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Digitization, Technological Innovation and Robotics—as tools for boosting productivity of SMEs in the construction industry

Project study

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1.

Introduction. The background of the project

With the support of the Visegrad Fund, the Hungarian Association of Craftsmen's Corporations, hereinafter referred to as the IPOSZ, has already implemented its fourth project. This is due to the fact that the governments of the Visegrad Four are highly interested in those economic issues which had been considered important by the V4 SME organisations. It should also be noted that these organisations have been maintaining a harmonized professional relationship as well as a friendship, furthermore, these projects have always been enjoyed the participation of the biggest Western-European crafts organizations, as well. They provide support and service mainly for family, micro and small enterprises. In the project, the following organisations have participated:

- Austria WIFI Österreich
- The Czech Republic Association of Small and Medium-sized Enterprises and Crafts of the Czech Republic (AMSP ČR)
- Poland Malopolska Chamber of Craft and Entrepreneurship in Krakow, (MIRiP)
- Hungary The Hungarian Association of Craftsmen's Corporations (IPOSZ)
- Italy Confartigianato Imprese Bergamo
- Slovakia Slovak Craft Industry Federation (SZZ)
- European Builders Confederation, (EBC)

as well as the Ministry for Innovation and Technology and the Ministry for Foreign Affairs and Trade from Hungary.

The title and the ID number of the project is: Digitization, Robotics and Technical Modernization as tools for boosting Productivity of SMEs, 21830207. Within the framework of this project, primarily in the SME sector, we intended to survey the effects of digitization, technological innovation and robotics on the ways of boosting productivity in the main areas of the construction industry. We did not aim to have final conclusions.

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Together with the participating SME organisations, we would like to have a clearer picture of the effects on the implementation of digitization, technological innovation and robotics in such a special and essential area called the construction industry.

We aimed to get to know the appropriate good practices which are present in Europe, the V4 countries and Hungary, as well as their special problems, and to take an opportunity to help the V4 enterprises boost their effectiveness and maintain their competitiveness.

We also know that digitization, technology and information technology innovation, robotics together with artificial intelligence appearing slowly in the background, are all such significant factors which will alter the natural essence of tomorrow's society, economy and the jobs and professions themselves. Using future tense may not be correct at all, as these changes have already been started, and may reflect in our project, as well.

The enterprises and craftsmen in the European countries including the V4 countries as well, have to accommodate themselves to these changes. And for it, they need information, education, support and services.

Where should they go? Why not to their own professional organisations where they are voluntary members? And in return, we considered and still consider it our duty to help them. We believe that due to the quick spreading of globalization, European crafts as well as the organizations of the V4 countries need to cooperate so as to keep the balance between economic and social interests. On this undiscovered and rocky road full with difficulties these international projects may be small steps, providing a little help and this time our project is intended to summarize the opinions and viewpoints of various companies of different sizes.

László Nemeth

President of the Hungarian Association of Craftsmen's Corporations (IPOSZ)

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2.

The stages of implementation

While determining digitization, primarily, we should consider some basic factors. These are

a) The current situation worldwide:

- climate change – which is in progress
- the growing necessity of a sustainable economy
- the relationship between renewable and traditional energy resources – which has become a daily issue
- demographic issues and migration processes – which have become a central issue in today's society
- the idea of circular economy – which has been started to be implemented in today's practice
- environmental pollution,
- globalisation,
- the information technology and the technological revolution, and
- the appearance of artificial intelligence.

Today it is such an environment worldwide where it is a must to weigh future even for small enterprises.

b) Which geographical area was chosen for the project to study digitization?

Digitization may be studied

- worldwide, or
- by continents, or
- in Europe, or
- in economic areas in Europe
- and finally, within national frameworks inside each country.
- We studied this problem within the V4 countries, besides, we discussed the experience of the Austrian, Italian and Dutch organisations, as well as the European Builders Confederation (EBC).

c) Which company size was chosen for the project to study digitization?

Digitization may be studied among:

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- medium-sized and large enterprises,
- micro and small enterprises and in self-employment.

