

Smart Regions' Economical Innovations and Sustainability in Relation to Vocational Education and Training and Specific Required Skills: An Approaching Model through Qualitative Research in Greek Enterprises

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This paper talks about recent evolvement of smart regions' innovations in relation to vocational education and required skills. Research includes sample regions of Greece using smart cities' technologies for the past few years. Improvements in terms of economics and well-being of all the stakeholders are studied thoroughly, even though the country is still in recession. As a result, full use of technological innovations depends on the quality of vocational education of all the stakeholders and specific skills are in demand. The study aims to further create an educational model that promotes skills, providing better living conditions in the cities of tomorrow.

INTRODUCTION

Since the 1990's the term 'smart city' has been used either as a fashion label or as a way to help some certain cities distinguish and promote themselves as innovative (Ramaprasadet.al, 2017). Obviously the concept of smart cities or smart regions is strongly connected to the use of information technology in urban environments. In general, smart cities, include innovations that monitor, manage and enhance key infrastructure and public services such as transport and traffic management, energy, water and waste management, healthcare and community services.

A smart city is defined as a city that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently. This includes data collected from citizens, devices, and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, law enforcement, information systems, schools, libraries, hospitals, and other community services (MIT Press, 2015). The smart city concept obviously integrates information and communication technology (ICT) and various physical devices connected to the network (Internet of Things) to optimize the efficiency of city operations and services and connect to citizens (Peris-Ortizet.al, 2016).

As a result, a smart city is usually planned in a way that supports some specific elements. These elements include networked infrastructure that promotes economic and political efficiency while at the same time enable social, cultural and urban development, advanced public services, social and

environmental sustainability (Caragliu, 2011). Many researchers agree with the pre-mentioned elements and even enhance them with more such as emphasis on business led urban development, creative activities for the promotion of urban growth and protection of natural environment as a strategic component for the future (Albino et.al, 2015). In addition, other researchers (Giffinger et.al, 2007) conceive the idea of smart city as one that would excel in the following characteristics: smart economy, smart people, smart governance, smart mobility, smart environment and smart living.

At the same time, while proponents argue that smart cities will bring positive social change by the adoption of ICTs, enriched e-governance and human capital among the citizenry, opponents point out about the negative effects and gaps existing in their planning and execution. Despite efforts to promote its practice, there has been wide criticism about the concept and the way it has been adopted and implemented. The roles of various players especially the central role of private sector, is often challenged in the academic literature. A variety of expectations from various stakeholders make the potential implementation strategies even more complex. It is often argued that there are conflicting views in smart city's planning, which limit our knowledge about the 'real' smart city and its implications for building creative and inclusive urban space. Such uncertainty at the conceptual level, and the heightened importance given by policy makers and markets to its adoption, highlights the need for proper scrutiny. Therefore, literature proposes frameworks consisting of Restrictive, Reflective, Rationalist and Critical Schools, in the effort to analyze various stages in the development of the field (Kummitha et.al, 2017).

From the above, it derives that despite the fact that the general concept of smart cities is theoretically more or less the same; the deeper conceptualization may vary from city to city or from country to country. The reasons could be relevant to the level of development, the size of local resources, the general acceptance of changes and reformations, the flexibility of communities, citizens, authorities, etc. Another strong reason that is closely related to the wider concept of a smart city or a smart region is the smart or even innovative population. This element is obviously relevant to the level and quality of Education and Training that promotes the overall skills of the citizens and even the whole set of stakeholders. As digital transformation genuinely requires full participation of citizens and communities, the matter of suitable vocational training arises in addition to the formation of general required skills such as flexibility, adoptability, mobility, critical thinking, team spirit, etc. As a result possible changes might be necessary even in typical and vocational educational systems.

The above ascertainments seemed to be confirmed from various recent researches. For instance, a research undertaken by the Institution of Engineering and Technology (IET, 2016, Smart Cities: Time to involve the people?), has found that despite considerable investment by the UK government, local authorities and businesses, there is a basic lack of awareness among the British public about what a smart city is, does, and its potential to improve citizens' quality of life. Similar results are also available in different countries in Europe and even worldwide. Yet several smart skills are required which are even just as important as the technology installation itself, in order to ensure the consistency and the performance of the near future's integrated smart city.

