INDUSTRY 4.0 PLATFORM ACTIVITIES IN HUNGARY, PAST – PRESENT - PLANS

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Abstract: *The digitalization efforts of the industry has initialised several scenarios at the industrial company level. It had started at the beginning of the 3rd Industrial Revolution, and by now we may remember some good or best practices, while also can remember experienced pitfalls and bottlenecks. Since the past 3 years has demonstrated the world-wide push for the 4th Industrial Revolution driven technology adoption, new questions ought to be answered by politicians, national economy decision-makers, scientists and ecosystem partners from all areas and sectors. Hungary had experienced both success stories and drawbacks from the past of industrial automation efforts. The present status of the Hungarian National INDUSTRY4.0 Technology Platform is summarized with the agenda of the freshly formed working groups. Some comments and messages have been selected regarding the robotics topics, as seen from the international opinions. The future plans are strategic in their nature, they ought to raise the innovation and profitability of the Hungarian national ecosystem. With national and international project partners, actions are taken to escort, to coach, to push and to drive more industrial SME-s to become winners in the course of the 4th Industrial Revolution. The paper introduces the main aspects of the platform, and their description parts were prepared by the experts in MTA SZTAKI, who planned, constructed and defined the details.*

Keywords: TECHNOLOGY PLATFORMS, ETP-s, ENGINEERING ASSOCIATIONS, GOVERNMENT POLICIES

1. Introduction

INDUSTRY4.0 is a buzzword since the last 3-4 years, when the potential breakthrough of an emerging new technology-set had reached the open-minded top decision-making political level(s). Looking back, nothing has happened from one day to another, but numerous technologies have evolved continuously in a great number of co-related sectors (like processing technologies, micro- and Nano-electronics, intelligent data-processing technologies, IoT (Internet-of-Things), IIoT (Industry-related Internet-of-Things), sensor technologies, cloud-computing, e.t.c.), and their integrated effects within industrial application area, (like flexible production technologies, robotics, energy- and material savings and resource-optimization, predictive maintenance, minimization of logistic costs, processing of new materials, additive manufacturing AM, like LOM - Laminated Object modelling- or 3D Printing, implementation of SMART, digital or virtual enterprises, multimodal logistic networks within the value chains, with new business models, with new man-machine-robot interaction models,…) had reached a revolutionary overall potential change. This amount of change is so huge, that not a single company can jump to implement it alone, and immediately. Yet, the estimated and optimistic benefits that could evolve from those implementations, could deliver 20 to 30 % rise in GDP, and profitability of the related industrial segments. No wonder, that government high-rank officials are so keen to strengthen their commitment in the view of enabling such high outcome of this transition, namely the large-scale implementation of Cyber-Physical Production Systems (CPPS).

2. Hungarian economic relevance for activities in INDUSTRY4.0

Regions along the globe, each have its own term, definition and scale for the technology-transfer related to the implementation of the digital economy. The transatlantic countries prefer to care for networked companies, networked manufacturing, and even European large countries have their own word. Germans are punctually referring to INDUSTRIE 4.0, and also define the limits and boundaries of their target-area: limiting the application sectors only to industrial production with the IIOT. It is clearly seen, that Japan, South-Korea, and China have already set up their national nodes, to harmonize the scientific and technical activities, define the national priorities and vocabulary for the national key players.

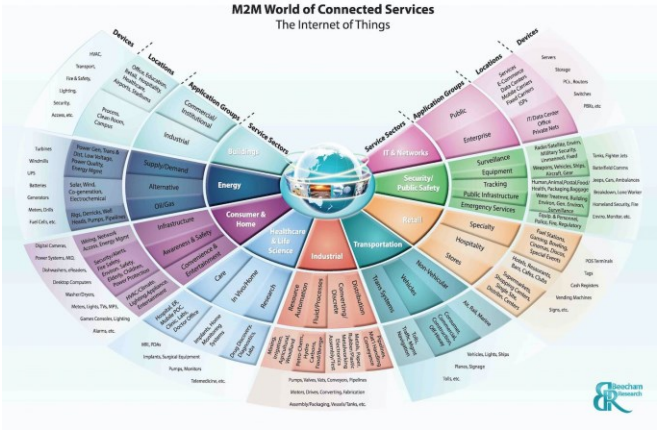

Fig.1. Industry 4.0 is a Sector in the Internet of Things (IoT), as demonstrated by KUKA-Robotics Heinrich.Munz Strategic Technical Consultant [1]