Within the framework of our project, we emphasized the latter ones, as few studies had been prepared on them, furthermore, we intended to bring the possibilities for cooperation between these two circles to the fore.

d) Digitization may be studied in general, in relation to the overall professions or within each specialized branch.

In our project we have chosen the construction industry as a specialized branch, because according to our experience the issue of digitization has a lot of different characteristics in each professional area, moreover it highly depends on the profession itself.

Within this specialized branch we analysed digitization from the aspect of mainly self-employed, family, micro and small enterprises, because together with millions of people we live our lives in a large, artificially built environment. We require a wide range of services including mending, repairing and daily life services which should be done in the future, as well.

e) Which methods did we use in our project?

- Within the framework of the project, first of all, we performed in-depth interviews with micro, small and medium-sized enterprises of the construction industry in every V4 country. It contained 14 interviews per country, including the same number of family-, micro, small, medium-sized and even large enterprises, as well.

These interviews were performed by questionnaires which were designed together with the organisations of the countries involved. In each questionnaire there were six questions, these are:

- In your daily routine do you feel the necessity of any kind of innovation, digitization, or generally you are too busy to deal with this idea?



From the aspect of digitization, do you sometimes examine the future of your job in a 5-10-year period? Or do you usually focus on your daily challenges exclusively?

- Do you have any information on the digital devices and procedures in your job? Do you know about any digital possibilities which may improve the popularity of your activities, offers and services given to your clients and major corporate partners?

In your opinion are there any digital or innovative devices or technological innovations in this area of the construction industry, which may improve the productivity of a small enterprise? Do you know and do you use any of the latest modern construction materials?

If you fail to look up for the latest digital devices and procedures available, is there any organisation or institute for the family, micro and small enterprises which may call your attention for the importance of this issue?

- In your opinion, regarding subcontracting activities and mending and repairing jobs and services provided for the population, is it possible to fully or partially substitute missing employment with digitization and technological innovation?
- If you know about these innovative digital devices and technologies or in-service trainings, how can you get them? Do you know about any tenders, sources of support or credit schemes which may help you with it?
- Do you know about any services or professional organisations which—considering the size of your enterprise—may provide you specific assistance with writing tenders or give advice about digitization at an affordable price?

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- In your own market, do you wait for such special political or industrial measures which may improve your enterprise's digital transformation? What would help family, micro and small enterprises with this issue?

- On the in-depth interviews performed during the project every country prepared a summary, and on the basis of these summaries there was a large international conference held last year.

Accordingly, we held a large international conference in Budapest on 15-16 October, 2019. At this conference the representatives of the organisations of the V4 countries were present: from the Czech Republic the **Association of Small and Medium-sized Enterprises and Crafts of the Czech Republic (AMSP ČR)**, from Poland the **Malopolska Chamber of Craft and Entrepreneurship in Krakow, (MIRiP)**, from Slovakia the **Slovak Craft Industry Federation (SZZ)**, and from Hungary the Hungarian Association of Craftsmen's Corporations (**IPOSZ**).

Furthermore, the representatives of the **WIFI Österreich**, the **Italian Confartigianato Imprese in Bergamo**, and the **European Builders Confederation, (EBC)** which represented also the **Netherlands Construction Association** were also invited to the conference.

From the Hungarian government, Dr. Adam Nagy deputy state secretary for sectoral strategy and regulation from the Ministry for Innovation and Technology presented the importance of digitization in the Hungarian SME strategy focusing on the construction industry and Gabor Tobias national V4 coordinator from the Ministry for Foreign Affairs and Trade evaluated the role of the V4 economic area with outlook for the construction industry.

Actually, this project is based on the experience of the in-depth interviews, the summaries prepared according to them, and the speeches at the international conference.

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3. Basic issues in the project

Basic issues in the project:

- **Is digitization necessary for small enterprises? If yes, what purposes is it necessary for and what does it help them with?**

The answer has been evident: digitization is necessary. And there is no alternative for it. On the one hand it is caused by the authorities since communication with them takes place on a digital basis, and on the other hand it is caused by the principals themselves as well, because at the moment when they order a service from smaller construction enterprises, they have already been thinking about a certain technology.

