



A Comprehensive Analysis of Engineering Competencies for IoT in Green Transformation within the Western Balkans Economy: A Case Study from UAMD University

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Abstract

The need and sensitivity in the energy sector has raised the sensibility of the education and industry sectors to accelerate the inclusion and perception of all the technologies that effect in the enrichment of the capacity buildings related to internet of things and green transition technologies. Considering the fact that Albania is at the basic phases is very important to orchestrate two parallel lines in this highway. The first one is the education area in order to instill is the best way the concepts of these modern technologies at the students in order to have future generations with the proper knowledge by integrating in the curricula new courses on IoT and green transformation. About the second on facilitation of the implementations rules of these technologies in industry by the support of national and European Union projects and regulations would be of great interest because will offer to the students a suitable environment for hand-on practice cases. Analyzing the findings based on the methodology of a survey it is highlighted on all categories of the question the gap that exists in Albanian education system on IoT and green transformation fundamental concepts and also they eagerness and readiness of academic staff and students to welcome every possibility that they encounter to feel more confident in these new technologies.

Keywords: Internet of Things, Western Balkan, HEIs, Green technologies, Albania education

1. Introduction

The challenges of sustainable development, both present and future, call for a profound shift in the habits and behaviors of the entire population on many different levels. This necessitates a shift in priorities, viewpoints, and behaviors, which

can only come about because communities and individuals are becoming more conscious, knowledgeable, and trained. This need is being met by the field of design for sustainable green behavior, which is creating tools, frameworks, and services to assist people in changing their routines and thought processes.[1] [2] By strengthening instruction and learning, boosting energy efficiency, encouraging safety and security, and enabling online learning, IoT and Green Transformation systems can aid in modernizing and strengthening Albania's educational system. It's crucial to remember, nevertheless, that to guarantee an IoT system's efficacy and durability, substantial financial commitment and meticulous planning are needed.

Albania is a developing country, so it is important to recognize the opportunities for smart solutions based on Internet of Things (IoT) and Internet of Everything (IoE) technology, their application for a green transformation, and the building of academic and institutional capacities toward national and regional cooperation between HEIs in the WBs to meet the Sustainability Development Goals for 2030 at certain values, by the valuable support of EU funding politics. The feasibility study of a human capacity building and infrastructure initiative is one of the pillars of this concept. Since Albania is in Industrial 4.0, preparing and informing IoT-related individuals will help them access these futuristic technologies. Many companies in Albania have developed and implemented IoT solution in different domains like fleet management, temperature control, electric chargers, smart cooler as an integrated part of smart homes which have influenced in energy efficiency and cost reduction till now but needs to be highlighted that the trend for usage of these systems is positive non forgetting to care also about the security issues that should also be evaluated seriously.

The importance of the inclusion of these fields in Albania is also recommended in the report of European Commission SWD for Albania on 8.11.2023 were cited: "Albania is in between.

moderate and a good level of preparation on energy. It has some level of preparation in the areas of environment and climate change. The country has made some progress in the areas of energy and, notably on the reform of the electricity market and in developing energy networks.

Limited progress was made in environment and climate change.[1]

Addressing the issues of climate change by strengthening green transition policies, pursuing efforts in sustainable hydropower generation and ensuring sustainable connectivity, constitute.

fundamental priorities for economic integration within the region and with the European Union. This cluster and the reforms concerned have significant links to Albania's economic.

reform program, the Commission's economic and investment plan for the Western Balkans and the green agenda for the Western Balkans. "Which influences with positive vibes in society and economy.

This article will cover application of IoT and green transition in different sectors in Albania some figures collected from a research on a HEI which will be detailed below, regarding the level of information that academic staff and students have on the IoT, green transformation, inclusion in the related projects to these topics and if there are interested to include these concepts as courses in the curricula followed by presenting a holistic and coherent method of education that is the application of digital twin in these areas to finalize with some recent implementations advances in the mentioned fields.

2. Applications of IoT and Green transition in different sectors in Albania

2.1 IoT in Education Capacity building is the most important phase in the education and the future of the country.

Strengthening this sector is a secure step towards a brighter educational process.

