The Vision that Carries the Digital Transformation on its Back - The Promises of 5G for Sustainability and for the Corporate Sector Focusing on the SMEs in Hungary

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Abstract
Digital transformation, including emerging telecommunication technologies, can be a game changer in the case of SMEs. 5G technology paves the way to substitute different expansive communication technologies, becoming the backbone of i4.0 solutions. Although companies declare the importance of digital transformation, 5G is not necessarily part of it. Especially, SMEs are uncertain about 5G. This paper highlights the business model opportunities and benefits of utilizing this disruptive technology. We analyze the 5G awareness of Hungarian SMEs based on a survey targeting their digital transformation. Hungarian SMEs have significant unawareness regarding the technical issues and the business manners as well. Providing information and guidance based on governmental funding is expected and required.

Keywords
5G, Digital Transformation, SME, Sustainability, Competitiveness, Management

1. Introduction.

5G is one of the key technologies and catalysts of digital transformation. From a conceptual point of view, it is more than that. It is more like a mechanism of destruction and creation, born from the cooperation of research groups, telecommunication companies, and regulatory organizations. It is destructive in the sense that it will retire a range of technologies and business models used recently. Meanwhile it is also creative, as it opens the door to an economy and a society that is inconceivably efficient, interconnected and autonomous (Mitra, 2016; Vook et al, 2019). 5G can be regarded as the backbone of digital transformation and the services and solutions based on it. Other i4.0 technologies are related to this and are merging into this process (Fox et al., 2020).

The term "digital transformation" has been used from the beginning of digitalization. The CoVid disease highlighted its importance and has given a new momentum for developments of frameworks, theoretical approaches, and sustainability perspectives. Limited research exists on SMEs' digital transformation to address post-CoVid situations, where technical and sociological aspects emerge (Papadopoulos et al., 2020). SMEs need to change their thinking about their business to maintain sales levels after CoVid and to be ready for similar problems in the future (Matt et al., 2020; Anim-Yeboah et al., 2020; Indriastuti et al., 2020). SMEs face higher challenges compared to multinational companies in the management of digital transformation. Their overall digital readiness level limit decision-making processes. However, Key Readiness Indicators (KRI) can be determined to help companies developing directions of

interests, identifying actual trends, and increasing employee competences (Brozzi et al., 2018; Saad et al., 2021).

Open innovation is another field for SMEs that needs to be exploited both theoretically and practically. Pillars of open innovation practices were listed as knowledge and technology sourcing activities; innovation expenditure; sources of knowledge; human capital; innovation networks; and intellectual property protection (Jones-Evans et al., 2018).

5G has a different value proposition than former mobile communication technologies that require new argumentation and communication techniques to highlight the features and the business opportunities for the enterprises to persuade them to adopt (Khurana et al., 2020; Wang et al., 2021; Tudzarov et al., 2017). The companies, independent of their sizes, should invest in piloting and utilizing 5G.

Research Questions and Paper Review

This study examines the perceptions of the SMEs in Hungary, whether or not they realize 5G as a disrupting, game-changer technology of the future. Is this sector of companies aware of the potential in efficiency, in business growth that 5G brings? Can this set of companies operationalize the vision of 5G? Are they ready to implement it already? Preconceptions are based on other research findings, mainly on digital transformation in the CEE region. These studies state that the awareness is strong, but the implementation, and utilization is weak. Our expectation is to reveal similarity to these statements at a higher level of disparity in the attributes.

The Theory of the Digital Transformation and the Power of 5G

"Digital transformation impacts every segment of the economy and society. Added value, trained workforce and relocated industry become the most important benchmarks in the competition between nations. New technologies will result in new business structures, new products, new operating models and digital networks." (Gyimesi, 2021). The meaning of the competitive advantage will have a twist at the level of companies. Autonomous systems will fulfill the majority of the repetitive tasks. Rising efficiency will be the driving force of the decision makings. New, connected products (smart products) will be linked to each other and the producers, modifying the role of the manufacturers towards becoming service provider (Klitou et al., 2017; Morrar et al., 2017; Blanchet et al., 2014; Giesbauer et al., 2016; Nick et al., 2019).

Kagermann has a positive perception on digital transformation. He believes, that i4.0 accelerates the economic growth, the competitive advantage, the innovation capacity and also results in better work conditions, fosters creativity and efficiency at the same time (Kagermann et al., 2013). Smit defines the three main theoretical areas of change caused by the digital transformation such as technology, business model, and society (Smit et al., 2016). The change will be radical and complex compared to the previous industrial revolutions (Pfeiffer–Suphan, 2015). The technology shift will be the driver of resulting growing productivity, rising value proposition, value-add focus, digital production and strong vertical and horizontal integration (Geissbauer et al., 2016; Roblek et al., 2016; Ilic et al., 2017; Hoff, 2016).

5G as a technology can be considered as a backbone infrastructure component responsible for the connectivity and mobility. 5G supports other applicable technologies of the i4.0 paradigm: IoT, cloud solutions, social media, autonomous technologies, augmented reality would not exhibit their potential without 5G (Probst et

al., 2017; Nick et al., 2017; Rüßmann–Lorenz, 2015; Karabegovic, 2017; Jain et al., 2017; Scott, 2020). Moreover, smart factory, connected factory, cyber physical and autonomous systems, smart cities, smart homes, smart grids, smart logistics, autonomous driving cannot be completed at a higher interpretation level without 5G (Schlaepfer et al., 2015; Rodic, 2017; Qin et al., 2016; Kagermann, 2014; Jain–Mondal, 2017; Giffinger et al., 2007; Paskaleva et al., 2018; Effing, 2017).