At best the smaller enterprise's preparedness and technological facilities are enough, but at worse they are not, which makes smaller enterprises think about new skills to study, new technologies to apply and new materials to use, otherwise they are forced out of the market.

Each enterprise confessed that in the construction industry **digitization has no alternative**. Furthermore, they also clearly stated that **small service operators need at least a sufficient level of digitization**, as because they have neither resources nor workers for implementing digitization larger than their own needs.

Answers clearly reflect that in the construction industry, both traditional and innovative technologies will be used for a long period of time, because of the continuous renovation and maintenance of our constructed environment. Certainly in parallel, the number of newly built flats and offices—which have been built by innovative technologies—keeps growing today, so in the event in the medium term a smaller enterprise intends to participate in these construction projects as a subcontractor, they will have to undergo further professional trainings, adapt relevant innovative technologies and as for work organization they will have to acquire certain digital skills, as well. All of these changes will be required by the market

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which is built on the continuous maintenance of our built heritage. Moreover, it requires that today.

Today information technology is an integral part of the small and middle-sized enterprises. When a small or middle-sized entrepreneur wants to be successful e.g. in the property market, information technology skills and knowledge are pre-conditions for that.

For small and middle-sized enterprises **there are three segments** determined which have a high importance so as to be successful in this market.

One of them is to have digital marketing. What do we think about? Basic things. To have a great **website** which is easily accessible, thus it fosters the number of clients and charges.

Second part of it is **to have the ability to use information technology for providing a quote to a client.** To easily use excel and communicate with the clients.

The third part of these competencies is **to be able to use technology in their own profession at the level of implementation.** While professionals are measuring a possible work area, they should use digital cameras and be able to easily send and receive data—which is actually exact information on their work, e.g. how to assemble something or to download a service manual, etc. Without these digital competencies, today a professional can be successful in few segments only, especially in communication with large enterprises. The key is: speed, which reflects the reaction time, so as to gain market or positive things by having good digital skills, and certainly it reflects how much we would lose in lack of digital skills. That is the point.

Large enterprises should help small and middle-sized enterprises with acquiring these competencies. They must be able to follow digitization platforms. Thus, these platforms are needed to be designed so as to allow the participation of small and large enterprises jointly. This is one the most important possibilities for cooperation.



- **In the field of services and the repairing and fitter jobs, is it possible to substitute humans and their work? And if yes, how should it be possible with the support of digitization, robotics and artificial intelligence?**

The answers reflect such a viewpoint that at the moment it is quite hard to forecast what and how fast will happen or emerge. Today nobody dares to give an answer to it even over a period of 15 years.

However, participants agreed that within a 15-20-year period in the V4 countries in the fields of repairing, fitting and those construction services which meet the needs of the population such break-through of digitization, robotics and artificial intelligence which would completely substitute humans and traditional skilled-work, is yet impossible at the moment.

The implementation of newly digitized technologies may help work, improve work quality and save workforce.

Digitization may improve work organization as well, but it does not substitute skilled-workers at the moment. For example, there are walling robots. It came up whether it is possible to use a walling robot in smaller towns. It is clear that today it is not an alternative to use this robot within such a short period of time. Everybody admitted that **the tendency keeps accelerating progressively**, but the period of time when it first appears in the construction industry on a wider scale is hard to predict.

We would like to emphasize that **this issue is brought up mainly in the area of the repairing, fitting, maintaining services and of those which intend to renovate our built heritage**. However, we must call the attention to the fact that this service sector **has a great importance within the construction industry** and the micro and small enterprises within this service sector give a high proportion of all the construction enterprises.

- **Do statistical surveys and scientific evaluations give full details in this area? Do they describe the realistic situations of micro and small enterprises?**



Certain statistical surveys have shown us that regarding certain digitization and quality issues, Hungary together with the other V4 countries have been deprioritized. **But enterprises we interviewed had a different viewpoint.** They emphasized that a large number of work force drains away because they are able to fulfil their duties also in the more developed labour markets, for example in Austria, Germany and different countries in Western Europe. Actually, they can do their jobs there, as well. Thus, in that repairing and fitting service segment where they work, they have such a huge professional knowledge. This is why the issue is arising, whether statistics give full details and provide a realistic view of the situation or statistical conclusions are drawn mainly according to the experience of middle-sized and large enterprises.