To ensure result the focus was on all levels of education compatible for before mentioned subjects: Adopt the implementing legislation for the Law on Energy and Green transition. Be sure that there are enough resources for the VET and HEI system to be optimized in line with the demands of the labor market. Enhance the professional development and training of educators and trainers, with an emphasis on pedagogical skills related to the implementation of the competence-based inclusive approach and digitalization from pre-primary to university level, including VET education. [1] Ensure sufficient resources for the optimization of the VET and HEI system is in line with the needs of the labor market; improve the professional development and training of teachers and trainers, with a focus on pedagogical skills related to the implementation of the competence-based inclusive approach and digitalization from pre-primary to university level, including VET education.

The trainings and courses regarding IoT are inserted in a few universities in Albania.

The concepts on IoT are as integral part of course summarized in one or two subjects.

Regarding green technologies or green transition there is not any course till now

The main universities that offer IoT course in Albania is Polytechnic University of Tirana

One of the main ongoing projects in Albania which integrates IoT, and green technology is “Green Energy-Efficient Schools for Albania” where due to the favorable climate in Albania have been exploited all the resources to foster for the new generations. [3] and for a cleaner and sustainable environment

Furthermore, is very important to consider filling the gap of IoT and green technologies concepts in upper secondary and professional schools and the creation of EIT branch in Albania due to the main needs [4].

2.2 ICT Sector

IoT demand is always increasing, and cloud computing services are used to meet it. Data centers are becoming one of the greatest energy consumers, leading to increasing environmental problems and CO₂ emissions, to supply the infrastructure needed to support the IoT paradigm. With the usage of IoT sensors and tools can measured and predict the consumption of energy and the possible savings of energy. [5]

2.3 Implementing of IoT and green technologies in energy Sector.

The main implementation of these technologies in Albania is focused on the applications of the renewable energy possibilities. These technologies have underlined on the production on energy for solar panels, wind turbines only one application in Albania and the modernization of the mains resource of the production of energy in Albania hydropower to achieve better efficiency and to improve maintenance of the systems to increase sustainability and use in an intelligent way our natural resources.[6],[7],[8]

2.4 IoT in small and medium-sized businesses

Both advanced technology concepts in industry are in the early stages of development in Albania, thus their cross-application will be a double challenge in the industries where they will be implemented.

Important is to establish a secure channel over which data will be exchanged, because in these circumstances, vulnerabilities will be on the rise due to the widespread usage of open-access devices such as smart phones, I Pads, laptops, and other similar devices.

In Albania, simple IoT solutions are used in a variety of industries, including agriculture, data management, tourism, environmental protection, and energy efficiency. Vodafone, for example, provides a variety of options, such as Vodafone Smart Clima, Coffee, Asset Management, Cooler, Communication IoT, and so on. [10] There are a lot of accelerators that support WB countries including Albania to generate more integrated and special solutions in help to education, labor market, Europeanisation, and industry advanced in many other areas, such as education, health, and finance. On the other hand, implementing and maintaining these tech trends under well-studied and tested security rules, as well as by qualified specialists, poses several obstacles. [9],[10]

2.5 IoT and green transition in emerging technologies like blockchain, 5G and AI

The integration of IoT and green devices by supporting the easiest of gathering the data in real time and the minimization of energy consumption due to the green nature of the devices can offer many possibilities to elaborate this data in machine learning and artificial intelligence models to create different trend for predicting the future to prioritize the needs for sustainability and cleaner environments. [12][13]

3. Results of a Survey on Inclusion of Academic Staff and Students of UAMD in IoT and Green Transformation

The study addresses the specific needs, the level of information that the students and academic staff of UAMD possess on these technologies and the desire they have to participate and contribute in the implementation and share know-how experiences for coherent technologies that influence on the innovative and efficient education and market in country under development like Albania inspiring to be member of EU Union and comply the Sustainable Development Goals influencing with positive vibes in society and economy.

By obtaining insightful information from students, faculty members, and businesses that operate mainly in the city of Durrës, the primary goal of the survey is to gain a deeper understanding of the general integration and uses of IoT and

Green Transformation in Albania's education and business-oriented ecosystem.

3.1 Methodology

Direct inquiry is the technique employed to get primary data. The questionnaires comprised between 13 and 16 questions, and because they included both closed- and open-ended questions, they can be classified as semi-structural surveys.

