

# Digital Transformation in Academic Society and Innovative Ecosystems in the World beyond Covid19-Pandemic with Using 7PS Model for IoT

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**Abstract—** *Science ecosystem has been evolved during modern human life. Teaching, learning, education, and doing research connecting elements of this ecosystem include students, professors, administrators and researchers from academia and industry. Different learning systems have been developed in different countries results in various science ecosystems that interact with each other. While the main goals are the same and there are many collaborations between them, but their reactions are different during the world paradigm shifts such as ICTs, IoTs and the Internet revolution and recently emerged Covid-19 Pandemic. In this paper we are going to study and share some experiences of different education systems. This may help developed and developing countries to tune current or determine new strategies, especially when the world faces with the crisis of Covid-19 Pandemic. We will discuss about the digital transformation in academic society and innovative ecosystems in the world beyond Covid19-Pandemic by using 7PS model and the 5<sup>th</sup> wave theory.*

**Keywords—** *e-Science, Strategy, Ecosystem, Innovation, Partnership, 7PS model, 5<sup>th</sup> wave theory*

## I. INTRODUCTION

Information and Communication Technologies (ICTs) and IoTs have pushed the world in its most recent technological revolution on the last decade of past century result in changing our lifestyle in many fields in starting the new millennium. Learning and science ecosystem were no exception; and digital transformation efforts will continue with evolving the new paradigm in learning, science and innovation ecosystem we called it E-science.

E-science had been defined in literature; and many scientific conferences and workshops have been held during past years. Large scientific data sets and highly distributed scientific networks as well as flexible and scalable computing power are the most important technological aspects in this new paradigm which have continuously grown.

Collaboration in level of scientists, research labs and universities have considerable effects on the way in which research is conducted and on the innovation process. Therefore the partnership between universities and research and innovation centers, in running joint programs and common courses, professor and student exchanges and

doing collaborative research projects, has become one of the most important issues that should be considered in future science ecosystems which are moving toward the knowledge societies.

1. What are the new opportunities and challenge for academia in the Post-Corona era?
2. What are dimensions of new emerged academic and innovation ecosystem after Covid-19 Pandemic?
3. What are the best reactions in science and learning ecosystem in Germany and Iran during Covid-19 Pandemic?

20 years after this brilliant technological start for the millennium, while the ICT infrastructures and applications have been vastly deployed, Covid-19 Pandemic has suddenly appeared and results in unpredictable changes in our life and seems it is shaping a new world. While this crisis has had catastrophic consequences, it reveals the value of digital transformation; and in many cases we see the acceleration of the transition.

In fact, the timing of the events and reactions might not be ideal, but the force caused by crisis make many impossible matters to be real. For example, e-learning have a rapid jump and more than 90% of the classes in high schools and university run in the web-based system. In first stages of pandemic and while the quarantine suddenly applied in almost all parts of the world, many web-based communication tools and digital channels have been used instead each other to overcome the limited capacity of them. Video conferencing apps such as Zoom and Adobe Connect, messengers apps such as WhatsApp and Telegram, video sharing apps such as YouTube, and video chat apps such as Skype are used in a mixed manner for connecting students and teachers as well as the meetings between students and supervisors in universities. Some of these apps reach to unpredictable records; for example, zoom has surpassed 300 million daily meeting participants. This is good news, but the bad news is security and privacy concerns. On the other hand, many other issues have been highlighted.

For instance, whether the current remote web-based system and facilities is sufficient to perform all exams or not, and should we have changed our vision and change the evaluation methods in the schools and universities?

Another important concern is removing the face to face collaborative activities of the students and classmate. Although learning materials and servers can be accessed remotely but the main lack is the small space i.e. how they spent all the time physically alone.

## II. BACKGROUND

### A. Covid19-Pandemic:

It should be noted that the quality of actions in the teaching and learning ecosystem depends on the environment and equipment available to the students. In this new situation in which the students left campuses and removed from physical resources such as libraries, computer labs and common spaces, the financial and digital divide between their homes have become even more evident. Also removing from the labs reduces the performance of professors and researchers.

On the other hand, since the crisis has been going on for a long time, we see that second priority activities such as holding large scientific conferences have been prepared to be run in virtual manner. In fact, after placing too much focus on daily operational needs, now long-term investment and movement has been emerged.