Having a conversation with small enterprises, it was clearly found that generally when skilled-workers hone their craft, they can adapt themselves to the **on-going new technologies much easier, because clients force them to do so.**

Having the opportunity for affording these machines, equipment and software is another topic: **the most cited obstacle is squarely the lack of resources.**

In conclusion, statistics are problematic because in every platform they analyse the SME sector in general. **But this sector is divided into family, self-employed, micro, small and middle-sized enterprises, moreover within micro enterprises, we distinguish enterprises under 5 persons employed and above 5 persons employed, as well.** In Hungary, for example, 30% of GDP is produced by micro enterprises and their role in employment is about 70%. When those statistical analyses are being prepared according to which certain conclusions are drawn in Hungary and Europe as well, **enterprises are not surveyed according to each economic segment and in relation to the GDP,** but they choose 20 large enterprises and 2 small ones. From this moment on, it is clear that **these statistical analyses do not reflect the real economic situation, but a high-tech environment instead, and it is likely that those conclusions are drawn in accordance with them.**

So, one the most important lesson of this project is that in the area of the micro and small enterprises in the V4 countries, construction specialists do not agree with their significant lagging in different areas of their profession.

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It is true that regarding certain **construction materials, technologies and certain areas of digitization the Western-European countries are more developed, but this lagging has mainly financial reasons and it is also due to the lack of organized and effective continuous vocational trainings.**

A lot of small enterprises stated that they do not need much digitization and large investments in technology, because they have so much work as even the daily needs of the population are very hard to fulfil.

- **Does digitization help with the shortage of labour, the lack of expertise, and the management of the present employment situation?**

Every V4 country and the representatives of the organizations of the Western European countries also stated that **there is a shortage of skilled-workers in the construction industry.** It has such an extent that it also has an economic effect, as because they are not able to undertake tasks due to the shortage of skilled-workers.

Every enterprise keeps searching for the solution. So, when the issue is arising, whether digitization and new programmable devices may help with the slope of labour shortages, the answer is **yes.** Nobody questioned that with digitization it would be possible to save workforce. Well, there is an opportunity to act effectively, but the whole problem of labour shortage is impossible to solve only with this issue itself.

It is certain that **digitization and programmable devices require a new kind of knowledge, and there are generations which are fully or partially in lack of it.**

Neither vocational education produces young people who have up-to-date and mobilized knowledge in these areas. Thus, the **quality of both education and continuous vocational trainings in this area play an important role.**

Regarding digitization, the smallest enterprises found difficulties in the fields of administration and communication with the authorities. Here there is a need for practically oriented trainings. According to them there are only few trainings on the new technologies and programming, they mainly talked about trainings for micro and small enterprises.

They referred to the fact that these quick and short trainings used to be and are still provided by large commercial and manufacturing enterprises who distribute machines and products in the market. But recently the number of these trainings

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has been decreasing. We heard such a complaint that a Western country introduced a special technology in a V4 country. For a while it had been providing trainings and spare parts supply, but later on this company left the country. At the moment small enterprises have to wait for the spare parts for weeks. Certainly, the last victim is always the customer, the population.

According to the opinion of both the educational institutions and enterprises **there is only few innovative and good software in the market.** There are technology and computers, but on the contrary, **in schools, we find a shortage of software, and the enterprise software is too difficult and too expensive.**

Small construction enterprises would wish to use **BIM (Building Information Modeling)** but for them only a part of that is necessary, the part which they actually deal with while working. So, they should buy the whole software because there **is not any sub-software in the market which could join the main one.** We do not question BIM, but the lack of a kind of small-scale subversion of that having sub-software specialized in each field of the construction industry.

