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Professor P. Groumpos received his Ph.D. from the University of Buffalo of SUNY, in 1978, Department of Electrical Engineering and has been engaged in teaching, research and collaboration with industry since then both in USA (1979-1989) and in Greece since his return from USA to the University of Patras in 1990. He is full professor at the Dept. of EE&CS of the University of Patras. In USA he developed and directed an Energy Research Center at Cleveland State University (1981-1989) while in Greece he developed the Laboratory for Automation and Robotics (LAR) in 1991 and he is its Director since then. His research interests are in the areas of modeling complex dynamic systems, energy, environment, renewable energy sources, Robotics, Fuzzy Cognitive maps (FCM), techno and economics for intelligent buildings and smart grids, optimization of electric power systems and Intelligent Control. He has used extensively Fuzzy Cognitive Maps (FCMs) in many scientific fields with very useful research results such as in: Energy, environment, Transportations, Health, Communications, Agriculture, Business and Economics, Hybrid Energy Systems, International Affairs and reliability analysis of engineering systems.

He is the author of more than 300 scientific publications (Books, invited book chapters, articles, papers, monographs and technical reports). He was the President of Patras Science Park (2004-2010). He has been the general chairman in more than 10 International conferences the last 15 years. He has been as Invited Keynote speaker in more than 15 conferences the last 10 years. He is the co-founder of the Medical Control Association 25 years ago and he is its Vice-President since its foundation. He has been as principal Investigator in more than 20 Projects as well as partner in another 40 projects been funded from a number of different funding "bodies".
He is an Invited Academician honorary member of the Russian Council on Mechatronics and Robotics since 2002 and Guest honorary Professor of the East China University of Science and Technology since 2013.

CREATIVITY vs INNOVATION vs ENTREPRENEURSHIP: A CRITICAL OVERVIEW OF ISSUES AND CHALLENGES

INVITED PLENARY PAPER

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SUMMMARY

No one can guarantee that the world is going to be same five years from now because everything is changing with the blink of an eye. So, it is vital for all of us to know to keep ourselves updated through new knowledge. **Creativity is related to 'imagination',** but **innovation is related to 'implementation' and in essence to entrepreneurship**. In this Plenary Paper all the significant differences between them will be analyzed and discussed. Each one will be defined and the main scientific attributes and characteristics will be fully explored. A critical overview of issues and challenges will be presented.

Discussions about creativity and innovation are often made difficult because people are unclear about the exact meanings of some key terms. In particular there is confusion about the difference between creativity and innovation. The term of entrepreneurship is even more difficult to be defined.

Let us start with some definitions:

Creativity is characterized by the ability to perceive the world in new ways, to find hidden patterns, to make connections between seemingly unrelated phenomena, and to generate solutions.

Innovation is the implementation of a new or significantly improved product, service or process that creates value for business, government or society.

Entrepreneurship is the capacity and willingness to develop, organize and manage a business venture along with any of its risks in order to make a profit. The most obvious example of entrepreneurship is the starting of new start up businesses.
Some people say creativity has nothing to do with innovation— that innovation is a discipline, implying that creativity is not. And both of them have nothing to do with entrepreneurship. Well, I disagree. Creativity is also a discipline, and a crucial part of the innovation equation. There *is* no innovation without creativity. The key metric in

both creativity and innovation is value creation. And again both of them play a major role in entrepreneurship. For innovation to flourish, organizations must create an environment that fosters creativity; bringing together multi-talented groups of people who work in close collaboration together— exchanging knowledge, ideas and shaping the direction of the future. Organizations led by creative leaders have a higher success rate in innovation, employee engagement, change and renewal.
In economics, entrepreneurship combined with land, labor, natural resources and capital can produce profit. Entrepreneurial spirit is characterized by innovation and risk-taking, and is an essential part of a nation's ability to succeed in an ever changing and increasingly competitive global marketplace.
We tend to think of an innovation as a new product but you can innovate with a new process, method, business model, and partnership, route to market or marketing method. Indeed every aspect of your business operation is a candidate for innovation. Some of the most powerful innovations you can make are in business methods and customer services. If we look at companies like Dell, eBay and Amazon we see that their great innovations were with their business models rather than in new products. Innovations can be incremental or radical. Every improvement that you make in products or services can be seen as an incremental innovation. Most businesses and most managers are good at incremental innovation. They see problems in the current set-up and they fix them. Radical innovations involve finding an entirely new way to do things. However this is more risky.

In this plenary presentation other key areas to connect with are: the “Internet of Things” (IoT) and the “Internet of Services” (IoS), and the key components are Cyber-Physical Systems (CPS) and Smart factories. They will be shortly analysed and related to Creativity and Innovation. A number of examples from real life will be presented. Finally future research directions will be outlined and discussed.