5G Technology and its Economic Potential

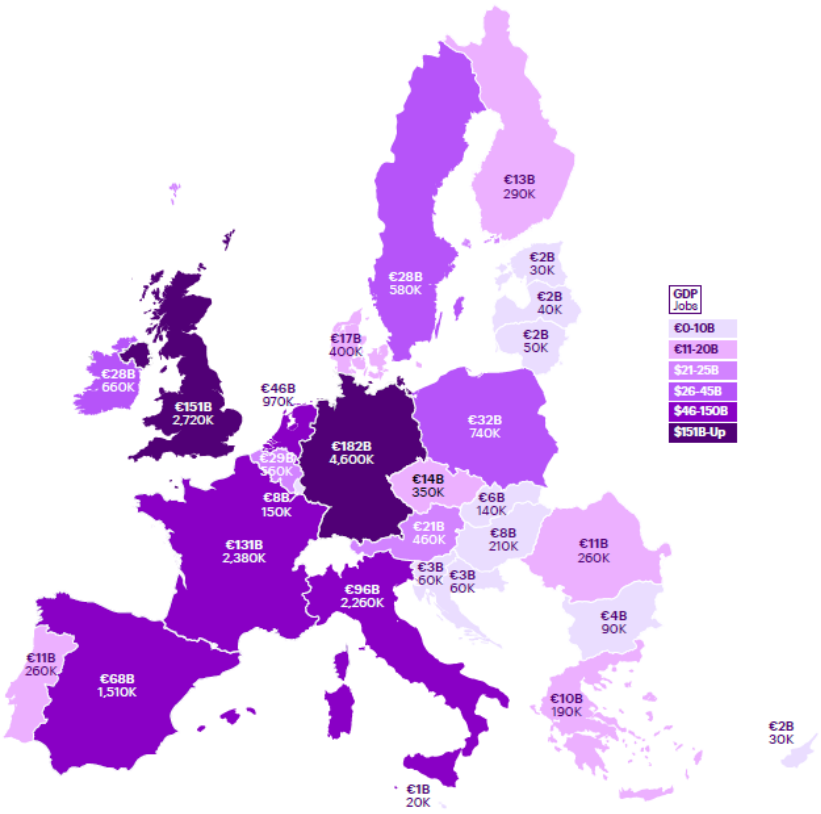
5G is transforming healthcare, the automotive industry, transportation, media, the energy industry, agriculture and the everyday "smart life" of the average person (Garcia-Morales et al., 2019; 5G IA, 2020). It will be one of the main wireless transmission mediums (challenging even the current Wi-Fi operation) on which the all-encompassing data network will be built. Billions of assets will be linked to each other directly or through statistical patterns in databases, ensuring humanity's smart way of life (Mitra, 2016). The PwC model calculates that it will contribute about $1.3 trillion to the global GDP by 2030 (Chow, 2019; Chow et al., 2021).

Accenture forecasts an extra output of €2 trillion between 2021 and 2025 as a result of 5G, creating 20 million new jobs, with a double multiplier effect seen elsewhere in the economy. The research predicts 210,000 new jobs and a GDP surplus of EUR 8 billion for Hungary. Figure 1 shows the predicted impact on the economies of the EU (Wang et al., 2021). Like any other emerging new technologies in the past, 5G will make various jobs unnecessary and at the same time, create new jobs and professions.

5G has a special role due to the nature of the telecommunication and data transfer infrastructure. 5G is implemented as part of a national (digital) utility, in collaboration with the state and telecommunications companies around the world, and in collaboration with international agencies overseeing technological development. Development is also proceeding according to a precise timetable in the EU. According to the plans, the everyday application of 5G – populating it with data – is imminent (Husenovic et al., 2018). Nowadays, at the end of the pilot implementation stage, in the first phase of commercialization, we are in the process of expanding network capacity and creating fast-speed data transfer networks. The so called enhanced Mobile Broadband (eMBB) network can be considered as the next generation mobile network at an exponential scale speed and capacity, optimized mainly for machine-to-machine (M2M) communication, supporting e.g. autonomous driving, smart cities and smart homes. The eMBB pilot networks have been available in major cities around the world since 2019. In the future, according to the schedule, newer, more special solutions conforming to higher and higher technical standards will arrive in the coming years, followed by 6G from 2030 as planned (Zakeri et al., 2020). According to European Committee guidelines, by 2025, cities and major traffic routes in the European Union must have contiguous 5G connectivity (Axon Partners Group, 2018). The implementation is coordinated by the EU as a flagship program, managed and supported through PPP and international cooperation along with FP7, Horizon2020 and Horizon Europe activities (Davies, 2016).

„The European Investment and Structural Funds (ESIF) supported EU countries' implementation of their national broadband plans (NBPs) by providing almost €6 billion in grants in 2014-2020. 56% of the planned projects have been signed. The Commission proposed that this support continues in 2021-2027, with the focus on very high capacity networks." (EC, 2020).

Figure 1.
The impact of 5G on the economies of the European Union (Wang et al., 2021).



The EU, as a political force determining the continent's digital development, examines the progress of the member states year by year. The first pillar of the research methodology is Connectivity, which examines the country's voice-data network capacities. 5G has been present in the index since 2019. According to the 2020 DESI publication, the first 5G cross-border corridors have already been implemented (Figure 2.), and the number of cities with 5G coverage is increasing (Figure 3.) (EC DESI, 2020).

For end users or B2B and B2C consumers, 5G will bring a new communication era, meaning it will change the reality of mobile data transfer they have got used to. With up to 10Gbps (20Gbps downlink) mobile data transfer speed, which is ten times the current throughput, a 3GB movie can be downloaded in less than a minute. This also changes the users' behavior by avoiding downloads and moving towards streaming services. Broadband access and coverage that allows the use of a virtually infinite number of sensors per area can be achieved. Furthermore, 99.999% application availability and essentially zero latency (<5ms) are available on the 5G backbone, which is a prerequisite for real-time machine communication while adhering constantly to a concept that treats energy conservation as a key consideration (Khurana et al., 2020) (Manufacturing Institute, 2020; Wang et al., 2021).

Figure 2.
5G cross-border corridors (EC, 2020).

5G not only outperforms the current 4G technology by orders of magnitude in terms of capacity and volume, but also because it provides digital answers to other business questions. 5G can serve goals that go far beyond the current practices of SMEs regarding automation, efficiency, digitalization proactivity, work organization, data use, management and communication. For the industry 5G should perform optimized for ultra-low latency, which is essential to maintain digitalized production to autonomously resolve either deterministic-periodic, deterministic-aperiodic, or non-deterministic situations. (Garcia-Morales et al., 2019; Vella, 2019). Note, that 5G will not replace 4G/LTE networks, they will coexist and share the workload. On the other hand, inefficient, uneconomic 3G services will be shut down even now in 2022.

Although some countries allow only large 5G operators to provide (local) services for companies (i.e., Hungary), other countries allow the operation of local networks using dedicated 5G frequencies. This may open new business models for micro operators (Ahokangas et al., 2019).