Almost all V4 partners referred to **the generational aspect of the issue.**

It was unambiguous that **almost everyone uses computers today.** So even the youngest ones. On the contrary significant part of the smallest enterprises has no websites and digital contact information. They say that they do not need it. We had a significant lesson while analysing this issue, **we found a kind of generation gap which may be bridged only with time.** Younger people have better digital skills and preparedness but less professional skills and knowledge. Elder specialists who have great professional knowledge and experience do not want to be or are not able to be digitized. Obviously, this duality is present today.

We received a proposal for **collecting and digitally record the professional experience of the elder specialists.** This way their knowledge may be forwarded to the younger generation. It may be important mainly in the construction industry because the maintenance and renovation work of older buildings as well as the constructional management of heritage buildings require such professional knowledge which is based on older constructional technologies and is hardly manageable with new and innovative technologies. Each country or at least the V4 countries have a great architectural heritage. We are full with

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beautiful old houses and flats which were built several decades ago. They must be kept renovated and maintained.

At all levels, there is a general labour shortage. Within the construction industry, we found no enterprise segments—small or large—which did not complain about the shortage of skilled-workers. They already told us that there are companies where 70% of the staff is over 60 years old, furthermore, the younger people do not intend to come to the construction industry, they are hard to be attracted to this field.

Considering the changeover in this industry, everybody is preparing for a long process based on the mentioned generational problem. It will not be a quick and short switchover completed overnight. This fact may have a high importance, because after **the quick implementation of digital measures we may face with a longer-term problem when applying digitization**, and as for the elder generations, it may happen in the construction industry, as well.

Due to it, the black- and grey economy may increase. We constantly need a lot of information and a lot of training courses which provide a possibility to exercise the knowledge. **It may be one of the most important services provided by professional and employers' organizations, but for it, they need a large support of the state and tenders, larger than they have ever been.**

Every country complained about the high tendency in the migration of skilled workers. Moreover, even German and Austrian colleagues complained about the significant pulling effect of the US on the German labour market. They also said that after some adventurous years a higher number of elder people come home from the US, but higher than 50% of the younger generation stays there. So, the work force issue has not been settled yet.

There is an intention to an increased utilization of migration. **However, in this area there are a lot of educational, linguistic and cultural problems to be solved.**

- **How fast does the construction industry change due to digitization? Do companies want to follow the changes, can they? When there are**



new devices available, is there a possibility to get to know them?
What are the manufacturers' and the distributors' roles?

Here the answer depended on the size of the enterprise.

For example, there was a family enterprise with two persons employed, father and son, and they reported that they have enough work for the coming years. He always studies what the client wants him to do because he always visits the bigger fairs, advertising performances and free shorter-term trainings. At the moment he has a digital problem or he might be involved in servicing he does not want to deal with this issue at all. He is not able and does not intend to fulfil the requirements of the service networks. His opinion is that this time the customers rather take their technology to the service network, and he does well from the basic services he provides to the population. If he has a work which requires programming intervention, he also entrusts a more qualified specialist with that. But they are less than the needs, thus waiting time is longer for the customers. It is a kind of attitude.

Obviously, it is not said by a middle-sized enterprise, where there are 8-15 persons employed, because it intends to be the member of the service network—the subcontractor of various main contractors. Thus, it is forced to be able to communicate with, for example, the main contractor. Today it requires digital skills and knowledge.

To a certain extent, these skills and knowledge are necessary for even skilled workers in the construction industry. Digital technology may be found in various fields of the service sector today. For example, when fitting a water pipe or doing some electrical work, with the help of a camera a skilled worker may be guided by an expert from a distance of 220km. But for it, that worker must know the technology as much as to be able to receive information from the expert located at the other end of the camera, and to use the software installed on smart devices.

Well, situations are different. One thing is sure: the smallest enterprises are the most difficult to involve in digital technology, because they are



willing to deal with this issue until they find a solution for their repairing and fitting problems.