Hungarian experts-based support team for a National I4.0 Platform has also declared to select the industrial production sector, as the primary focus area. Other sectors, like digital governance, or digital well-being has separate means to prepare working papers for the decision-making bodies.

3. Launching the Industry 4.0 National Technology Platform

After almost 20 month of preparation, the idea became implemented: a National Technology Platform needs to support the government decision-making process at a very high political level. In spring 2016, The Ministry of National Economy organized the event, invited 30+ CEO-s from reputed industrial firms, both from large and from small enterprises, from universities and other academic circles, and appointed MTA SZTAKI to be the first-term leader of the Platform. Within 3 month time another 25 firms had submitted their wishes to join the Platform. [4]

Fig.2. Founding CEO- members of the Hungarian National INDUSTRY4.0 Technology Platform

A group of experts had set up the Platform, and each member had to sign the joint understanding document, to accept the rules and terms. Thanks for their hard work, the platform is up and running. The very first draft suggestions and strategic orientation papers were prepared and forwarded to the ministerial-level decision-makers.

In October 2016, the most urgent topics forced the establishment of the following seven working groups. MTA SZTAKI has also prepared an intelligent application that can run on several mobile platforms as well, as shown in figure 3.

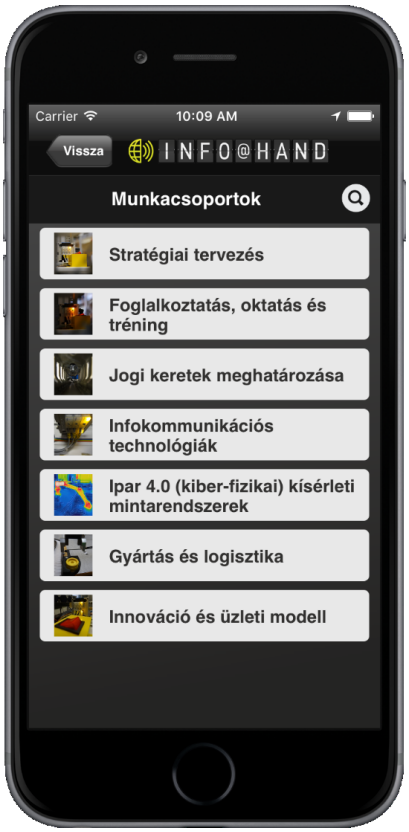

Fig.3. App to support the Working groups of the National Industry4.0 Technology Platform

The Work Groups of the Hungarian I4.0 NTP (by T. Várgedő)

The Hungarian Industry 4.0 National Technological Platform operates several Work Groups in order to fulfil its mission defined in its Organizational and Operational Regulations. Their activities focus on specific issues related to I4.0 and they formulate answers and recommendations to the challenges presented by the practice.

The participants of the Work Groups are delegated by their own organizations, members of the Platform and they represent special expertise in the given area. They work closely together with the corresponding governmental forums and bodies thus contributing directly to the formation and implementation of the Government's strategic goals.

Currently the Platform has 7 Work Groups:

- Strategic Planning
- Employment, education and training
- Production and Logistics
- ICT technologies (safety, ref.-architectures, standards)
- Industry 4.0 Cyber-physical Pilot systems
- Innovation and Business Model
- Legal Framework.

Strategic Planning Work Group

The Strategic Planning Work Group addresses mainly the issue what answers are required to the challenges raised by the Industry 4.0 towards Hungary, in order to adopt best practice solutions and thus the results attained so far in global competitiveness of our industry sector could be preserved and even further reinforced.