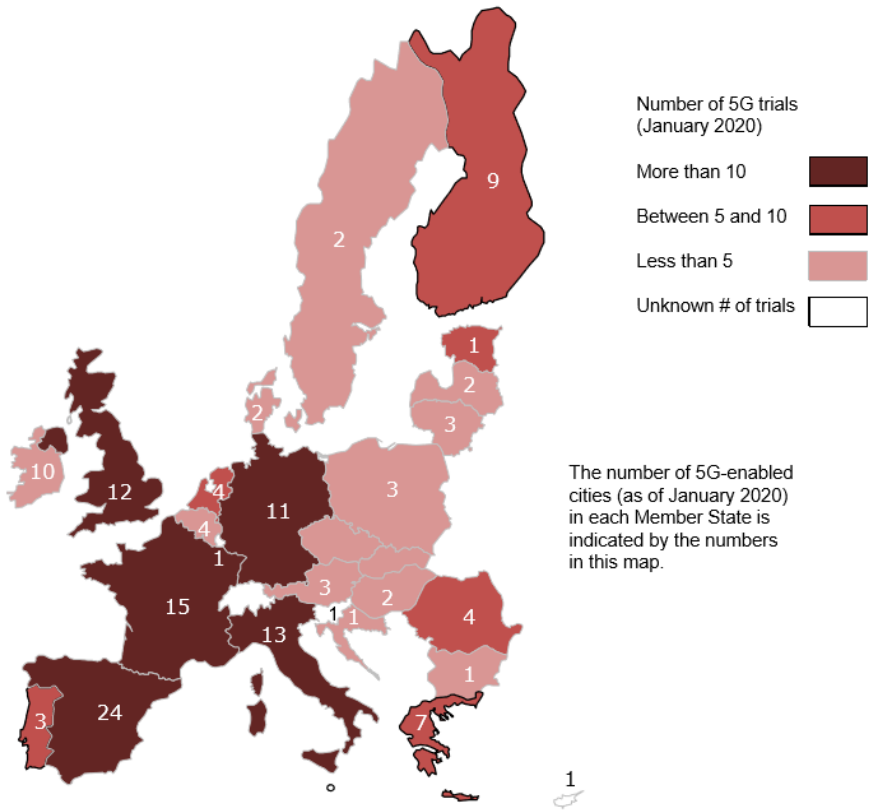
2. 5G and the Digital Transformation for SMEs

5G builds heavily on the involvement of SMEs. Technology guidelines are more supportive of this sector than ever before in the evolution of telecommunications. The previously used uniform methodology of data communication of 4G, which focuses on serving the mainstream, will change, as will the monopoly position of telecom companies. Segmentation and network slicing provide ways to implement a certain kind of delegation - task transfer, task sharing - to the SMEs, and they provide the optimal service for a given purpose (Tudzarov, 2017). This is a real entry opportunity for players in the SME sector, as new niche markets and functions are emerging for business and virtualized network layers over physical network infrastructure. To optimize network and technical solutions, brokers (intermediaries) will have to assume

new roles between customers and the telecommunication companies. It will be necessary to manage local implementation (Quality of Service, local private network management), or even to develop and adapt third-party software applications (5G IA, 2020; Manufacturing Institute, 2020; Camps-Aragó et al., 2019). Especially, so called "5G campus networks" can challenge telecommunication service providers. Several countries enabled the use of dedicated frequencies for industrial use, that is, corporations can implement, manage and use their own 5G local network independent of a service provider. 5G comes with new definitions for added value and new services and new types of agreements and business models (5G IA, 2020). The new business models are built on the pursuit of solving individual connectivity tasks and the vertical separation and specialization of services (Axon Partners Group, 2018). SMEs can benefit from all the additional indirect opportunities of the 5G concept, which can be characterized at a macro level of digital transformation (Khurana et al., 2020; Fox et al., 2020; Manufacturing Institute, 2020).

Figure 3.

5G cities in the EU (EC, 2020).



As the (data) backbone of the digital transformation, 5G creates a connection that is optimally accessible always and everywhere (Lu, 2017). The definition of digital transformation, according to the international consulting company Roland Berger is as follows: all changes can be linked to the digital transformation, which is achieved through the application of digital technologies to society as a whole. Digital transformation is achieved through the collaboration of intelligent and autonomous, data-based interconnected systems (Hoff, 2016). Digital transformation is carried out uniquely in each market, industry and application, but it is important to note that it has an impact on business models and the methods of value creation in all areas

(Kagermann et al., 2013). Industry 4.0 is the term for the industrial digital transformation (Blanchet et al., 2014).

At a micro level, i4.0 is all about new manufacturing and management techniques, changing collaborations, new products, expanded revenue sources, information-based business opportunities, and more efficient production. An interesting example of the difference between vision and reality is that, based on theoretical studies, the main motivation for the i.4.0 transition is the development of a new platform-like system of smart products and product services that can communicate, and the new revenues generating through them. However, corporate leaders today consider this process primarily as a cost-cutting opportunity.

At the dawn of GSM technology (2G) digital voice transmission was the only goal. Data transfer was first implemented as 2.5G (GRPS) followed by 3G (UMTS) that gained massive popularity. The latter has already been specifically developed for the transmission of multiple services (voice, data, internet, video). The first broadband access was achieved using 3.5G (HSDPA). Today's popular 4G (LTE) technology provides service that is considered to be the mobile broadband connectivity and also supports real video streaming (Tudzarov, 2017; Mitra, 2016). 5G, however, is changing the rules of the game, making wired end user connections and Wi-Fi obsolete even on the production floors.

As a good example of a 5G empowered factory, the test implementation of Kista brings the automated future close. During the Kista trial, the movement of a large number of autonomous mobile and stationary robots as well as fellow employees working in the field was coordinated by machine vision-based processing of images from the camera system covering the area, and via the VR-based data communication of professionals at the factory. The new 5G-based solution has made it possible to replace the limited individual task optimization of mobile robots - the limitations being the result of the robots' stand-alone algorithms - with a higher level of optimization for the factory premises. Thanks to the new system, a large number of robots can travel and work together with the operators and other ad-hoc devices within the enclosed area, resulting in a higher level of identification, control and safety. The data connection features of 5G made it possible for the engineers to match signals of sensors and images of cameras to the computing power of the central control software in the solution. All this would not have been possible with previous wireless technologies or using the individual algorithms of the mobile units, but the low latency of the 5G communication network and its data transmission capacity ensure the operability of the system. (Landernäs et al., 2020). From a business point of view, the image of a highly efficient, autonomous digital factory operating in cooperation with robots emerges, which can turn from an idea into everyday reality. From a corporate perspective, 5G is a kind of breakthrough point for realizing unique plans, visions, concepts, innovation ideas - in combination with other new, disruptive digitalization technologies.