To collect the necessary data from various target groups, the survey was structured in three distinct questionnaires:

1. Professor's questionnaire
2. Students' questionnaire
3. Companies' questionnaire

The answers to the first and second questionnaire come from the University of Alexander Moisiu. The third survey is intended for businesses of all stripes operating in the ICT industry in Albania. The students' survey included 15 questions in three different types: multiple choice questions Yes/No, five-point level agreement Likert scale, open-ended questions.

The academic staff survey was composed of 16 questions with three various types as the one of the students.

The third questionnaire had the same structure but had the range of distribution geographically larger.

The data collected are from 105 students, 29 businesses, and 30 full- and part-time academic staff members from the Department of Information Technology and Computer Sciences are included in the study. The data collection period encompassed the dates 28 March 2023 through 17 April 2023. I will analyze only the first questionnaire about the Professors since they are the crucial factor that influences mostly in education management and improvement of the results.

3.2 Analysis of the questionnaire

About the question "Do you use IoT related concepts in the courses that you teach? There are the following rates as in Fig.1

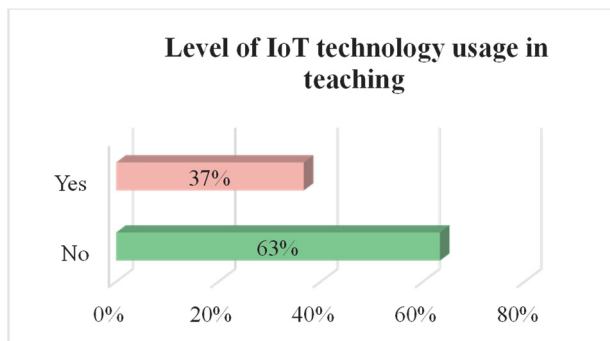


Fig.1: Percentage of the usage of IoT concepts in teaching courses

Relating to the question -Where are mentioned from the academic staff the IoT-related concepts, after analyzing the response, is realized that the mainly courses where the concepts are included are in the field of Multimedia, Technology and Innovation and Information Systems.

From the question that aims to tackle in which study program are the concepts of IoT provided there are the following results represented in Fig.2

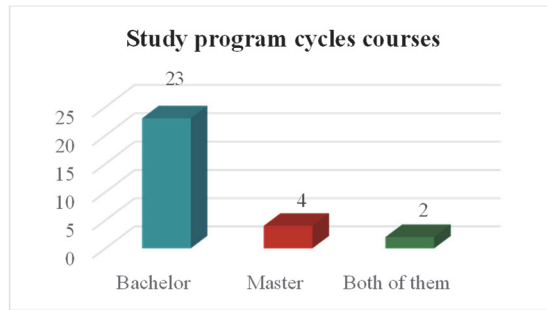


Fig.2: Study programs courses with IoT concepts

The question designed to rate the importance of IoT / IoE related-topics by using Likert scaling from 1 to 5 where 1 is for the lowest level of the importance and 5 for the highest comes with the results in Fig.3 where is evidenced the trendline regarding the importance of IoT / IoE - related topics is in increasing order which elucidates the readiness of academic staff regarding the implementation of such topics during their courses.

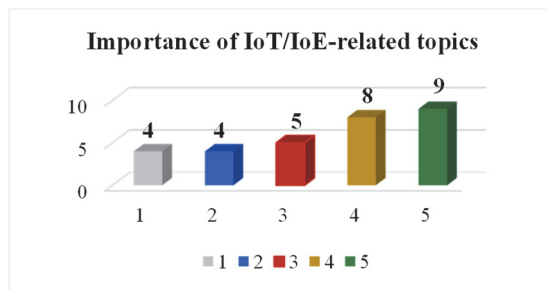


Fig.3: Importance of IoT / IoE - related topics

From the question- Have you had the opportunity to attend training or workshops related to IoT the rates of attendance are as shown in the graph in Fig.4

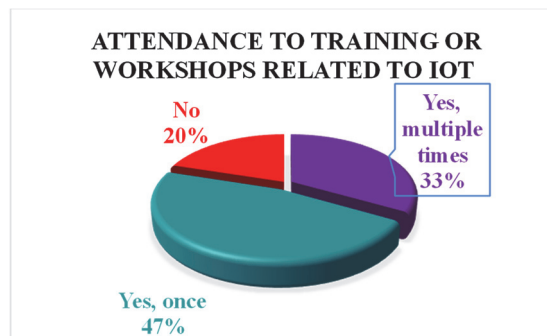


Fig.4: Percentage of attendance at training or workshop related to IoT.