At this point, a significant role is placed on Vocational Education and Training (VET), as it usually emphasizes skills and knowledge required for a specific job or trade. VET may take place at any adult age level; therefore this is a major advantage in enhancing smart skills (soft and digital) required for the smart citizens of a smart city. As a result, VET holds an increasingly important role and this concept seems acceptable worldwide.

Specifically, adult learning is considered a vital component of the European Union's lifelong learning. It is essential for employability and competitiveness, social inclusion, active citizenship and personal development. The challenge is to provide learning opportunities for all adults, throughout their whole life, especially disadvantaged groups who need them most. The rate of participation of adults (25-64 years old) in learning varies significantly between EU countries: from 1.1% to 30.4% (Eurostat, 2017), and the overall trend is that numbers are stagnating. Participation rates are especially disappointing for low-skilled and older adults. Action at European level will increase knowledge about successful policies, provide support and enable a better exchange of experiences between countries. European Commission is working with 32 countries to implement the Renewed European Agenda for adult learning. This

highlights the need to significantly increase adult participation in learning of all kinds (formal, non-formal and informal learning) whether to acquire new work skills, for active citizenship, or for personal development and fulfillment. Moreover, improving and modernizing education systems is a key priority for the EU, so that gradually citizens may be successful in a complex and interconnected world that faces rapid technological, cultural, economic and demographic change (European Commission, 2018). The Commission supports innovation in education through the following initiatives: University Business Cooperation, Digital Education Action Plan, European Institute of Innovation and Technology, Entrepreneurship Education, Working Group on Digital Education: Learning, Teaching and Assessment.

At the same time, according to Carrie Yau (Executive Director of the Vocational Training Council in Hong Kong), Hong Kong's Vocational Training Council has already reformed VET system in a way that it now provides quality vocational and professional education and training to nurture globally competitive individuals for the development of Hong Kong and the region. It offers vocational education and training from crafts to technician up to degree level every year to 250,000 young people and in-service workers, of whom 50,000 are full-time students (Carrie Yau, 2017). To further such education and training, the Council has already dealt with a number of priority issues such as: Rebrand VET as 'Vocational and Professional Education and Training', in order to change the mindset of students, parents and educators who wrongly perceived vocational training as blue-collar education for less talented students with limited career options or prospects. Another basic issue that Hong Kong's Vocational Training Council has observed is that the whole VET system should take into consideration not only trade skills but soft skills as well. The target is to create critical thinkers, problem solvers and design thinkers. The Council has devoted significant efforts to promoting vocational and professional education through publicity campaigns, school outreach activities, forums and seminars, targeting local and international educators, plus skills competitions and events. In addition, the Council is planning to soon launch a three-year vocational baccalaureate program for senior secondary level students, enabling them to join a university of applied sciences, equivalent to a higher education institute, or traditional university. Finally, Hong Kong has invested in dual-track vocational education. Making reference to the international best practices of Swiss and German models, the Earn & Learn Scheme had been introduced in 2014 for secondary school leavers, with support from government and industry, which provides an opportunity to follow a well-defined path for higher qualifications. By integrating structured classroom learning with on-the-job training, young people can put learning into practice in a work setting. Following positive feedback, the scheme has been extended to cover 10 industries and trades. The plan is to further develop the dual-track model to degree level, ultimately achieving dual-track learning for all.

Furthermore, in USA, VET is usually referred to as Career and Technical Education (CTE) and it includes a great variety of options (Tucker, 2018). The abundance of possibilities, is very much welcome, in the minds of most Americans, as it offers ways into making their future that they might not otherwise have had. As a matter of fact, USA holds some of the most impressive CTE programs in the world. The reason for this is that they are centered in problem and project curriculum, which is particularly well suited to the kind of economy that is now emerging globally. In fact, certain cities such as Philadelphia, are investing in employee involvement to encourage creative solutions and face common challenges. Projects include efforts to address zero waste, bike corrals, public health, computer-aided dispatching and training programs.

RESEARCH

The pre-mentioned issues have led to the present research which targets to investigate the relativity between two certain Greek smart regions (Trikala and Heraklion), VET and required soft and digital skills. The two cities that took part in this research are unlikely candidates for leading smart cities, but they all include innovations that have improved lives despite the present financial crisis. Yet, they are a leading example due to the country's debt crisis over the last decade. Despite the financial difficulties, the Central Union of Greek Municipalities is engaged in digital transformation policies with special emphasis

in creating access to data and technologies, in promoting an advanced e-governance model with public participation and enhancing digital skills¹.