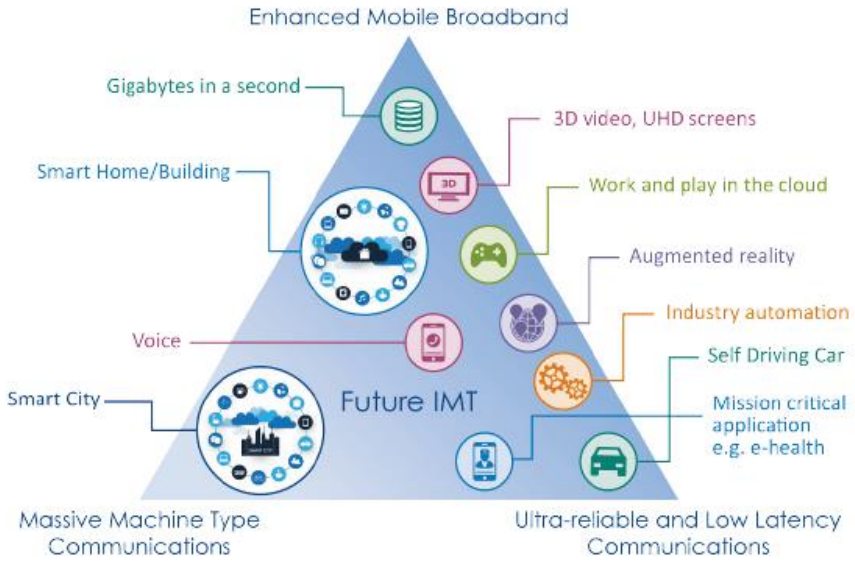
5G responds to cases and business ideas similar to the example above with solution packages and industrial solutions highlighting the different benefits of the technology, for example, high level of mobility with normal or low-energy consumption, optimal data connection and latency, different levels of coverage indoors and in densely or sparsely populated areas, high-reliability services, or actual real-time services (Tudzarov, 2017). In terms of technical classification, the logically versatile service package can be divided into the following three main categories: enhanced Mobile Broadband (eMBB) to provide fast data connection, massive Machine Type Communications (mMTC) to support commercial and industrial sensor communications, and ultra-Reliable Low Latency Communications (uRLLC) for

transportation, industrial automation and robotics (Garcia-Morales et al., 2019; Manufacturing Institute, 2020). Figure 4 shows the grouping of the specific application areas (Husenovic et al., 2018). During business use, a device can be involved in data transmissions that can be classified in several categories at the same time (e.g., mobile robot). The possibilities are not exclusive, and they can build on each other.

The concept of IoD (Internet of Digital Reality) has been defined and adjusted to the new possibilities that 5G, fiber optic networks, and virtual and augmented realities make possible now, and even in a fully immersive way in the future (Baranyi et al., 2021; Wersényi et al., 2021; Cook et al., 2018). This concept covers not only the technological foundations of emerging technologies, but also human factors and business models (management, marketing, effectiveness), trying to bridge the gap between new technologies and the corporate sector as well.

Figure 4.

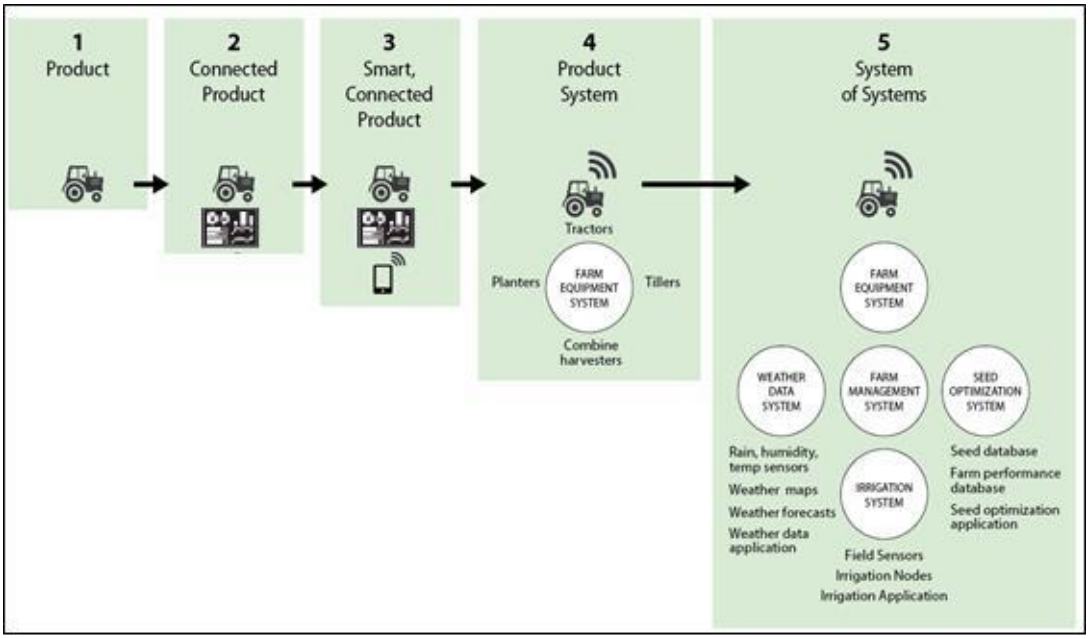
A technical classification of the use cases of 5G (Husenovic et al., 2018).



Nevertheless, 5G solidifies the Porter vision of Industry 4.0 to any market players (including SMEs), which describes the transformation of a simple product into a smart product as a metaphor for the formation of complex digital ecosystems. By evolving into a smart product, a simple product acquires more and more service elements over time, then first turns into a local ecosystem and then into a complex ecosystem (or one of its elements) through the interconnection of systems. As it evolves, the ecosystem built around the smart product collects and processes more and more data, enabling it to control itself with increasingly accurate business intelligence, based on big data patterns found in its databases. During the process, the product is not separated from its manufacturer for a moment. There is data communication between them continuously. For example, additional services include proactive interventions, suggestions for operation and application, recommendations, and upgrades, and eventually, it is the data that turns out to be the most valuable and most up-to-date link in the chain, which can be used or sold independently (Porter et al., 2014). See Figure 5.

Figure 5.

Smart Product Ecosystem (Porter et al., 2014).



Despite the potentials of 5G presented above, international studies show a significant underperformance either in awareness of the technology or commitment of using it.

Barclays' research in England highlights that a large number of respondents are aware of the importance and the effect of 5G as well as its inherent possibilities, and believe that they apply to them and are affected by these effects. However, most people cannot fathom how they could employ, introduce, or try 5G in their own business. This reflects an uncertain, backward, passive picture of the use of 5G (Bain, 2019):

- 62% of executives surveyed have a little knowledge of 5G;
- 28% of companies surveyed have knowledge of how 5G could be used in practice;
- 15% of the companies surveyed have a plan for adaptation;
- 9% of companies surveyed took significant steps to exploit the potential of 5G;

Concerning the benefits of 5G, the expectations are as follows: increase in business efficiency (31%), possibility to leverage IoT (27%), possibility to communicate with more customers (19%), decrease in business costs (18%) (Shafique et al., 2019). These awareness facts underperform the digital transformation awareness values. The following list contains data from the CEE region:

- 62% of the companies in the Czech Republic consider themselves to be affected by the digital transformation paradigm (Vrchota et al., 2019);
- Czech SMEs are lagging behind in everyday implementation. The direct steps of realization are missing: no nominated authorities, no dedicated budget, no identified benefits can be perceived (Basil, 2017);
- 71% of the companies consider i4.0 important for their competitiveness in Hungary (Nick et al., 2017);
- Among Polish companies the highest demand for i4.0 solutions can be detected predominantly in the following branches of industry: vehicle industry (93%), manufacturing industry (45%) and pharmaceuticals (35%) (Grzyb, 2019);

- SMEs members of the sector do not use i4.0 technologies, making low efforts to rise their competence levels in Poland (Adamik–Nowicki, 2018);
- In Slovakia, 84% of large corporations, 71% of medium-sized companies, and 47% of the SMEs have a strong understanding of the digital transformation and only 50% started digital transition (Grencikova et al., 2020);
- Referring to the whole CEE region, a slow and incremental digital transformation progress can be seen. No full commitment can be identified due to lack of competences and financial resources (Szabó et al., 2020).