There are fundamental changes occurred on the work of teachers, students, researches and scientists, and on the upcoming new challenges. By passing the hard time, and adapting with the new situation, now we are looking for the synergy between elements of learning and science ecosystem. This can be done by knowledge exchange and sharing best practices. Germany has one of the best reactions to the crisis of Covid-19 Pandemic and has valuable experiences achieved in the crisis which can be used for Post-COVID-19 Environment.

Generally, the top 3 negative impacts of COVID-19 crisis in the field of this proposal are:

- o Inability to face to face visit for professors, students and researchers.
- o Significant decline in experimental activities in the research and training lab.
- o Inability to resume the international mobilization especially in short term.

and the top 3 positive impacts are:

- o Wide recognition of the value of digital transformation and information technology among professors, students and staffs.
- o Improved corporate ability of long-distance collaborative work.
- o Provision the opportunities and motivations for developing Leap Frog strategies.

Our main questions in the current situation are:

- o How can have the agility in this new condition because the learning is a continuous procedure.
- o How can keep the momentum of active research projects.
- o How can cooperate effectively in new condition.

The main activities we consider in this project are holding conferences and workshops to study and share best practices and exchange innovative ideas between Germany and Iran in the field of the project. We are going to find innovative techniques, strategies and processes to increase readiness of academic society for post-covid-19 era by:

1. Sharing the best practice between entities and countries

2. Exchanging knowledge and experience
3. Establishing educational join programs and workshops
4. Establishing a professional network of the experts in this filed from two countries
5. Doing applied and developing research project like Erasmus +
6. Preparing advice for development in a Post-COVID-19 environment

### B. 7PS model

Based on the traditional model for sustainability, sustainability has three pillars (Environment, Social and Economy) but Prof. Dr. Doost Mohammadian believes that sustainability has more pillars than these three ones. Seven pillars are required to develop sustainability. Environment, economic, social, educational, cultural, technical, and political aspects are formed sustainability. These aspects make a puzzle that all of the segments directly or indirectly are related to each other. Figure 1 is presented seven aspects of sustainability and its' classification.

To achieve educational sustainability all these seven parameters should improve approximately equable. Sustainability is occurred when the figure is more regular.

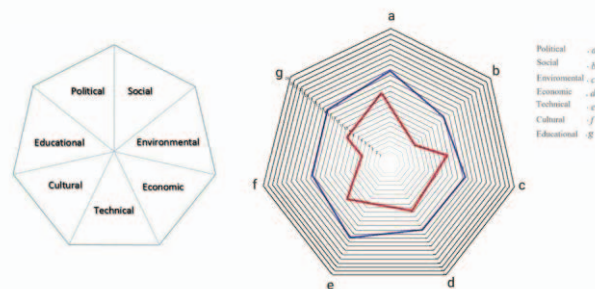


Figure 1. 7 P.S Model [Doost. H, 2017-19]

Generally, high quality of livability and life, health and prosperity with social justice, being environmentally friendly and preserving the earth's capacity to support future life are the main aims of the sustainable development.

### C. 7PS Pattern and DPIr Models

Based on the 7PS model, it is possible to measure the sustainability compass with using 7PS DPIr Model (Doost. H, 2017-19). Figure 2 is presented how to measure the educational sustainability which is made of the trinity of Impact (I), Probability (P) and ratio (r).

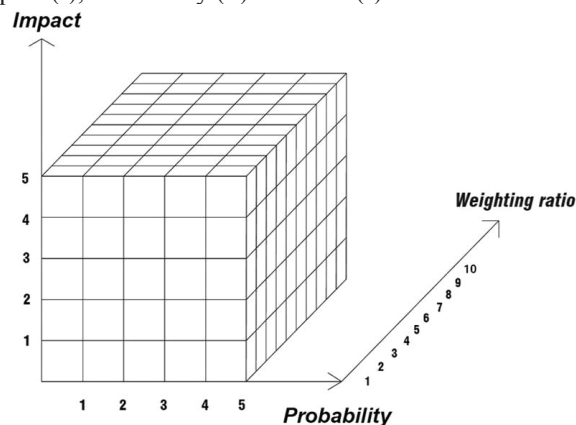


Figure 2. 7PS DPIr Model [Doost. H, 2017-19]

7PS package model is combination of 4 models related to seven pillars of sustainability with a focus on educational sustainability.

Figure 3 is presented how to calculate sustainability based on 7PS model for each seven factors.