Trikala, located in the middle of Greece, is a medium sized flat provincial city (population 76.000), given a smart city award in 2004 and since then the city has a highly planned strategic orientation towards the future using digital technologies, information and communication technologies to enhance quality and performance of urban services, health services, government services and mobility providing added value to the city (Greek News Agenda, 2017). The overall goal in Trikala, is to make sure that collective benefits are maximized by implementing policies that reduce cost and resource consumption to engage more effectively and actively with citizens. Key smart sectors include transport, energy, health, care, culture, tourism and e-government. Trikala has the distinction of being the first smart city in Greece, integrating technology-powered solutions into the daily life of the municipality and delivering government services to citizens through e-governance. From free Wi-Fi service throughout the city to tele-health care for the elderly, from driverless buses to the e-Dialogos platform where citizens can participate in the public life of the city and its decision-making, the town is using technology to increase transparency and improve citizens' daily lives. Trikala is leading the way as a 21st century model for other Greek cities looking to partner with American companies to put technology to use for democracy (Pyatt, 2017). The local government, with the help of the tech firm **E-Trikala**, also funded the purchase of Lego and Raspberry Pi robotics kits to all its 120 public schools. In the effort to create a new, modern version of the Greek city, Trikala is trying to limit brain drain by encouraging young graduates to return home and use their skills and expertise to improve their local area. It is expected² that in the next decade, Trikala will become the norm rather than the exception, with various developments like urban farms, autonomous vehicles, advanced renewable energy systems, etc.

Another Greek city that has been gaining the title of a smart region is Herakleion (population 144.000) in Crete. Herakleion is considered³ a smart, sustainable city with strong cultural and tourist identity. Electro mini buses are already in use in order to minimize pollution, air toxins and therefore improve public health and protect natural resources. Moreover, the adoption of ICT helps transport and generally supports sustainable urban mobility mostly in tourist areas. These transport policies include certain web applications regarding arrivals, departures, stops and routes of transport vehicles, together with public monitors that keep citizens constantly informed. Transport routes are designed in such a way that passengers are transported directly to the center of the city through the fastest way (Fortune Greece, 2017). In addition, Herakleion has been investing⁴ in green economy, energy, smart water supply, natural resources, digital transformation, mobility, transport, smart living and citizen's welfare.

Qualitative research took place in both of the above regions (Trikala and Heraklion) mostly among local enterprises (N = 10) and local authorities such as Chamber of Commerce, Local Municipality and Water Supply and Sewerage Company (N = 3) in each city. The statistical methods used, compare basic elements before and after the establishment and the use of the integrated technological facilities. In both cases, the samples were representative and interviews and questionnaires were given in person or sent through mail. Moreover, the interviews and questionnaires included semi-structured and even unstructured formats as this way allows more flexibility, immediacy and responsiveness (Jackson et al, 2007). In this way, research enhances deeper understanding of the social, technical, cultural, human issues, trying and hoping to provide answers to the set of the researched questions. The interviews and questionnaires included several aspects of the matter, basically regarding the following sectors:

- General knowledge, information about the concept of smart cities
- Level of smart applications that are being used either in enterprises or in daily personal use
- Level of improvement in various functional ways during or after the use of smart applications
- Ways of transformation of simple daily life in the smart region and how this is perceived by employees, authorities, enterprises and citizens
- Degree of readiness of the citizens to adjust and flourish in the new environments of a smart region

- Level of changes in terms of various frameworks (technological, institutional, human, data management, energy)
- Educational level of its participant, age group, participation in VET programs, etc.
- Adequacy of soft skills received through former or present education in order to face smart city's challenges
- Record of skills in demand
- Critical thinking, flexibility, team spirit, etc. in the VET programs

DISCUSSION

After careful classification of the above and the construction of relevant tables and graphs, several conclusions were extracted. The leading idea supports the fact that smart cities and smart skills (soft and digital) are two interrelated facts.

The first conclusion is related to the poor amount of skill's cultivation received in former levels of education. This was found both in enterprises (85%) and in local authorities (88%). In fact, a considerable number of employees mentioned that a huge amount of soft skills needed in today's demanding working environments were nearly never taught or cultivated in any way, in various received educational backgrounds.

The second conclusion refers to the level of soft skill development through various offered VET programs. It has been found that most VET programs do not emphasize thoroughly enough in soft skills growth (90%). Yet, some well-designed VET programs have been classified as the reason of improving workplace, salaries, level of personal well-being, etc. (10%).