Nevertheless, it is almost impossible to find direct scientific research results on 5G technology.

Sustainability and Competitiveness

Technology and digital developments are easily adopted by "big tech" companies, multinational corporations and by capitalized companies. New technology is always expensive, including buying new equipment, installation, and maintaining the entire operation. Implementation, however, gives competitive advantage. SMEs who are able to adopt to the developments also gain advantage over their competitors nationally and internationally. Being competitive often brings risks, high costs and energy demand, waste etc. It is very challenging to maintain sustainability (Olawumi et al, 2018; Alsharif et al., 2018). Reducing costs, increasing productivity, optimizing management (manpower, logistics, communication, etc.) can be supported by the digital transformation in the long term.

3. Analysis in Hungary

This study is about evaluating whether the Hungarian companies, especially the SMEs, are ready for 5G or not. The submitted questionnaire is dedicated to measure the 5G awareness of the respondents compared to their digital transformation awareness. Within the research the operationalization level of the Hungarian companies is also evaluated, compared to the awareness. The results might help policy makers to put emphasis on the necessary knowledge transfer at any level, as well as creating programs for dedicated financing activities. The mindset of companies should be changed - it is time to start talking about 5G by emphasizing business benefits instead of explaining the technology itself.

The primary research was made by a survey in Hungary with 25 questions and 6 data point scales, where applicable. In total, 102 responses out of 2000 successfully submitted surveys were received, which represents a 5% response rate. The database of the target companies contained mostly SMEs in manufacturing.

Additionally to the survey data, the available financial statements of the reviewed companies were also analyzed and evaluated together with the questionnaire. This method allowed the identification of further connections between the willingness of the 5G implementation and the economic capabilities of the companies.

The population of the surveyed companies were categorized based on the definitions of the EU recommendation 2003/361 along with the 2020 updated definitions. Table 1 presents the ceilings applied to the definitions for individual firms. A firm that is part of a larger group may need to include staff headcount/turnover/balance sheet data from that group too.

Table 1.
Definitions by the EU recommendation for company sizes (EC, 2020).

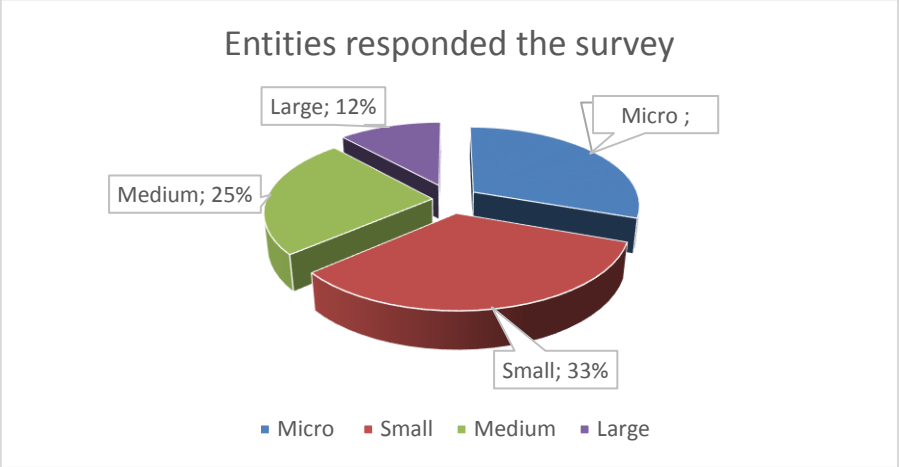
Company category	Staff headcount	Turnover	or	Balance sheet total
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

This paper aims to evaluate whether the SMEs are aware of the potential of 5G technology in Hungary, if there is a clear and proportionate evaluation of the forthcoming effect of 5G on the business models and whether they are ready to invest in it already. Additional validity evaluations were also made on the data set. Benford analysis and ANOVA analysis confirmed the values we present.

4. Results and Evaluation

Based on the above definition, the survey included 31 Micro, 34 Small, 25 Medium and 12 Large companies. Figure 6 presents the distribution of the companies per size in the questionnaire. From the classifications, we can identify that small and medium-sized entities represent 58% of the total number of companies.

Figure 6.
Entities responded the survey.



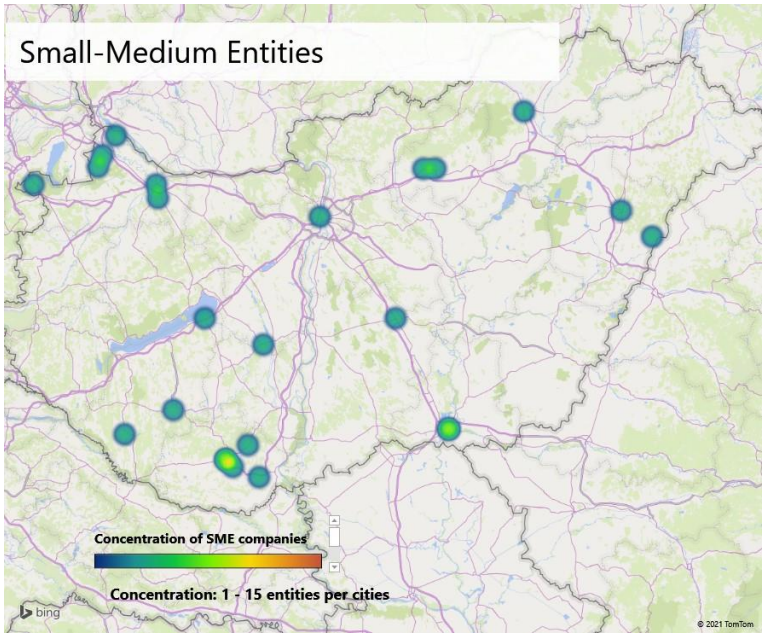
There were 102 entities in the responses, 93 entities were identifiable by the court register. Three companies were not registered in Hungary or their economic data were not accessible (no name given in the „name" field). Furthermore, 8 entities were identified as sole traders, where public financial information is not available about their economic performance.

