New technology challenges and the ZalaZONE eco-system environment

Leticia Pekk* - Dr. Andras Hary**

** Zalaegerszeg Technology Center (e-mail: leticia.pekk@tc.org.hu)*
*** ZalaZONE Industrial Park Plc. (e-mail: office@zalazonepark.hu)*

Abstract: The aim of this paper is to interpret the new technological challenges of mobility in relation to technological trends, using ZalaZONE R&D environment as an example. The first part of the paper approaches the topic from the point of view of trends, illustrating the interpretation of the automotive industry with concrete examples. It examines aspects related to technological change from the perspective of the environment, drivers and impacts, pointing out the importance of the human and technical side. Finally, the response to the challenges of new technologies is presented using the example of the ZalaZONE testing environment.

1. INTRODUCTION

Nowadays, very significant and extensive changes are taking place in many areas. In the related researches, they are often called as megatrends. Different authors formulate the megatrend areas from different perspectives, Naisbitt (1982) was among the firsts to use the term. Some definitions tend to emphasize long-term implications (Galinska, 2018), others refer to the continuity of change like Malik-Janowska (2018), Hajkowicz (2015), Rohner (2018), or even the role of complexity in relation to megatrends (Peciak, 2016). A good overview of the topic is provided by the study of Linthorst and Waal (2020), they summarize the main areas of change based on the analysis of research trends and publications, primarily from the point of view of economic and management impacts (Fig.1).

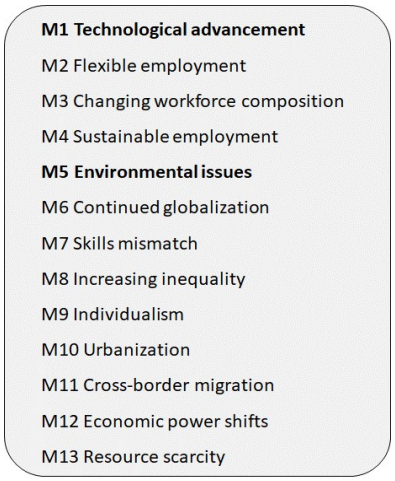

Fig. 1. Megatrend areas

Megatrends can be used to derive technological trends, which have an impact on the development of different sectors and specialties. In this perspective, it is necessary to rely not only on scientific researches, but also on the works of various industry analysts. A number of publications by renowned industry experts are available publically like publications of PwC, Roland Berger, MicKinsey (2021) and others. The trends of key changes in mobility highlighted by PwC analysis (2018), are mentioned as autonomous driving, connectivity, electrification and shared mobility. In this summary we refer to two ones without needing to be exhaustive. For further discussions, see, Future Today Institute (2021), etc.) and Roland Berger's (2017) examples, shown by Fig.2 and Fig. 3.

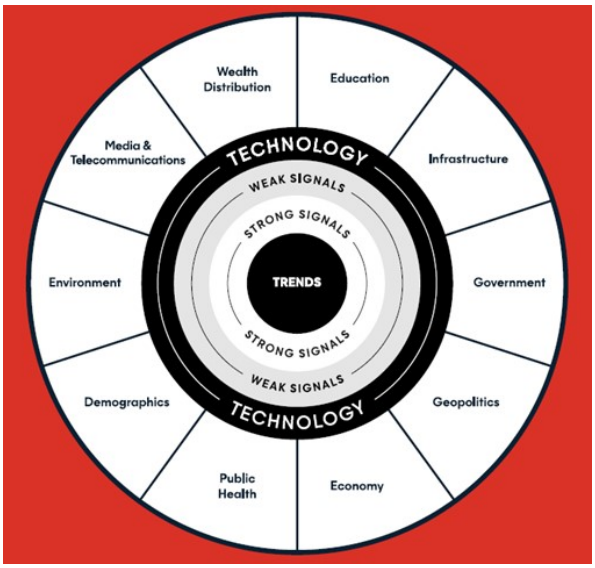

Fig. 2. From megatrends to technology trends

The approach of Future Today Institute (2021) illustrates 11 macro forces, each of which has an impact on the world. In addition, disturbances usually arise from the 10 main influential sources of macro-change and technology behind the others. Thus, when looking at future developments, it is necessary to analyze the possible disturbing areas. Technology is the connecting element of the 10 influential macro-changes. Trends are formed from the intersection of macro forces and signals. These are a kind of manifestations of new developments and their collision. Thus, they take shape the sectors over many years, but not necessarily following a linear path.