We found problems in brick manufacturing, for example. It is said that bricks manufactured by the highest technology in industrial production under a short period of time, will have permanent deformation with time, resulting constant clearance problems while construction. It is because older technologies used to leave time enough for the drying process of the bricks, but new technologies do not. In the area of both designing and implementation, the use of tablets is spreading in the construction industry. However, **some of the architects were against the use of tablets saying that at the stage of implementation they are not useful at all, and for precise work the whole plan and drawing should be printed on paper.**

Energy changeover in the construction industry is another issue. As the older ones cause environmental pollution and they are expensive, as well, it is evident that the use of new energy resources is a must. Enterprises think that **energy changeover is impossible to be implemented in a shorter period of time.** For example, it is impossible to suspend gas heating by 2025 either in Hungary or in any other country. **And it means that the additional services will be available for at least 20-30 years.** This knowledge should be forwarded to younger people, thus we need those people who can teach them. New gas boilers will need to be programmed and these new problems and demands should meet education and adult training. Everybody agreed that energy changeover is necessary. We know that besides the solar energy, there are various types of energy resources, but the **usage of them will not be a quick process especially in the V4 countries.** **And it means that the majority of construction work will be necessary for us for several decades in the future.**

- Are the present education and continuous vocational training system are suitable for finding a solution for digitization problems in the construction industry? What is the role of digitization in this industry?

Everybody agreed that as for new technologies, **in adult training the shorter-term, effective and targeted job trainings are necessary in order to deliver**



digitization knowledge quickly. We there are only few trainings like that, especially specific trainings.

Partly because there is a shortage of trainers in every V4 countries, and partly because the continuous vocational training of them is not completely resolved and left alone they are not able to follow the latest technologies. Finally, **the number of young workers as well as dual educational institutions keeps decreasing in the construction crafts, moreover, there are not new recruits.**

To attract young people into the construction industry as well as its method is an important social and political issue. **All of the V4 countries mentioned the issue of the large-scale migration of skilled workers.** Secondary education should receive even more attention which is in process in some of the V4 countries, and **economies should be involved in the theoretical and practical education to a higher extent.** It is also under progress in the V4 countries, moreover, **in some countries, e.g. Poland crafts organizations run secondary vocational schools.**

It is also an important issue whether vocational educational materials are able to keep up with the real situation within the profession and to fill it with such contents which are attractive to the younger generation. It became evident that **from the aspect of digitization, problems of the secondary vocational education cannot be separated from the primary education.** In the future digitization and programming skills should be taught at an early age at the level of primary education better than today, thus **at the level of the secondary education there were only its professional aspect which should be acquired by the students.**

At the moment in the construction industry, providing an electronic quote or making a precise measurement for it or even the assessment of the materials necessary seems to be problematic, not to mention its digital visualization. Without these skills and knowledge, it is sure that innovation cannot be followed in the future.

In every V4 country, it is a general opinion that the direct relationship between the educational institutions and the economy must be strengthened at secondary level, as well. It must be applied to the micro and small enterprises, too. But for this communication there are only few possibilities provided by the law.

In the relationship of micro and small enterprises and higher educational institutions there is an even larger gap in the construction industry. However, in



practice, a lot of engineers work in the construction industry, they need to study many practical things while the given assignments because today dual education partly exists in higher education, although **the government intends to do so**. At the moment dual education exists mainly in large enterprises and **only few micro and small enterprises have a relationship with higher educational institutions**.

- **Nowadays within the construction industry, from the aspect of digitization, what is the relationship between large and small enterprises like? What is the experience like about this cooperation?**

So as to understand this cooperation we must introduce the concept of **proptech** in the construction industry. It is a word coming from property technology. Today, in it a large part of the population performs well, because they live in their own properties. In other countries the number of leased properties is much higher. But in the future the concepts of property, technology and digitization will not be separated. It also means that **today a property's complete internal energy supply is an issue related to digitization**, as the lightning, heating, ventilation, water supply system may be controlled digitally in the property. Thus, it means that the additional jobs—such as fitting the water pipes or the ventilation system or the heating system—require programming and digital skills and knowledge. According to this technological process, in the future these jobs will become closer to each other and there will not be sharp contrasts between them anymore. Today large companies which build huge new office blocks and properties take these new technologies into account. This is why **they are interested in having such a micro and small enterprise sector in the background which are essential for them in the implementation, operation, continuous maintenance and repairment of these new technologies**. **Logically, from a certain aspect, these two sectors will have to cooperate in the future even stronger than today**. This general concept may highlight energy, environment protection and water management issues within the construction industry. **These issues might motivate further researches, studies and projects—at least according to the participants of the conference**.