Index	Description	Row
Si	Sustainability for each pillars	1
Pi	Probability for each pillars	2
Ii	Impact for each pillars	3
ri Normal	Normalized ratio for each pillars	4
Effective Educational $S_i = \sum (P_i * I_i * r_i \text{ Normal})$		

Table 1. How to measure educational sustainability [Doost. H, 2017]

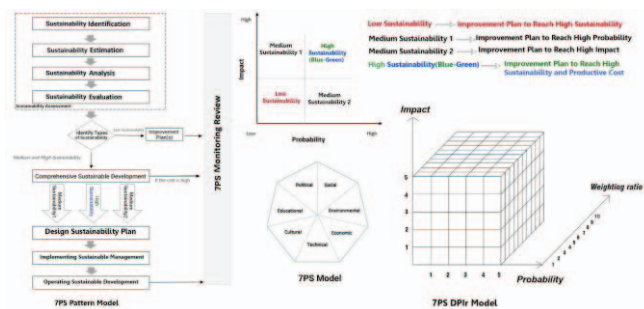


Figure 3. 7PS package Model [Doost. H, 2017-19]

D. The 5<sup>th</sup> Wave/Tomorrow Age Theory and Education:

The 5<sup>th</sup> wave/tomorrow age theory is about proceeding of future of I4.0 (I5.0) as a symbol for west, Society 5.0 (Society 6.0) as a symbol for non-west and edge of tomorrow that has been invented and introduced by Prof. Dr. Hamid Doost Mohammadian for the first time in 2010 and had been evaluated and improved between 2017-2019.

Based on this theory, education, has a very important vital role to reach social responsibility, CSR strategies, and environmental friendly could improve quality of livability and life based on 7PS model to reach sustainable development.

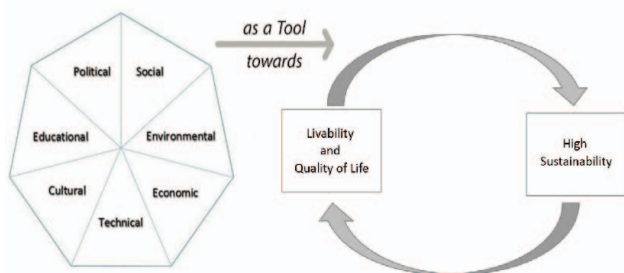


Figure 4. Relation Among Quality of Liveability and Life & 7 Pillars of Sustainability [Doost. H, 2017-19]

Generally, the 5<sup>th</sup> wave or tomorrow age theory is a tool to achieve one of the seven pillars, such as educational sustainability; that is a path to deal with today's challenges and tomorrow's crises as well as maintain the world for future. These theory can be as a readiness for sustainability with seven pillars with a focus on education and academic aspect based on being educational focus and get ready for the academic society and innovative ecosystems in the world beyond global tomorrow's crises such as contagion of Covid19 to make the word as a better place for living.

Therefore, this theory is a way to create modern business which could deal with future concerns through HR competencies, implementing, developing, and applying high 4.0 technologies like IoT and IoT-Education.

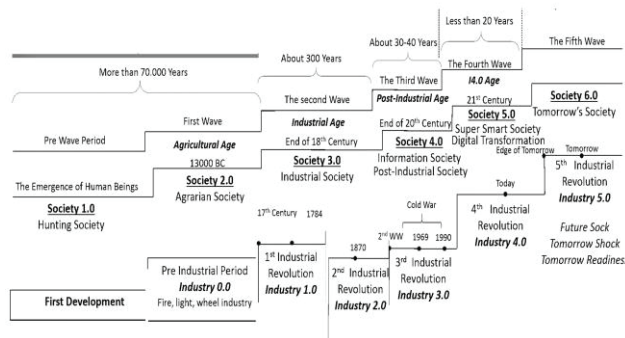


Figure 5. The 5<sup>th</sup> Wave/Tomorrow Age Theory [Doost. H, 2010-17]

Technology development has led to new opportunities for business improvement in educational sector. The world academic economy has changed from an academic society and economy to a data and innovative academic society, ecosystem and economy, leading to the concept of the "Internet of Thing-Education". Human being strategies and high technologies are fundamental tools to implement in the 5<sup>th</sup> wave theory readiness.