In the process of data evaluation some data were excluded, because some of the respondents did not give the information in a proper form. The regional presence of the companies can be seen in Figure 7. The heat map presents the concentration of the small-medium sized entities who answered the survey. The highest concentration can be seen around the major cities in the south-east and south-west, and furthermore

around the north-west area of Hungary. This provides a good areal distribution of the answers within the country.

Figure 7.

Location of the enterprises that answered the survey.



Out of the 25 questions, the 5G technology related questions are summarized in two different tables per company category. All the answers are scaled from 1-6 with six possible answer categories with specific meanings. A dedicated set of questions were asked to gather impulses regarding the openness of the companies on new technologies, their ideas on i4.0 and their digital awareness.

Based on the answers of the companies segmented by their size, results of the research reflect the correlation between the size of the company and the technology openness and the involvement of technology. All segments show strong readiness for digitalization and digital transformation (representing 4,3 – 5,5 average values) in line with their sizes.

However, 5G as a highlighted technology significantly undervalued compared to the general understanding of the digital transformation. It is shown that only a moderate interest is provided by the companies towards 5G (representing 3,0 - 4,5 average values). The biggest gap between the digital transformation awareness and the 5G awareness is observed in the micro-enterprises segment. It is assumed that the technical prerequisite for the everyday operation of the companies, the misunderstanding of 5G and the lack of efforts put into understanding it can explain these results. We should also consider that the survey was completed in the middle of the CoVid affected period, thus, smaller companies may delay and postpone this kind of investment. It seems that 5G does not yet have the expected level of recognition, awareness, and identification compared to its important backbone functionality within the digital transformation paradigm.

Table 2.
Small entities' responses.

Survey question	Mean	Median	Mode	Var
Does the company produce for export or for the domestic market? (1= purely domestic; 6= purely export)	2,29	2	1	N/A
Who makes up the company's customers? (1= only consumers; 6= only companies)	4,79	5	6	N/A
Does the spread of 5G technology induce business opportunities for your company, either in terms of manufacturing or product development? (1= no opportunities; 6= absolutely opportunity)	2,24	2	1	1,54
Will 5G technology in 3 years be present daily in the operation of your company, either in terms of production or product development? (1=not present in operation; 6=full presence)	2,55	2	1	1,75
Do you think that the deployment of 5G technology will significantly support the digital transition? (1=no; 6=yes)	3,33	3	3	1,81
To what extent does your company fit in the image of an ideal digital company? (1=not fit at all; 6=perfect match)	3,88	4	4	1,22
To what extent will your company meet the ideal level of digitization you envisage and consider necessary in 2-3 years? (1=not fit at all; 6=perfect match)	4,55	5	5	1,35
Is it important for the future of your company to adopt new technologies? (1=not important; 6=very important)	5,27	5	6	0,88

Referring to the dedicated 5G questions of the study, the most positive values of answers can be observed at the general level of 5G understanding as a supporter element

of digital transformation. Referring to 5G as a technology to be applied, the answers show significantly lower values indicating uncertainty in the usage of the technology. This suggests companies "know that 5G will come" but still do not know "how they can use it for their own benefit".

Table 3.
Medium entities' responses.

Survey question	Mean	Median	Mode	Var
Does the company produce for export or for the domestic market? (1= purely domestic; 6= purely export)	3,72	4	2	N/A
Who makes up the company's customers? (1= only consumers; 6= only companies)	5,76	6	6	N/A
Does the spread of 5G technology induce business opportunities for your company, either in terms of manufacturing or product development? (1= no opportunities; 6= absolutely opportunity)	3,13	4	4	1,65
Will 5G technology in 3 years be present daily in the operation of your company, either in terms of production or product development? (1=not present in operation; 6=full presence)	3,5	3,5	5	1,59
Do you think that the deployment of 5G technology will significantly support the digital transition? (1=no; 6=yes)	4,54	5	6	1,59
To what extent does your company fit in the image of an ideal digital company? (1=not fit at all; 6=perfect match)	3,79	4	4	1,14
To what extent will your company meet the ideal level of digitization you envisage and consider necessary in 2-3 years? (1=not fit at all; 6=perfect match)	4,83	5	5	0,82
Is it important for the future of your company to adopt new technologies? (1=not important; 6=very important)	5,29	5,5	6	0,86

The micro and small enterprises are homogeneous in not considering 5G an important, future-shaping element. At the same time, midsized and large enterprises

share the common understanding that 5G is crucial in fortifying digital transformation at the technology level (see Table 1 and Table 2).

The answers are inconclusive regarding the question evaluating the business dimensions of 5G directly. The respondents do not consider 5G and its derivatives (smart products, connected services, linked devices) as a direct and strong business opportunity. Nevertheless, in all segments, answers having average values between 2,0 and 3,5 and a low level of variance could indicate business development and opportunities.

In general, the average values of the answers differ by segment. The lowest average values are detected within the micro and small enterprise segments. Values are 30% lower than the values of the medium and large enterprises supporting that smaller companies have significant difficulties interpreting the 5G paradigm compared to the larger companies. Company size is considered as a main parameter in case of 5G implementation, probably due to the financial ground (lack of capital for investment).

Interestingly, while the highest openness level regarding the digital transformation is presented by the large enterprises, the highest openness regarding 5G can be seen by the midsize companies. Flexibility and their intensive, cost-effective problem-solving attitude can be an explanation for this observation. Midsize companies may think that introducing 5G could be their chance to keep up with larger companies.

Cost saving and increased efficiency as driving factors can be observed, similarly to other international reviews. Digital transformation and 5G is considered more like a production-centric phenomenon than a business development and/or sales, marketing or management strategic toolset for all of the selected company segments. Most organizations expect to be a more efficient organization, and they also expect to have automated, connected procedures together with new customers (Figure 8). Based on the survey answers, most of the companies expect production, information technology, logistics, finance, controlling and sales to be the most impacted areas (Figure 9.).

From the marketing point of view, it is important to discover consumer behavior, especially if consumer activity is changing. Some factors have a direct relation to 5G services and acceptance. Perceived enjoyment, skills readiness and resources are key factors in the so called Technology Acceptance Model (TAM) that can be a basis for theoretical research (Shah et al., 2021; Al-Maroof et al., 2021).

The variances of the answers differ question by question. The highest level of variance is detected in small enterprises. The answers of the micro, midsize and large enterprises have lower variances. The number of involved companies, the variety of their profile, the uncertain technological base, or the technology independence level of the segment can be the reason for this.

The respondents are convinced that they are rather satisfied (moderately satisfied) with the current and expected future status of their digital transformation (values are between 3,6 and 3,8, except the micro enterprises, where it is 3,0.) All reviewed segments expect improvement in their digital transformation status in the next 2-3 years (values are between 4,5 and 4,8, except micro enterprises, where it is 4,4). The micro enterprises forecast 30%, whilst the other sectors expect 20% of development. This progress may have a direct relation to the 5G penetration.

