Architecture

The platform's architecture should be based on cloud computing. It is a new advanced technology which accelerated the innovation in the IT industry in recent years. Cloud computing is a new business model that provides on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. Its task is to ensure availability of enough computing resources to use the services they are paying for.
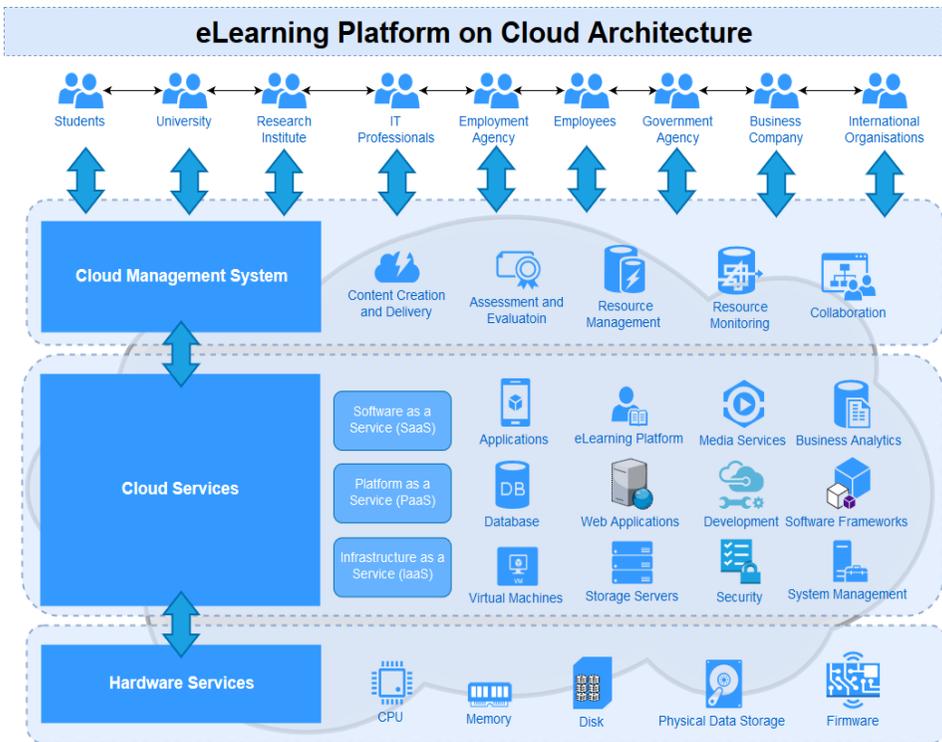
Figure 1: eLearning Platform on Cloud Architecture and User groups.

The cloud computing model provides high scalability by creating virtualised resources that are made available to users. These processes run in the background and the users do not need any skills in order to use the cloud computing concept. The users are simply logging into the application they are willing to use which connects to the server where the application is installed.

According to researchers, cloud computing is one of the new technology trends likely to have a significant impact on teaching and learning environments.[24]

Considering the multiple stakeholders implementing iSITEC in the cloud would be the proper architectural solution in order to deliver a high quality of service to its users' demand when using the services of the platform.

iSITEC Services

The collaborative nature of the iSITEC will provide a comfortable environment for creating, managing and conducting online IT training, distance learning, and interaction between stakeholders, students, and professionals.

Companies that will use the services of the iSITEC will effectively and efficiently implement their own solutions for remote IT staff training, partners or customers. iSITEC will provide user training through online tutorials for working with the system for online collaboration, complete eTraining for managers and employees.

In addition, iSITEC will offer online tutorials for content creators, teachers, and managers of the system. iSITEC will provide technical support and hosting of IT products, services to update the latest versions of the system software, subsequent training of superusers, and case studies.

iSITEC will be equipped with tools, facilitating cooperation, joint collaboration when developing training material and course content. iSITEC will have standard configuration settings, as well as customised configuration.

The focus of iSITEC will be placed on its users and the ease of use of the digital platform: registration for IT training and services, content management and detailed profile information and results.

iSITEC will offer IT companies refresher courses for their staff, it will provide an opportunity for organisations or universities to conduct their online IT consulting and training by providing a platform for cooperation as a runtime environment.

iSITEC will find realisation on the market by providing hosting services for IT courses for university and companies. In addition, the platform will provide IT specialists training and advice, lectures and seminars, as well as IT courses for personnel who wish to work at an international organisation such as NATO, Eurocontrol, UN, and the European Commission. The system will offer organisation and subscription for organised events such as IT summer camps for children and professionals. iSITEC will provide free IT training for children and youngsters, deprived of parental care.

iSITEC will have a positive effect on the sustainability of the development of IT professionals and job opportunities in national and international organisations, as its main goal will be to raise the level of IT competencies through continuous training and re-qualification. One of its main goals will be to contribute to the stable economic growth of the IT industry through the development of IT professionals.

Another important goal will be achieving sustainable employment of trained and retrained staff on the platform by placing them on a job after successfully completing the training. An important social impact will be achieved by offering free IT training for children, deprived of parental care.