Employment, Education and Training Work Group

The Employment, Education and Training Work Group has as its main task to cover all educational aspects of I4.0 which determine the highest priority HR preconditions and implications for its implementation in practice. There is a fundamental impact to be expected on the employment and labour market that I4.0 is certainly to bring with in all areas: the technical environment of physical work, the organisation and control of production, the dominant concepts of corporate business economics, all these demanding more sensitive reactions to the turn in demography, workforce mobility and approach to the related social issues. These changes need a completely new strategic thinking and tools to be applied from all actors of the triple helix scene.

Production and Logistics Work Group

Cyber-Physical Systems (CPS) are computational structures that are strongly linked with the surrounding physical world and the physical processes therein while providing and, making an intensive use of, the internet based services for data access and data processing. The Cyber-Physical Production Systems (CPPS) can be expected to pave the way to the 4th Industrial Revolution, often referred to as Industry 4.0.

Accordingly, the Production and Logistics Work Group focusses on such key goals as the digitisation of the Hungarian manufacturing industry as defined in the Irinyi Plan which will certainly play an over-important role in shaping the future of sectors in Hungary.

ICT Technologies (safety, reference architectures, standards) Working Group

The evolution processes of modern information and communication technologies closely tied with those of production and logistics systems create not only new opportunities but also generate new challenges. The ICT Work Group deals with those aspects of I4.0 that are connected to the implementation of the national strategy aiming to facilitate the digitisation of the Hungarian industry.

The main topics comprise the horizontal integration of the value creation chain, the vertical intra-factory integration of the entire product life-cycle, their technological assumptions to be considered and obstacles to be overcome.

Industry 4.0 Cyber-Physical Pilot Systems Work Group

The Cyber-Physical Pilot Systems Work Group concentrate on the implementation perspective of one of the Platform's key topics, i.e. how can the required progress in culture, the existing paradigms of thinking as well as the related technologies be facilitated in the most efficient way. To complete this task it is crucial to create I4.0 pilot systems for research, development, demonstration and education / further training purposes.

Innovation and Business Model Work Group

The main focus of the Innovation and Business Model Work Group is to determine the major directions of R&D work at the research institutions and companies - based on their direct needs and the international trends - in the way that the innovation requirements of the national economy could be met. A key goal is to strengthen the research potential of the institutes and enhance their innovation capabilities and through these to facilitate the general technological development and expand the scope of the impact of innovation in Hungary. An additional benefit of these efforts is expected in speeding up the process of transforming research results into marketable industrial products.

SMEs and start-ups may directly benefit from the technology transfer and the working group will formulate recommendations as for developing and applying new business models as well. Dissemination of innovation is high priority.

Legal Framework Work Group

The Legal Framework Work Group's first task is to define the final legal and organisation form of the Platform which is operating now as a free association without any organised legal form. Also, it is required to finalise the current temporary Organisational and Operational Regulations complying with the new legal form.

Furthermore, it addresses any issues which have a legal implication, those which are beyond the primarily technical approaches and action plans. These are e.g. related to the risks and threats in the society of the digitisation and the mandatory harmonisation with the EU directive Digital Single Market Strategy for Europe.

4. Supporting SME-s to launch Industry4.0 implementation projects

The Hungarian Government has prepared the S3, the Strategy for SMART Specialization in 2015, and expressed the interest and will, to increase the innovation within SMEs, and in the production sector of the economy. Also, the National Bureau for Research, Technology and Innovation has supported the plan, and funds were opened in the form of grants, and loans, and for exceptional actions. Among these actions, the national co-financing of EU grants enabled the opening of two Teaming EU projects, while small-scale support of individual bilateral, academic-industry cooperation projects were launched, like the INTRO4.0 EUREKA [5] project, supporting a German-Hungarian technology sharing/transfer action. The Ministry of National Economy has preannounced to open CALLs, named after a Hungarian, but internationally highly reputed, scientist-engineer: József Irinyi, and industrial companies are invited to submit their proposals for Cyber-Physical products, productions, services and business-models.