Figure 8.

How the digital transformation affects and transforms the future of the company – a survey question and the distribution of the answers.

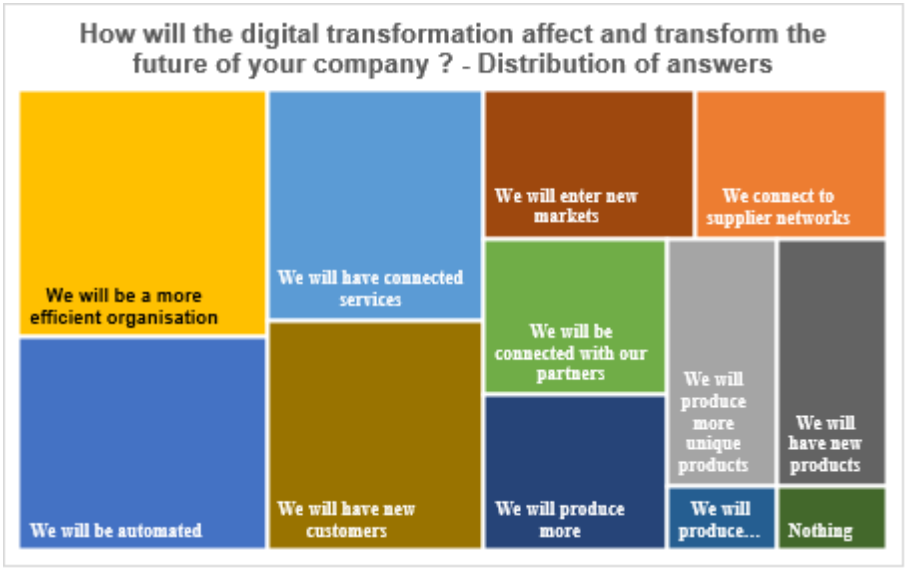


Figure 9.

Which areas will benefit from digitalization – a survey question and the distribution of answers.

Fundamental Analysis

The expectations about the development in digital transformation (including 5G) should meet the financial results of the companies. The respondent companies dispose of the capital for investment purposes. The targets of investments might take place in various technology items of digital transformation.

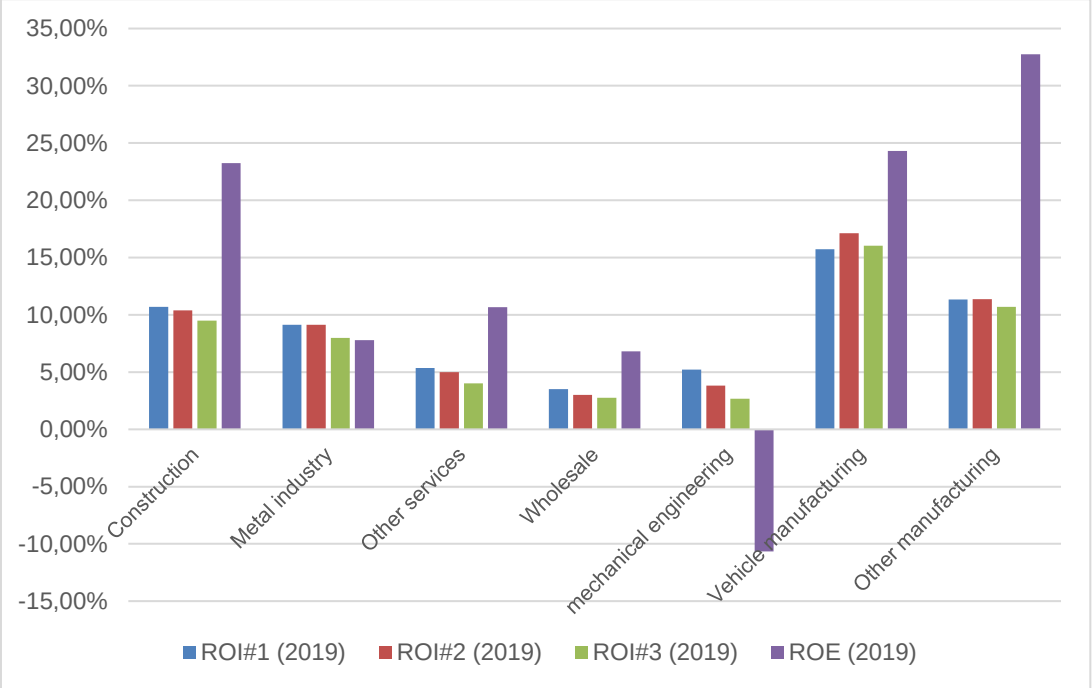
Utilizing 5G infrastructure does not necessarily mean huge investment costs for enterprises. We assume that they do not really know the actual investment costs and overestimate them. Several 5G related services can be utilized by a single 5G subscription and a 5G capable mobile device. On the other hand, establishing a production-level (speed, latency, coverage, tolerance, redundancy) local 5G network requires professional design and relevant investment as well as applications, interfaces,

and i4.0 capable production. The larger the company, the higher investment costs (and implementation time) can be predicted.

In the fundamental analysis section, we review and contrast the companies' investment capabilities with the expectation and adaptation of new technologies. Figure 10 presents four profitability ratios of the reviewed companies in an aggregated form by industry types.

Figure 10.

Top 7 industries by respondents and their economic performance (in %).



The profitability of companies was aggregated by industries with the observed indices interpreted as follows. In general, the variants of the Return on Investment (ROI) ratios and the Return on Equity (ROE) were collected, along with the calculation of Working Capital.

- ROI#1 = Operating profit / Net Sales (in %)
- ROI#2 = Profit before tax / Net Sales Turnover (in %)
- ROI#3 = Profit after tax / Net Sales Net Revenue (in %)
- ROE = Profit after tax / Equity (in %)
- Working Capital = (Total Assets - Fixed Assets) - Current Liabilities (in %)

Profitability ratios ranged in positive value ranges, except for one occasion of the ROE indicator of mechanical engineering companies. It is important that the ROE indicator surpassed 23% in the case of the construction and vehicle manufacturing industries, and reached 32% in other manufacturing. Concerning ROI ratios in Figure 10, the metal industry is behind the construction companies with ROI indicators ranging between 7-9% in 2019. Nevertheless, the manufacturing sectors still generated higher returns overall, with the wholesale sector generating the smallest, but still positive, return in absolute terms in terms of the ROI indicator.

The service industries held the least favorable positions in terms of returns. Even for the least profitable companies, the adaptation of the technology would be a suitable option because it would require no significant hardware investment to implement. With the conditions previously discussed, 5G technology does not require additional investment as telecom operators build the necessary infrastructure; SMEs are customers of service.