The experience in developing or working of academic staff to develop and work with IoT/IoE projects based on the

method of Likert scale from 1 to 5 where 1 is for the lowest level of the importance and 5 for the highest there are the results as shown Fig.5

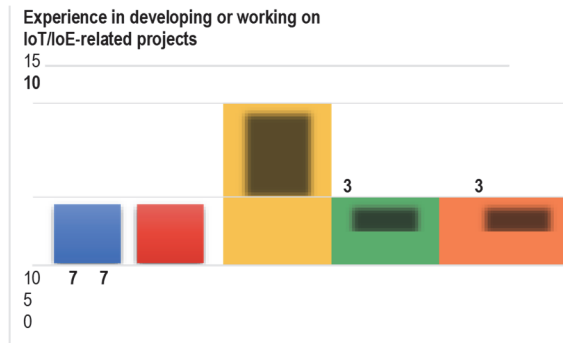


Fig.5: Experience in developing or working on IoT/IoE-related projects.

Referring to question on the level of the facilities and resources to implement IoT related projects and courses in Aleksander Moisiu University it is merely shown that most of the academic staff have not included IoT/IoE- related projects in their courses. Only 34% have integrated this kind of project in their courses, which shows the need for more projects in Aleksandër Moisiu University because 56% have not yet integrated.

The indexes of usage of green transformation related concepts in teaching from academic staff of Aleksandër Moisiu University that is analyzed in the next question are literally low and expressed in percentages are 67% and that use 33 % that use in moderate levels which will be detailed in the next Question.

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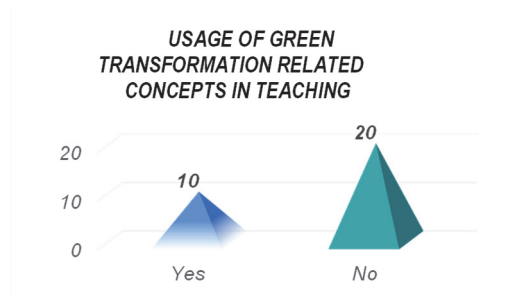


Fig.6: Usage of green transformation related concepts in teaching

As a result of the next question, which is also constructed using a Likert scale the results show that, for 17 out of 30 professors, the importance of green transformation-related teaching strategies is very high (levels 4 and 5). This is extremely positive given the growing importance of energy efficiency requirements as well as environmental clarity issues.

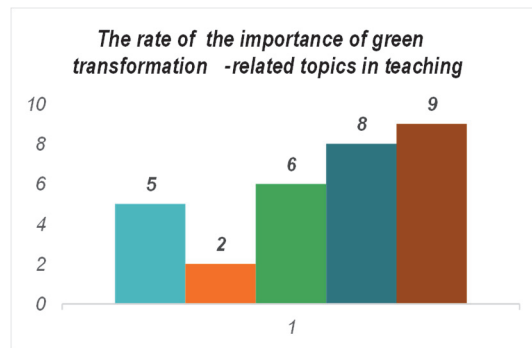


Fig.7: The rate of the importance of green transformation-related topics in teaching

Based on question 12 of the questionnaire where is measured the experience in developing and working on green transformation-related projects of the academic staff of Aleksandër Moisiu University is evidently shown that the experience is at less than medium levels more concretely in percentages is rated from poor to excellent (level 1-5) in these values 1-26.6 %, 2-16.6%, 3-30%, 4-13%, 513%. The product of the question emphasizes very clearly the need for more attention in developing or working green transformation related projects inclusion.