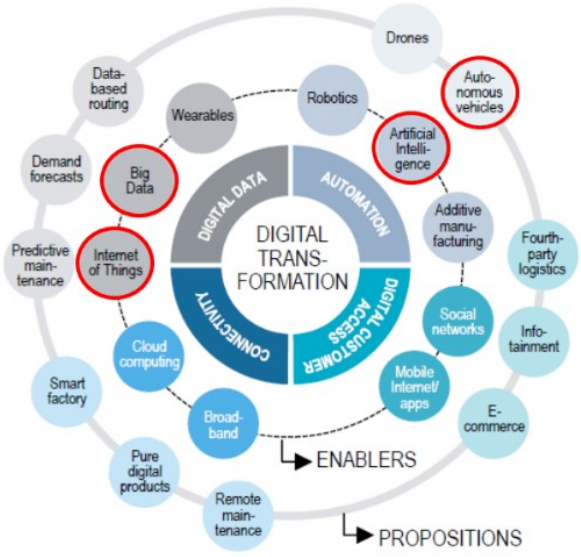

Fig. 3. Key technologies of digital transformation

One of the aims of this research is to understand how technological influences are being struck at the level of operational value creation. The dual approach to this theme is the interpretation of human (soft) and technical (hard) technological capabilities and competences. Several researchers have highlighted the importance of the two points of view, one of the leading one is by Radu (2020).

2. IMPACT MODEL EXPLANATION OF THE NEW TECHNOLOGIES

Technological changes, the emergence and spread of new technologies can be examined from several perspectives. First of all, it is necessary to understand and interpret the environment of change, i.e. the sectoral effects derived from megatrends, keeping in mind the dynamic nature of the environment. Secondly, it is important to get an overview of the drivers of technological change, based on the specificities of technology pull (as a social demand) and technology push (as market pressure). Technological changes at the level of businesses and services take the form of technological competence. Given that this is a combination of human and technical know-how (Pataki, 1994), this should be examined as a source of value creation on the basis of man and the asset background.

It is the subject of related separate researches of the authors, here it is only referred to it as an example that individual technological changes do not appear on their own, but are related to each other. There are parallel technological changes, they are interlocking each other, but they can also be reinforcing or weakening the other's effects. With regard to examples in the automotive industry, it can be clearly seen that the temporality and dynamics of each new technology vary considerably, as having the effects generated and the new competence aspects (Fig.4).

In connection with the individual technologies, the strength of the relationship between them, the complementarity of the technologies, their overlap, their temporality, and the effect of the generated changes can be examined.

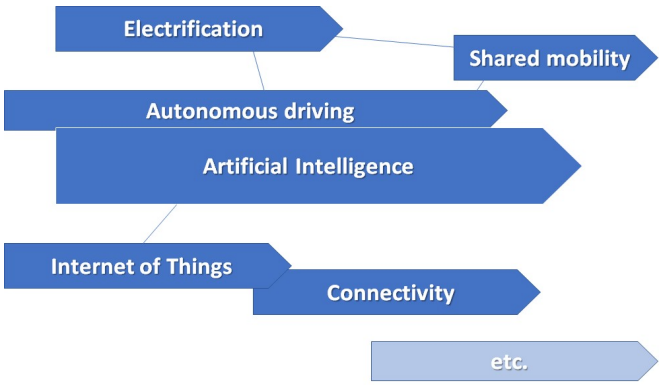

Fig. 4. Interrelations of new technologies (example of vehicle industry)

In some cases, the development of a new technology takes place more quickly and sometimes over a long period of time. Beyond the time horizon, it is also important to know which phase of development is to talk about. Gartner examined expectations for technologies at various stages of the development process. The hype curve published by him for evolving technologies is shown in Fig. 5 (referenced by NATO S&T, 2020).

The figure reflects the movement of each technology alongside the specifics of the curve. The figure illustrates the different state of Level4 and Level5 self-driving technologies; in between with 5G technology related to connectivity.

The forward-movement of new technologies on the hype curve is influenced by a number of factors. Of particular

interest is the social demand for technology and the relationship between the technical development and the market potential in view of maturity of the market demand. In reality, the common result of these driving forces groups is a fundamental determinant of technological development (Pekk, Háry, 2021).

Fig. 5. Automotive examples on Gartner Hype Cycle

Gartner's Hype Cycle includes the followings:

Innovation Trigger: After a long period of time, a possible new technological breakthrough seems promising. This trigger for initial innovation is based on early experimentation, provides a theoretical basis and also arouses media interest. This will generate additional publicity and interest. At this stage, no viable product exists or its market viability has not been proven.

Peak of Inflated Expectations: Early disclosure can be a success, but in most cases, it is accompanied by failure. Some companies are taking steps towards an innovative idea and many are not.