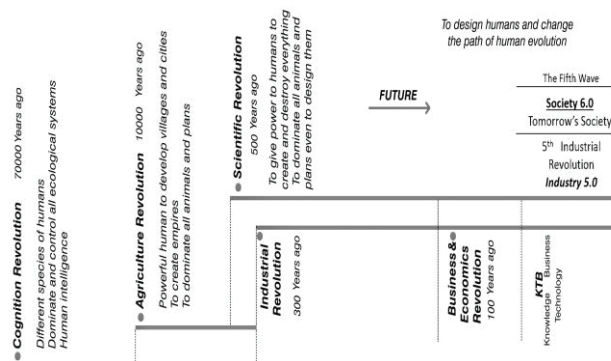


Figure 6. The 5<sup>th</sup> Wave Theory: Revolutions [Doost. H, 2010-17]

E. i-Sustainability Plus Theory for academic society and innovative ecosystem:

i-Sustaiability Plus Theory has been invented and introduced by Doost. H. in 2010 and has been evaluated and improved between 2017-2019, which is made of the trinity open innovation, sustainability and 4.0 smart high technologies e.g. digitization and smartness. This construct which is including the idea of sustainable smart education is probed as a new idea of academic society and innovative ecosystem in tomorrow's schools, universities, and societies. The idea of i-Sustaiability Plus theory derived from the combination of real life, high technology, and virtual reality for which again digitization is a prerequisite. In recent decades, digitization, smartness, innovation and sustainability are remarkable drivers of sustainable development.

Figure 5 is presented the i-Sustaiability Plus theory, which is made of the trinity open innovation, seven pillars

of sustainability (7PS model) and 4.0 smart high technologies such as IoT-education:

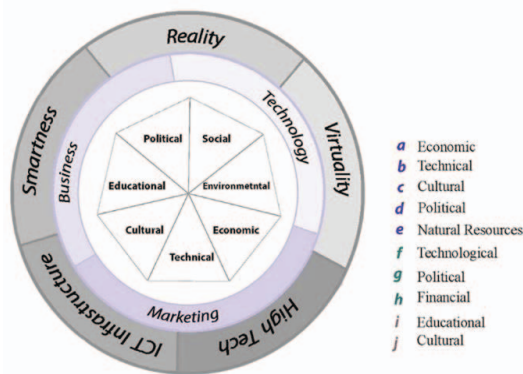


Figure 5. i-Sustainability Plus Theory [Doost, H, 2017-19]

### III. DIGITAL TRANSFORMATION IN ACADEMIC SOCIETY & INNOVATIVE ECOSYSTEMS IN COVID/POST-COVID19 ERA

IoT-education technologies could support to improve, develop and implement training, learning, and educational procedures, for digital transformation in academic society and innovative ecosystems for different courses to forecast, prevent and face with the today's challenges and tomorrow's crises caused by the contagion of the Covid19 in the World beyond Covid/Post-Covid19 Era.

The most important challenges of educational management and digital transformation in academic society and ecosystems in Covid/Post-Covid19 Era is related to:

- Lack of Innovative Academic Ecosystem
- STEM for Vocational and Technical Training
- Actors Competencies
- Financial and Economics Restriction
- Quality of E-Science / Distance Learning / E-Learning
- Cultural Synergies Challenge
- Applicable and Practical courses
- Online Exams
- Online Logistics
- The Other Schools and Universities (Competitors)
- Lack of Balancing among Theory, Labor Market and Industry
- New Job Market in Covid/Post-Covid19 Era
- Lack of Motivation to Use IoT-education

### IV. DISCUSSION

COVID-19 presents a major threat to the global economy and the health of millions of people around the world, Chinese cities have been placed on lockdown in an attempt to contain the novel coronavirus (COVID-19), as increasing press data are placed on Chinese and international health professionals. Surprisingly, planning and design professionals are absent in the conversation even though previous pandemics reveal severe impacts on the urban fabric from social and economic perspectives. This paper is regarding digital transformation in academic society and innovative ecosystems in the world beyond Covid19-pandemic and developing a preparedness and continuity learning plan to include pandemics in their disaster

management strategies so that their involvement in designing protocols with other learning and health related organisations can be entertained and enabled, and their deployment in pandemic stricken businesses/SMEs can be effected as integral components of normal educational environment planning activities and also in incident situations like containing the current novel coronavirus (COVID-19). In this regard the following key question, result and impact will be addressed to shape the basis of this research and turn COVID-19 massive challenges into meaningful changes.