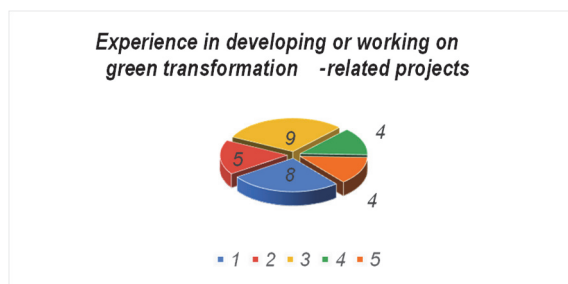


Fig.8: The experience in developing or working on green transformation related projects.

The purpose of this question is to estimate the significance of integrating more IoT/IoE technologies and green transformation concepts/courses in the study programs at UAMD. This will be done using a Likert scale from 1 to 5, where 1 represents the lowest level of importance and 5 the highest level of importance. According to the data, 57% of respondents think that integration with levels 3-5 is crucial, and 43% think that integration with levels 1 and 2—which relate to scaling—is less important.

Looking at the analysis of the following question regarding the viability of implementing IoT/IoE and green transformation as a useful component of teaching the material in a clear and concise manner, it is pleasing to note that 67% of academic staff members are ready and want the implementation, 37% are in favor of it, and 0% are not at all.

Considering the analyzing of the next question on the possibility of the implementation of IoT/IoE and green transformation as a practical part of teaching the information tailors in a well-defined manner with 67% of the academic staff which are ready and want the implementation, 37% are positive and 0% are with negative vibes, pleasantly saying that these are really very satisfactory indicators. (Question 14- How do you see the possibility of implementing IoT/IoE and green transformation in the practical part of teaching?).

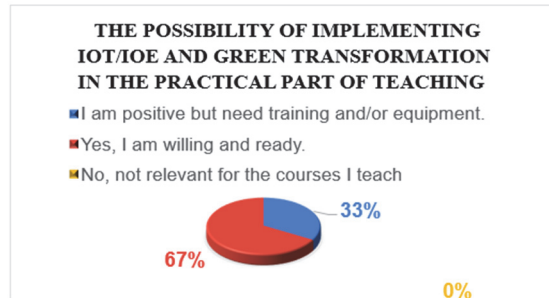


Fig.9: The percentage of the possibility of implanting IoT/loE and green transformation in the practical part of teaching

About the question on -How do you think that IoT/loE technologies and green transformation could be integrated more effectively into the courses you teach?-67% have No Comments, 7% have answered No Answer, 7% wish Success for the project and 19% come with these comments: As an emerging technology IoT/loE, is good to be part of education.

Green transformation is very important from the social, economic, and ecological side.

Increase the number of training courses and projects in these study areas.

- Support IOT and green transformation.
- Implement it as fast as possible in UAMD.
- The new courses support students to be coherent with the new development in the market.

3.3 Outcomes of the survey

Enhancement of the Educational Sector: The study highlights how critical it is to integrate IoT and green transformation principles into curricula of the height education level. It emphasizes the necessity of creating new courses that are especially focused on these contemporary technologies in order to guarantee that the upcoming generations have the information they require.

Industry Implementation: According to the study, national and EU initiatives and laws should assist the adoption of IoT and green technologies in industry. With the help of this support, students will be able to work with these technologies in a real-world setting and gain practical experience.

Current Status of Albanian Education System: The research points out a conceptual gap in the country's educational framework concerning the Internet of Things and green transformation. It also highlights how eager and prepared students and faculty are to take advantage of opportunities to further their grasp of these technologies.

Applications in Diverse Sectors: The article explores the Albanian sectors of education, ICT, energy, small and medium-sized enterprises, and new technologies like 5G, and AI where IoT and green transition technologies can be used.

4. Conclusions

To conclude the article may provide suggestions for enhancing the incorporation of IoT and green transformation technologies into academic courses and business operations, based on the survey results. These suggestions can involve expanding training and resources, creating new courses, and encouraging collaborations between academic institutions and business for Albanian and specifically UAMD university education system. It is of great interest to be highlighted how knowledgeable, prepared, and interested they are in integrating IoT and green transformation ideas into corporate and educational processes. Different respondents had different levels of awareness and preparedness, according to the study, but many of them said they would be interested in using these technologies.

The recommendation of the European commission, national needs and the survey conducted go in the same direction, furthermore there is an obvious benefit from the social, competitive and economic prospect.

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