From the investing capabilities perspective, the average working capital per group of companies is as follows: micro entities: 44,5M HUF; small entities: 119,2M HUF; medium companies: 449,5M HUF and large entities: 11 503,6M HUF. Based on the values along with the profitability indexes, it can be concluded that the companies of the sample are economically capable of adapting the technology.

Summarizing the financial indicators, the startup of 5G utilization is available for all segments according to our research. The other selected elements of Industry 4.0 can be implemented along with the capital adequacy and the digital transformation strategies, step-by-step, project-by-project.

Benford Analysis

To provide validation on reliability of data, we carried out a Benford analysis on the 2020 net sales revenues of the respondent companies. Benford's first significant digit (FSD) law addresses the distribution of the first digit of values in the sample, suggesting that a monotonically decreasing distribution can be seen with the increase in the values of the first digits. The mathematical technique serves as a tool for identifying irregular patterns in data (Stambaugh, 2012). Besides various cases in fraud detection, in auditing, and in internal control, it can be used for questionnaire data. According to Judge, the probability of a number having a particular non-zero first digit can be:

P (First digit is d) = $\log_{10}(1 + (1/d))$

where d = 1, 2, ..., 9 (Judge, 2009).

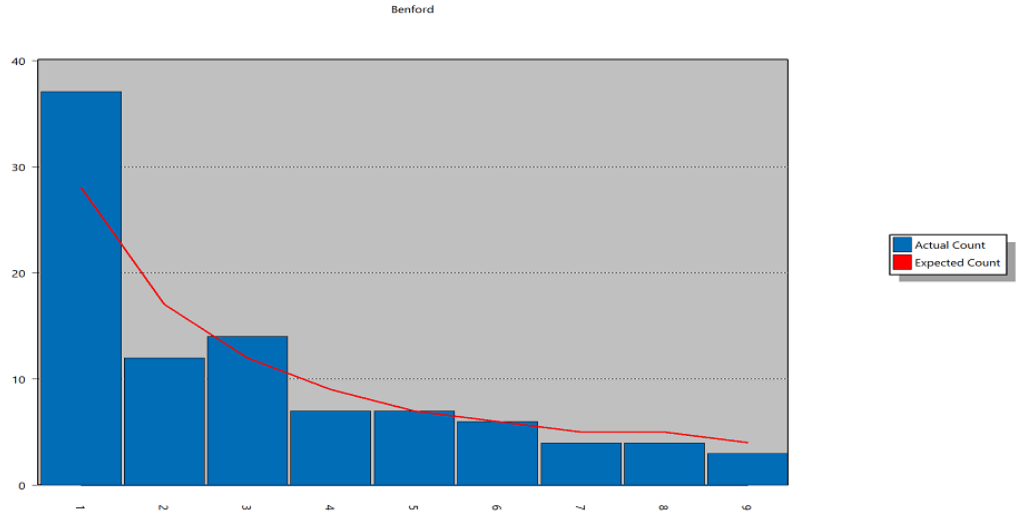
The following table and figure shows that the net sales revenues of 2020 follow the pre-defined Benford distribution (Table 4 and Figure 11), therefore it is suitable for further data analysis.

Table 4.
Benford analysis data table.

Leading Digits	Actual Count	Expected Count	Z_{stat} Ratio
1	37	28	1,845
2	12	17	1,097
3	14	12	0,548
4	7	9	0,561
5	7	7	0,169
6	6	6	0,121
7	4	5	0,420
8	4	5	0,144
9	3	4	0,395

Figure 11.

Benford analysis.



We have validated the answers from the respondents with a one-way ANOVA test to identify whether the answers are statistically significant among the groups of companies. The F critical value with the Degree of Freedom (DF) = 3; alpha = 0,05 was 2,44. The F value of all groups was above this level, especially in the case of small and medium sized entities. Based on this test, the answers in the survey statistically significant with a 95% confidence level.

6. Discussions and Suggestions

We believe that the evangelization and the foundation of 5G is a common task of the market players and the governments at the national level globally. 5G technology seems to be hard to understand despite all the benefits it brings. This is well exemplified by a 2017 survey in Hungary, in which, in addition to the provision of education and financing, the provision of digital transformation core infrastructure appears to be one of the most important elements, emerging as an expectation towards the government (Nick et al., 2017). Beyond the aforesaid measure, governments can do a lot to promote digital development, primarily by developing standards and national strategies, performing tasks related to the provision of information, and supporting professional organizations (OECD, 2019). It would also be advantageous and effective regarding all the market segments, including SMEs, if the government organizations support marketing promotion, knowledge transfer, discussions, simplifying the key messages, proposing low scale business values, and testing the technology (Gilles et al., 2018).

In Hungary, the Digital Development and 5G Competence Center opened its doors in 2020 at Széchenyi István University in Győr, established, supported and financed by the Ministry of Innovation and Technology. It is the national and regional knowledge center for 5G and related technologies, covering both technical and non-technical aspects.

7. Conclusion.

5G is one of the main disruptive technologies of digital transformation. It should be interpreted also as a business and strategic (management) proposition with strong focus on sustainability. The managements of companies (SMEs) examine whether the planned investment will pay off in terms of the company's future. In this respect, the use of 5G opens up opportunities and shuts down companies lagging for good. The potential for cost reduction, automation, autonomy, visual processing, data-driven efficiencies, and supply chain interconnection can be enhanced using 5G (Gundall et al., 2018).

5G is identified as a digital transformation technology by the Hungarian SMEs as well. On the other hand, 5G is not considered a game changer in our research for now, despite the vision of the cited international studies. It seems that the recognition of the possibilities opened by the disruptive technology is not justifiable, as of yet.

Our results also refer to the founding of Nick and research fellows (Nick et al., 2017) presenting that 5G as a digital transformation technology is mainly considered a technology of rising efficiency and cost-cutting. The Hungarian SMEs do not reach the level of understanding that utilizing 5G may result in business opportunities as well. 5G is basically identified as a technology without plans and ideas of how to internalize it. Bigger companies have a stronger awareness and a more outlined vision of 5G and of digital transformation in general.

We see a risk of lagging SMEs, failing to use the opportunity that 5G and concept makers offer them. As a consequence of our study, we suggest putting emphasis on 5G argumentation, specially dedicated to SME companies. Instead of communicating the complexity of 5G, which is hard to adopt, the messages should be transformed to ones of simplicity and concreteness. The value proposition should contain business indications, business development opportunities, and direct offerings that can be interpreted by the small and medium sized entities.

Governmental bodies and the digital transformation platforms also have to start business level communication on 5G. Without changing the attitude towards 5G, the digital transformation may lose momentum, at least for SMEs.

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