Potential Users of iSITEC

The iSITEC platform can be used by companies that are wishing to employ an IT specialist or those wishing to provide refresher IT training to their employees. An important potential user will be universities that wish to integrate their remote IT consulting and training into iSITEC. Another group of potential users will be schools that wish to improve the IT knowledge of their students and improve the interaction between the students outside of class work. Proven teachers, who are willing to conduct remote IT training and consultancy, would be the next users of the platform. The other user group is the students who wish to complete their IT training through iSITEC. IT professionals aiming at raising their qualification level are another target group of potential users. Last, but not least, is the group of disadvantaged people, willing to acquire IT skills and find a corresponding job from home, and orphans aiming to acquire IT skills and find employment.

Advantages of iSITEC

The system will have an intuitive interface and can be used by users without the need of having experience with similar software. iSITEC will be used in the IT sector for education and training. In the iSITEC system, creation, storage, and sharing of information will be easy and convenient for users. The platform will offer opportunities for interactivity, e.g. by registration of multiple users and forming communities of interest. iSITEC will meet the new standards for an online collaboration system and will offer all relevant functionalities. The platform will offer training by providing guidelines on the necessary IT skills in the sector. iSITEC will have a bridging role between employer, teaching, and learning.

iSITEC Functionalities

The system will have modern and easy to navigate interface. Each iSITEC user will have available his personal dashboard, where they can manage their IT products: consultations, training, tasks, tests, notebook, progress, etc. iSITEC will facilitate communication and interaction between users, teachers, and employers through discussion forums, blogs, chats, etc. Through the Calendar function, the users will be able to track deadlines, to receive meeting reminders, and to organise group meetings. The text editor in iSITEC will be intuitive and easy to use. The users will be able to activate the feature to receive a notification when inserting new tasks, in the publication of new messages in the forums. All registered users will be able to receive and send personal messages in their personal inbox. iSITEC users will be able to track their educational progress.

The underlying technical solution of iSITEC shall be solid, it will meet the requirements for offering high-quality service (Quality of Service) without any or

with minimal interruption to the end user (High Availability). iSITEC will use advanced server technologies with virtualisation to optimise hardware resources and meet the needs for performance (Server performance).

The iSITEC software platform will be modern and dynamic, it will offer the new features for online collaboration and eLearning resources – texts, tests, videos, presentations, dictionaries, forums, chats, certification, and others.

Administration Features of iSITEC

Users will be able to customise the design and layout of their view in iSITEC. The system will offer a few options for authentication – User Recognition (connecting through existing registrations in social networks such as Facebook, LinkedIn, etc.) and/or register a new user. The interface of the system will have multilingual support. iSITEC will have features for backup and recovery. Users who own an IT product in the platform will be able to administer the roles and rights of their users (superuser) and also be able to easily integrate their Course content (presentations, layouts, videos, tests, other educational materials). The software will carry out periodic updates of security patches and the system outages shall be agreed in advance with users. iSITEC will have an option to track account activity in order to be able to create reports on course progress.

iSITEC superusers (teachers, university, companies) will be able to create and manage online content and products such as counselling sessions, courses, webinars, and others, to meet the requirements of their users. Online products can be developed to meet the needs of the client, for example, different educational approaches (teacher training in a group or individually) and forms of education (online, present or mixed). The platform for online collaboration will provide opportunities for cooperation in the creation and delivery of educational content.

iSITEC will have options to connect to external resources, such as material from other websites. Teachers will be able to integrate multimedia files, images or documents.

Members of the groups will be able to share and discuss, and to allocate the total activities, by function management tasks (Task manager), with the possibility for comments from all participants and new posts from the course administrator. Teachers will be able to easily manage the systems of assessment and course process. Trainee users will be able to view both their own activities (published posts in a blog) and the activities of other participants in the group (Blog Posts). iSITEC users will have the opportunity to evaluate the platform (Rating), which would improve its quality.

iSITEC – Creating Added Value for the Society

The final products of iSITEC will be designed for the following groups of potential customers: a) business companies and entrepreneurs, who wish to retrain IT skills of their personnel; b) higher educational institutions such as universities or research institutions, who could use the platform to perform their IT online training; c) qualified teachers, instructors, and lecturers, who wish to perform individual IT training; d) students, who wish to upgrade their skills and train postgraduate; e) IT

specialists, who wish to upgrade their level; f) disabled people or children without parental care, who wish to find realisation from home, using their IT potential; g) IT specialists, wishing to search for a career in international organisations as NATO, Eurocontrol, United Nations, and European Commission; h) budgeted institutions and governmental organisations for their own staff retraining courses.

In this study, the principles of transparency and the elimination of discrimination in respect of users of iSITEC are applied. iSITEC will aim to support and provide opportunities for the development of handicapped or disadvantaged people and children deprived of parental care. The aim of the platform is to create and prepare IT staff by engaging disadvantaged people and by the provision of the free digital environment for retraining in order to overcome their isolation.

Using the resources of iSITEC will create economic value, through the creation of social value such as to help improve the quality of life of persons at risk and to provide opportunities by acquiring knowledge and enhancing their skills.