Through of Disillusionment: This is when the limitations of technology become clear and some implementation attempts are lost, so they do not produce results. This will reduce overall interest. In addition, through introductions and continuous development experiments, progress can only be made in refining the underlying serving technology. It is important to place where a particular technology can be applied. If these do not happen, the technology eventually does not result in a product and disappears completely or returns to the start, and then waits for further improvements, or technological convergences.

Slope of Enlightenment: To understand a technology, it is possible to better crystallize one of the potentials so that it becomes usable and evaluable for that particular technology. Then a new generation of products, services, more successful trial and trial products can be seen, so more attention is paid to technology. However, some companies remain cautious.

Plateau of Productivity: Mainstream adoption takes place. Technology has found its market by understanding the limits and determining its applicability. However, problems and new ideas that could potentially trigger a new cycle may still arise. Otherwise, technology will be so well integrated into the technological environment that its use will become commonplace until it is triggered by a new technological development.

On this basis, in the light of external factors, the interrelation relationships of the technologies concerned can be examined and the interactions of the driving forces can be modelled. As a result, the human vs. asset-side technological competence are mixed and their impacts can be examined in relation to the specific corporate or service environment.
The automotive industry is changing very dynamically, the transition from internal combustion engines to alternative drivelines is irreversible. However, in the next decades, vehicles with both technology concepts will be available in parallel. This double load increases the pressure to cut off operating areas for greater efficiency.
Switching to emission-free individual mobility for electrified vehicles would hardly be possible without electrification of the powertrain. First of all, there is the issue of local components – the fact that cars only emit very low levels of harmful substances, dust and noise. It also seems that 'zero emissions' will be a global initiative: the idea is that the electricity used to charge vehicles should come from renewable sources, thus ensuring CO_2-neutral mobility.

In the case of autonomous vehicles, rapid progress in artificial intelligence, machine learning and deep neural networks makes it possible to achieve what has was seen till now as utopian. Thus, these solutions do not require human intervention in complicated traffic situations. This completely redefines the use of individual mobility platforms. New application scenarios are emerging that would have been unthinkable a few years ago.

Connecting cars to the outside world sums up the concept of connected mobility. This term actually means at least two technology concepts at once. On the one hand, it refers to Car2Car and Car2communication, which is the connection of the car to other cars or transport infrastructure (e.g., traffic lights). On the other hand, the term also includes the relationships of the occupants of the vehicle with the outside environment. In the future, they can communicate, work, use the Internet, or use multimedia services during the trip.

All these technology trends suggest that mobility is expected to become easier, safer, cheaper and more comfortable. At the same time, the revolution in individual mobility is forcing the industry to reinvent itself to some extent.

3. ROLE OF ZALAZONE ECO-SYSTEM ENVIRONMENT

Autonomous vehicle control, the rise of electric vehicles, automated vehicle control solutions pose serious technological challenges not only for vehicle manufacturers but also for developers. Several of the traditional test tracks are only available to the OEMs that operates the track, and outside users are usually saturated. In addition, testing capacities are less prepared for the new types of testing needs arising from technological change in the automotive industry. Therefore, there is a strong market demand for a state-of-the-art testing environment, as majority of the testing facilities have been created before the current technology revolution of the mobility sector.

There are still limited facilities in the world that allow full-range-scenario testing of complex autonomous functions, especially where it is feasible to test complex situations and functions along with traditional vehicle functions in safe and repeatable way. This gives the ZalaZONE environment (Fig.6) its uniqueness, with a focus on testing both traditional and automated solutions. The ZalaZONE Research and Technology Center, located next to the test track, offers a wide-range and open collaboration between settling companies and university research sites, automotive test track players, regional industry and the technology partners to provide internationally competitive knowledge-based services. It implements an environment of research, innovation and education where the fundamental knowledge and practical competences, the expansive developments that meet economic and industrial needs create added value all togeher. Within the Research and Technology Center, local specialists and collaborating partners provide R&D, innovation and technical service solutions to emerging industrial problems in various fields of automotive, mechatronics, software and communication technology developments, as well as mechanical design, manufacturing technologies and materials technologies and challenges.

Fig. 6. The ZalaZONE Proving Ground

6. CONCLUSIONS

The current paper addressed technology development issues, positioning technological transformation as an opportunity from megatrends to key technologies. Some specific examples from the automotive industry were also presented. Based on their considerations, the model-like interpretation of the effects of technologies was explained, including the role of the environment, driving force and impact. The authors pointed out that the new technologies have some relationship with each other, the specifics of which are the subject of further research. Service and R&D capabilities are a specific mix of human and technical side, which issues complex technological competence, building on them is possible to build service responses to support new technologies. Finally, the paper presented the ZalaZONE environment as a practical reference, which is also a test environment, a service background and a stage for research and development in one.

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