Launching the EPIC Teaming project from 2017

The scientific objective of the proposal and project [6] is to further strengthen/upgrade the institute research potential, especially in the field of Cyber-Physical Systems, with special emphasis on Cyber-Physical Production Systems Design, control and management of robust, cooperative systems in the cyber-physical world. Industrial and scientific partners are welcomed to establish win-win partnerships and business cooperation.

Hungary wants to increase its strength in innovation, and to raise the productivity indicators. Though the automotive sector plays a number 1 position in the GDP, the aim is to broaden those industrial sectors that could strengthen Hungary's economic independence e.g. from the German automotive parts export ratio.

5. Robotics, as a fundamental topic in the 4th Industrial Revolution

The cyber-physical products and production is closely related to the new type of robotic products and also as mechatronics-based production technologies. As seen and experienced from the World Robotics Forum, or from the Munich AUTOMATICA-ROBOTICA Fair, there is a significant rise in the production and industrial application of robots. There is a miss-belief, that by the increase of robots in the firms, the human workers have to lose their jobs. As pointed out by a world-survey, this is not the case, the number of required employees is increasing by each installed robot equipment in Europe, in USA, or in Japan. It is important to realize, that the application-area of new robotic sites are being forced out by human needs, namely by the 3D application zones. The 3D is now referencing the human working environments, where robots must replace humans: as DANGEROUS, as DIRTY and as DULL physical work-environment that prohibit humans –and soon European employee-law will give stronger force to it.

6. The Hungarian Scientific Society for Mechanical Engineers (GTE)

The GTE has been a key player in the establishment of the relevant Platform-building started almost a decade ago. GTE was officially the responsible host to run the Hungarian National ManuFuture Technology Platform, and this post enabled GTE to interconnect the ManuFuture European Technology Platform with the Hungarian activities. This action integrated around 90 Hungarian engineering and manufacturing enterprises, supplied them with the European documents, generated the translated docs, and the experts prepared the relevant Vision, Strategic Research Agenda and Roadmap related to Hungary.

The GTE, as the most relevant scientific society with country-wide reach out, has decided to carry on with the preparation of the 2017 INDUSTRY4.0 conference, as the successor of the 22nd biannual Manufacturing Conference, with an extended title: INDUSTRY4.0 In Practice-2017. The Conference is scheduled for the end-of September/early October [7].

7. Some closing remarks

The driving force behind the Industry 4.0 efforts is clearly the deep need for the access of tested, standardized integrability of all process- and business-activities related to material and information flow in the production sector. Both manufacturing and also assembly, all servicing and total life-cycle based activities are in need of reliable data-, message-, knowledge sharing using a common facility and service background. Its high value had been pointed out already several years back [8]. The MAP (Manufacturing Automation Protocol, IEEE 802.3 and 802.4 standards had defined alternative media along the 7-layer ISO Open Systems Interconnection. There were very optimistic, good and reliable solution with the internationally developed standard stack, but business issues avoided to reach a maturity level. Real-time and deterministic solutions were too clumsy and expensive, thus non-deterministic, cheap, and easily available CSMA/CD based Ethernet networking covered the 85% of all implementations regarding

industrial networking solutions. Today the need is the same, some more sophisticated and modern Software solutions are offered, like the OPC Unified Architecture model. Let us hope, that the same mistakes are not repeated again, by altering from sound, tested technologically correct solutions.

Another topic, where history could, but should not repeat itself, is the operation of Technology Platforms – in some respects. When the economy needs harmonized solutions, the relevant government bodies have the responsibility to enable a platform's useful activities.

