ECED 2018: Day 1 - Digitalization

Motivation:

Less than 10 years ago – somewhere in Europe - a group of bright university professors and excellent managers from industry were discussing the fact that large European-based traditional companies did no longer participate in - or had even actively decided to leave - the market of mobile phones, tablets, and other personal electronic devices. They were not the least bit worried about this and they were convinced that Europe would continue to contribute to the global value-creating processes in general. The unquestionable important role of Europe in the automotive industry, in the industry for large medical devices and machines and so on was the proof of that.

The discussion was apparently based on the paradigm that technologies would continue to develop in parallel – of course with certain cross-fertilization. The value of the individual technical artefacts – results of ingenious engineering – was beyond questioning. However, this discussion did not anticipate the convergence of technologies – the mega trend that is disruptingly sweeping across our continent today.

There are many factors at play. Foremost digitalization, but that is not new. However, complete digitalization of all information and (big) data is new. Add to this a globally networked assortment of communication technologies, which are fast and wireless (at least for a short distance), and millions of small computers in pockets and everywhere in products, which are able to both generate and process data instantly, the result is fantastic! You have the 4th digital revolution that presents a wide-open arena for technologies to converge, to enable users, to augment reality, and to effectively hack everybody and everything. This 4th digital revolution also brings about particular issues of ethics.

Today, it is easy to see that the discussion that took place less than 10 years ago, somewhere in Europe, dismissed how a small computer with internet access dramatically would change the human behavior. Mobility is an example: The smartphone provides unprecedented possibilities in form of car-sharing and integrative mobility systems. The archaic need to move no longer provokes the dream of a car – as it has done in youngsters of at least 3 generations who could not wait to get their driver's licenses and be able to move freely. This dream founded a strong emotional condition, which in turn formed an economical basis for large industries for decades. The underlying archaic need is not really the engineering artefact - the car - but the mobility. In addition, this can be addressed by an optimized integrative gadget, which fits in your pocket. It´s obvious that new answers on archaic needs potentially create important disruptions. Nothing can any longer be taken for granted.

The 4th digital transformation is penetrating all areas in which engineering plays a role of a previously unknown intensity. Not only the human need of mobility but also of communication, learning, memorizing facts, curiosity and getting information, self-affirmation and defining the personal status, and being sufficiently protected always have been catalyzed by a set of products, processes and systems. For theses, the current artefacts created by engineers play an important

role. However, it seems that the needs now find new ways to evolve and to be satisfied with the consumers. This development has the power to change everything, products, processes and systems and probably making a lot of them obsolete. Importantly, notions of responsible research and innovation become more and more important to engineers.

The purpose of **SESSION I** is to discuss and debate how the 4th digital revolution is changing our universe – and how we should change with it. Here we examine, what is really happening – and how we can stay on top of the game:

- How can we formulate new value propositions to our stakeholders, and help mutate old-school business models and plans into the digitalized world, developing future products and reshaping markets?
- How can old digital dinosaurs not stand in the way of the young digital natives – but rather guide them to a safer future?
- What are the important issues, knowledge, capabilities that then might be lost, when they are substituted by digital formats?

Let us collect questions and discuss these issues while we still exist.

In this part, we must also discuss about ourselves, our self-esteem and the structure of our universities. We are challenged. Like always, we must rethink and redesign our systems, only now we must act more quickly than usually. We cannot stick to our beloved products and processes, which are justified by traditions and experiences rooted in a world that did not have the current options of digitalization. The task is to analyze human needs and dreams and to anticipate the possible future development of old and new artefacts:

- Are we ready for the digital challenges, with our present mind-set, our attitudes and our disciplinary university structures? How do we shape new centers of competence in our universities addressing these challenges and options?
- Can we proactively and responsively navigate the societal changes and steer the current dynamic technical innovations to the benefit of society?
- How can we define and cope with the ethical responsibility resulting from the new options given by the digital revolution?

The digital transformation will fundamentally impact the world of private life, research, education, knowledge transfer and work – we have to respond to this. We have to have *our own dream* about how to use the new opportunities for addressing old archaic human needs.

The purpose of **SESSION II** is to discuss and debate how the 4th digital revolution is changing our world from the inside by giving us new opportunities in both research and education. The increasing ability to handle big data intelligently has a dramatic influence and many research areas are on the verge of a change in research paradigm. This data-driven development in science has made infotech an extremely powerful domain in science with implications for the "classical" sciences and with a considerable extension of our cognitive abilities. Computational thinking is the ability to analyze, realize, and evaluate data and data processes that may be performed without

human intervention. This ability can be used to experience, analyze, comprehend, represent, and manipulate the world in order to create things of importance to us. The formats we use in didactics and pedagogics will be heavily influenced by the digital revolution. We have to take our own medicine and make sure that machine learning, data mining, adaptive learning etc. are all used in the best way while trying to avoid unforeseen or unexpected side effects of revolutionary change.

On education, we will discuss:

- How do we redefine learning objectives for student skills, competencies and attitudes for a digitalized future when designing programs, and how do provide the learning opportunities?
- What happens when we no longer have to teach "knowledge", because of unlimited access to the internet, and will "back of an envelope" have any meaning for future students?
- Can we "hack" the brains of our students and make them better learners, improve possibilities for individualized teaching, and offer tailor-suited options for continuous education?
- What contemporary teaching formats will become obsolete and be replaced by digital tools and what formats will not?

On research, we will discuss:

- Can Computational thinking be applied to all "classical sciences" and what does that require of the "classical scientists"?
- How to take the opportunity of new digital options in sharing outcomes with society?
- Can we "hack" the brains of our researchers and make them better innovators for a sustainable future?
- How do we embrace "open science" and how can society benefit from the "democratizations" of science?
- How do we support the computational and data science needs of our researchers as universities of science & technology?