- ✓ Key question: How to Identify possible COVID-19 scenarios, realizing the potential risks and assess impacts on People, Processes, Profits and Partnerships (the "4Ps" framework)?
- ✓ Key Result: Responding to aforementioned question may result in mitigating actions and preparedness plan based on specific scenarios for which merit more focused planning. This will be completed by developing the steps needed to establish a educational business continuity plan (BCP).
- ✓ Key Impact: This framework will bring knowledge and experience to provide insight, help identify previously unconsidered risks and impacts to support businesses and provide an effective response to current and future crisis of a pandemic situation emerging.

IoT applications in education sector are related to:

- ❖ Cyber Security
- ❖ Educational Apps
- ❖ Increasing Efficiency
- ❖ Electronic certificates
- ❖ Interactive Learning
- ❖ Rating of teachers and schools

### V. CONCLUSION

This paper deals with the digital transformation in academic society and innovative ecosystems in the world beyond the Covid/post-Covid19 pandemic Era and application of IoT-education, This paper proposes a new model to do the three steps: 1) forecast, 2) prevent, and 3) face to the educational sustainability impacts, called seven pillars of sustainability (7PS). The role of education in the age of technology development is very important and according to the 7PS model, it is possible to forecast and measure the educational sustainability and effect of educational managers to fulfill educational project and some of the major challenges facing the IoT-education.

In 21st century, after this brilliant technological start for the millennium, while the IoT infrastructures and applications have been vastly deployed, Covid-19 Pandemic has suddenly appeared and results in unpredictable changes in our life and seems it is shaping a new world. While this crisis has had catastrophic consequences, it reveals the value of digital transformation; and in many cases we see the acceleration of the transition. In conclusion, IoT's application in education (IoT-education) are limitless and we are already seeing it in some of the intelligent universities today. It not only provides a better learning process for students but also reduces operational costs and a balance between operational and financial costs.

Since 2000, digital technology transformation has been already started but the contagion of Covid19 could push it to do faster as a super accelerator. The results of this paper demonstrate that IoT-education technology is capable to recognize it's quite evident that organizations all over the world are boarding onto IoT-driven digital transformation ventures to drive competences and education suppleness.

In fact, the timing of the events and reactions might not be ideal, but the force caused by crisis make many impossible matters to be real. e.g e-learning have a rapid jump and more than 90% of the classes in high schools, institutions and universities run in the web-based system. In first stages of Covid-19 pandemic and while the quarantine suddenly applied in almost all parts of the world, many web-based/IoT-based communication tools and digital channels have been used instead each other to overcome the limited capacity of them. Video conferencing apps such as Zoom and Adobe Connect, messengers apps such as WhatsApp and Telegram, video sharing apps such as YouTube, and video chat apps such as Skype are used in a mixed manner for connecting students, professors, administrators as well as the meetings between students and supervisors in universities (defenses). Some of these apps reach to unpredictable records; e.g, Zoom has surpassed more than 300 million daily meeting participants. This is good news, but the bad news is security and privacy concerns. On the other hand, many other issues have been highlighted.

Therefore the partnership between universities and research and innovation centers, in running joint programs and common courses, professor and student exchanges and doing collaborative research projects, has become one of the most important issues that should be considered in future science ecosystems which are moving toward the knowledge societies.

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## VI. FUTURE SUGGESTIONS

As it mentioned, IoT application in education and educational sustainability could give some research suggestions for the educational actors in academic society and innovative ecosystem as below:

- A comprehensive plan for digital transformation in academic society and innovative ecosystems in the world beyond contagion of Covid19
- Developing IoT-education technology to solve the educational management challenges for today's challenges and tomorrow's crises
- Preparing the European Universities and VET providers to forecast, prevent, and face to the educational challenge in the world beyond contagion of Covid19 and offer courses on IoT
- Role of IoT-education in preservation and transmission of social values to sustainable development
- Defining the domains affected by the implementation of intelligent educational management system
- Presentation of a model for the infrastructure and the implementation of IoT-education technology

- Developing a plan for IoT security, interoperability, management and privacy
- Solutions for IoT-educational challenges to implement the cultural sustainability based on 7PS model
- Design a comprehensive plan for the social educational consequences of Covid/Post-Covid19 Era

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