The third conclusion is that a set of certain soft skills has been confirmed as mostly necessary in adjusting in smart environments. The skills in demand (96%) appear to be: problem solving, flexibility, creativity, team spirit, communication, interpersonal skills, time management, adaptability, leadership and work ethic (integrity, commitment, self-motivation, discipline and responsibility, initiative, etc.). This conclusion is actually in agreement with a relevant survey by SMB World that has found that nearly 72% of CEOs believe that soft skills are more important to the success of their business than hard skills. In fact soft skills and hard skills should complement each other to make the total package an employ needs (Jackson, 2018).

Another basic result of the present research is the strong belief of most employees that appropriate design of educational programs is mostly helpful in later stages of work life. Therefore changes and reformations in educational curriculums with enhancement from baseline digital competencies to deeper computing, programming skills, computational and mathematical thinking is crucial in changing wider public perceptions of technology and its impact on daily lives, as well as equipping young people to live and work in a more computational world. Shifting society towards digital creation rather than just consumption could catalyze a profound change in civic engagement. Developing a digitally confident and capable citizenry through long-term technology innovation strategy and industrial policies could be achieved all the way from using open data as an effective policy instrument through digital infrastructure (Tryfonas, 2017).

Finally, the present study aims to gradually develop an approaching model that refers to the analytical ways of improving educational and personal skills in order to effectively use the present form of smart cities' innovations as well as prepare the communities for the future integrated smart cities attitudes. This model, once completed, could be useful to all typical and non-typical educational institutions that wish to adopt flexible and adoptable courses in order to facilitate certain requirements, providing better living conditions in the cities of tomorrow.

CONCLUSIONS

From the above, it derives that VET programs should be well-designed so as to support sufficiently soft skills development among stakeholders (citizens, communities, authorities). Digital skills and soft skills hold a key role in the future of smart cities. In both examined areas, research has shown the high need of VET's transformation, in order to become adjustable to the specific needs of both citizens and enterprises. Smart cities will be bringing many new jobs, as well many opportunities, so increasing professional and soft skills will most likely increase the chances of getting interesting and well paid work.

Another issue is achieving urban sustainability which is judged by criteria like elements of day-to-day quality of life (clean air, clean water, green space) that have direct effect on the urban public's health and productivity, infrastructure that focuses on the city's greenhouse gas emissions, public transit systems to electricity generation and transmission (water treatment, water deliver, sewage disposal systems). Residents of smart cities are simultaneously called to make key decisions about where they live and work and whether to buy such energy-consuming durables as private vehicles and home air-conditioning units. Given the long-lived durability of the capital stock, short-term decisions will have long-term effects on the city's carbon footprint. Finally another basic issue is a city's resilience to natural disasters and extreme weather events (Kahn, 2014).

In order for cities to move forward, the first step is investing in the IT infrastructure which will underpin the technology (construction trade, buildings and roads are only created with the vital infrastructure that supports them). With a skills gap already present amongst many IT and digital professions, the investment into smart cities of the future must be coupled with investment into skills and training. It is mandatory to excite the younger generations who are reaching key stages in their education that they will have a vital role to play in the creation of new technology, and how it will affect their day to day lives. In order to do so, it is also important to be open-minded about the type of talent needed. The skills gap will not improve within the sector if it is only limited to those with degrees in computer science, math or physics; it must extend to those studying business, or with great creative skills, for instance (Milligan, 2017).

According to Cisco Systems a huge number of new IoT job roles is already coming up such as cloud architect, virtual reality designer, data scientist, platform developer, robotics specialist, cyber security analyst, 3D print technician, industrial network engineer, neuro implant technician, network programmer, remote health care providers, machine learning scientist, business transformation practitioner, etc. Furthermore in this rapidly changing digital sector, it is quite important which technologies someone has worked on in the last 12 months as well as the areas someone has up skilled in.

To manage all the pre-mentioned issues that are thoroughly proved through research and academic literature it is crucial to invest in human capital. Improving or changing mindset and narrowing skill gaps are major factors in creating sustainable and successful smart regions and smart cities in general.

ENDNOTES

1. <https://www.citybranding.gr>
2. <https://edgylabs.com/greeces-first-smart-city-is-showing-us-the-future-of-living>
3. <https://www.heraklion.gr/municipality/epixprogramma/epixprogramma.html>
4. <https://smartcity.heraklion.gr/el/home>

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