The last message from the authors is the importance of security and safety. The higher the software ratio within the Cyber-Physical products and production processes, the higher is the risk. New, safe and sound solutions are still needed to be invented. [9]

8. Acknowledgement

The work carried out had been supported by the EUREKA international cooperation, INTRO4.0 [5] team, including the 25-year old Hungarian industrial partner HEPENIX, while the EPIC consortium [6] of the EU TEAMING project helped to understand the ecosystem, the international R&D&I-environment to match Hungary with the neighbouring and other EU countries.

9. References

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10. Appendix

Introduction of MTA SZTAKI, [2] the host of the National I40 Platform. www.sztaki.hu

The Institute for Computer Science and Control, Hungarian Academy of Sciences (MTA SZTAKI), the former Computer and Automation Research Institute, now with nearly 300 full-time employees including about 140 with scientific degrees, was founded in 1964 as a research and development institution of the Hungarian Academy of Sciences. The Institute gained worldwide reputation in computer graphics, computer-aided design and manufacturing, process control, robotics, operations research, numerical methods, advanced information systems and networking. ERCIM (European Research Consortium of Informatics and Mathematics) granted full membership to SZTAKI in 1994. The institute was awarded the title "Centre of Excellence" in "Information technology, computer science and control" by the EU in 2001.

Researchers at the Institute take part in the management bodies and working groups of the most significant international scientific organizations (CIRP, IEEE, IFAC, IFIP, etc.). Many of their colleagues are members of the Editorial Boards of leading international journals.

At the Institute, information science based developments exploitable both in Hungary and abroad, together with high-level advisory activity, are built upon the results, outstanding by international standards, in focused basic research. As a Centre of Excellence, this provides themes of interest and attracting conditions for talented young people in PhD study, for starting their creative scientific work.

The adequate infrastructure is an indispensable requirement of high-quality research activity. The Institute has realized in due time that its main research focus and the scopes of new laboratories (3D-internet, control of robotic devices and UAVs, SmartFactory, cloud-computing) should be determined by taking the most important directions of information and communication technology into account, joining this way the worldwide research arena of Cyber-Physical Systems.

The Institute is a stable, independent partner in R&D&I and in the fields of contract-based applied work, such as system planning, system integration, consulting and turn-key information systems. Quality is an important issue at the Institute: they have an EN ISO 9001:2000 certification.

Focused basic research:
- Computer Science
- Systems- and control theory
- Engineering and business intelligence
- Machine perception and human-computer interaction

Development and innovation
- Vehicles and transportation systems
- Production informatics and logistics
- Energy and sustainable development
- Security and surveillance
- Networks, networking systems and services, distributed computing

International relations

MTA SZTAKI in the past decade was intensively engaged in international scientific cooperation, the institute was involved in 44 projects within the EU FP7 Programme, in 8 cases acting as the head of consortium. This series of success seems to continue also in the Horizon 2020 Programme.

With respect to the research in avionics, the relationships with the University of Minnesota, the US Office of Naval Research (ONR), University of Bordeaux, as well as the German Aerospace Centre (DLR) and the European Space Agency (ESA) should be mentioned. Of special importance is the long standing R&D cooperation between SZTAKI and HITACHI that, going back to nearly a decade, has already resulted in a number of joint patent applications. Most of the Institute's activities pertaining to applied R&D in production informatics and logistics as well as to the industrial deployment thereof are carried out in the framework of the Fraunhofer-SZTAKI Project Centre for Production Management and Informatics established in 2010.

Industrial cooperation

MTA SZTAKI cooperates with significant major enterprises such as GE, Audi, Hungarian Telekom, MOL, Knorr-Bremse, Bosch, Opel. The technology transfer to small enterprises guarantees that the Institute's results keep on spreading in the widest possible spheres. The Hungarian National Technology Platform on Industry 4.0 is led by the Institute.

Participation in higher education

The Institute regards teaching activities as an important ingredient of its research work and also as an indispensable part of building the future. Many researchers at the Institute also fulfil teaching mandates at various Hungarian universities. On average, around 20 PhD students conduct research work at the Institute under the tutorship of the senior researchers.