Since the iSITEC will be an online platform, direct contact between participants in the platform will be avoided. Thus, the system is eliminating the conditions of inequality.

iSITEC will be a system for cooperation, where the implementation of common tasks, students' groups, and the participants will be interdependent, that will stimulate participants to work together to achieve the common assignments. In this way the disadvantaged people will be integrated into working online groups that will lead to social interaction.

In addition, using iSITEC will have an economic and social impact on its users. Since iSITEC is an online digital platform, it will provide access to its users to training that could be followed at any time and place independently of other schedules and activities. The "presence" in iSITEC is online, which saves transportation costs, travel time, cost of human resources, involved in the learning process, therefore the cost of the products in this platform will be several times lower than in regular classroom instructor-led training.

Another advantage of the iSITEC will be its time efficiency. It will enable employers to build the competencies of their staff such as independence, self-discipline and responsibility, self-organisation, ability to realistically assessing and making appropriate decisions with regards to planning and completing their assignments in the training.

There will be no limitation on the number of users active simultaneously in iSITEC. Active users could be employers, teachers, or learners. Employers will have the opportunity to re-train an unlimited number of people at a reduced cost or have access to the iSITEC database for qualified personnel to hire. Teachers could train more people and get with the same effort better revenue (should it be per participant). Learners save not only the employers' costs for re-training but they can also better organise their personal time and resources.

The Need for IT Competencies Management Environment

The competitiveness in any economic sector and support of permanent growth depends on the direct access opportunities and effective implementation and use

of information and communication technologies (ICT). They are of significant importance for the expansion of the market niche and the creation of new markets, for supporting effective user planning and business management, inexpensive and quick access to innovations and information.

IT as a sector has a double role in market growth. On the one hand, the sector itself provides supply on innovative technology and applications, products and services. On the other hand, it has a role as a horizontal factor for development and growth on other sectors. Training, qualification and competence management of IT staff in iSITEC will contribute to both vertical and horizontal growth of the IT sector. Horizontal growth will be achieved through expanding the platform's activities into new geographic regions and/or by increasing the range of products and services offered to current markets, while vertical growth will be the value added to iSITEC users in their career path, skills upgrade, easy collaboration between the different stakeholders. One of the possible risks iSITEC might face on the market is the pressure from customers and/or governmental policies for keeping the prices lower to an extent that the platform might become unsustainable. iSITEC shall maintain flexible pricing policies that shall be in compliance with the demand, taking however sustainability into account. Another threat to iSITEC could be the presence of strong market competition of new or already existing educational online systems. To mitigate this risk, the platform needs to excel in its products and customer services such as fixing issues quickly, responding to customers' requests in a timely manner, regular software updates, etc.

In conclusion, there are a number of vendors, academic and international organisations training options online; however, there is not one single online place yet created to gather all stakeholders to include companies, governmental organisations, educational bodies, research institutes, students and employers and to offer them a suitable and symbiotic working environment in order to efficiently and effectively manage IT competencies.

The expected results from the implementation of the proposed solution are as follows:

1. Synthesis of a business model for the implementation of a digital platform for IT education and collaboration (iSITEC);

2. Development and implementation of an eLearning platform for IT specialisations selection, training and development of IT professionals to work in national and international IT organisations;

3. Analysis, design, and development of innovative advanced software tools for remote training and cooperation between universities, teachers, students, and employers;

4. Creating educational resources materials for eLearning that can occur at any time and any place;

5. Exchange of best practices between government organisations, educational bodies, employers and employment agencies;

6. Providing hosting services for free educational courses and materials from Bulgarian and foreign educational bodies;

7. Provision of common collaborative research infrastructure and consolidated society in ICT by iSITEC for universities, teachers, students, and employers;

8. Provision of capacity for digital transition in all areas of education in order to avoid duplication of costs and human resources;

9. Attracting private investments and public funding for the development of training in priority areas of ICT;

10. Ensuring equal access to free educational resources through new digital technologies in the education for disadvantaged people.

Recommendations

In order to build a solid basis for the implementation of iSITEC, the research should continue further examining in depth the following areas:

1. ICT taxonomy for competence management;
2. Develop the governance structure for the iSITEC stakeholders;
3. Define the business processes for iSITEC and its management;
4. Develop the architecture of iSITEC;
5. Create a catalogue of services and service-level agreements/OLA and partnership agreements;
6. Identify a toolset for knowledge management in iSITEC and use of artificial intelligence;
7. Develop a pilot case for the area of information security/ cyber resilience in the administration and small and medium enterprises.

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Silvia **Matern** is a Ph.D. Student in Informatics at the IICT-BAS. She possesses over 15 years of experience in system support, software engineering, web development, system implementation, site acceptance, testing and documentation for government and international organisations. She served for more than 10 years in NATO structures (NPC, NCSA, NCIA) as a software engineer and a web developer managing all support and maintenance aspects of assigned information systems in support of NATO Operations. As a Ph.D. student, Silvia is researching the development of a centralised solution for management of IT competencies that should serve as a digital platform for qualification and pre-qualification of IT specialists focusing on IT taxonomy and the creation of a collaborative environment for government organisations, educational bodies, businesses, IT experts and students.