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In the project we presented opinions on the future of the cooperation between large and small enterprises in a 10-year period. But there is a **growing demand on the digitization of properties**. When these buildings are under construction, **there are huge shortages of skilled-workers. These shortages may be alleviated or partly supplement only by digitization**, and it is a huge problem not only in Central Europe but in Hungary, as well.

Half of the world's wealth is in properties. This is the greatest wealth in the world. It is even greater than shares or anything else. It is a safe and slow form of investment for pension funds. Most of the bank loans support properties. It moves very slowly and it seems to be incapable. It is not a liquid asset. It promises a predictable and certain return.

In the construction industry, construction starts with a preparation stage, then there is a designing stage, the construction stage itself, then the utilization, the operation, renovation, sales and then a maintenance stage. **By the conference the operation of large and small enterprises was examined from the aspect of construction, operation and renovation. Small enterprises are involved in these sectors and, in the future, they may have an even greater proportion in that.** At the conference some areas were listed where digitization may have a high importance in the future from the aspect of property problems. For example, there will be available to sell a property online. Selling and buying will be much faster. When a gas boiler goes wrong, the subcontractor will not have to go there to fix it because he can diagnose the case and may help effectively by using suitable software and devices such as a video cam. Digitization supports the work of craftsmen and skilled workers in the case they are willing to use it. They can schedule the different construction stages easier, put them in the right order so they can avoid delays and drop-outs, thus the increase in the prices, as well. **It the stages of designing and construction there have already been those BIM models existing**, it means that there are 3D architectural plans not only for the building but **each construction process: these are 4D, 5D and 6D. 4D is the time factor, 5D is the cost, 6D is the operation.** Our property becomes valuable when every factor contains its digital building model and it works. Actually, it is a kind of virtual reality, and it is very important to have its essential elements. **Process digitization will have a leading role in the stages**

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of construction and operation, there has already been software for it. Actually, it assists construction as well as operation. In the stage of construction, it distributes knowledge, so skilled workers in the working area may not be required to have a professional knowledge. They are enough to be in contact with experts and based on great communication channels and VR glasses, their knowledge may be sent to the worker immediately. Today it completely works. Distribution of knowledge is highly important because 40% of skilled workers' working time are about the measurement for building works of a project. Thus, only 50-60% of his knowledge is actually used. It would be more effective if he was sitting in front of the camera giving instructions. Relevant knowledge may be better used in the case the skilled worker with higher knowledge would give instructions and the one with less knowledge would go to the building area. It would also be a solution for such a labour shortage we are having at the moment. It is worth for thinking about it.

Utilization and sales. With the help of a 3D BIM model of a building it is possible to look around there without building it. It is available in every country. **Today in most cases there are smart flats and houses are built.** Their systems such as heating, shading, entering systems or even lightning may be controlled via mobile phones. These are the IOT sensors which are able to communicate with each other automatically via mobile phones. **Large enterprises have already known it, thus smaller enterprises are also required to know it, as they will have to maintain and repair these systems as the subcontractors, or the repairing parties.**

The most important part of the construction and property related activities is to have data and this data must be used. When selling a huge office building there is the physical part of it, there is the building itself and there is a certain office. Data is on paper, only, no live data is used. Today there is little live data only but in 5-10 years this tendency will change. We will use digital models of the data, instead of building plans on paper lying on the shelves we will use the digital model of the complete house containing its construction and operation stages, as well. Based on this technology a property's past and present may be possible to investigate. It results in even more precise information, thus the property itself will worth more due to that. This will have a high importance in the future.

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What can we expect digitization?

Digitization used to and will have an impact on large and small enterprises. Not only in the construction industry but our whole lives. We must exploit it and benefit from. It will be a great change and we must be prepared for it.

We can see that in several industries the impact of digitization is underestimated. Many companies who did so, started to decline. **But many countries and enterprises who understood this process became winners of the situation.**

4. Dr. Adam Nagy deputy state secretary for sectoral strategy and regulation from the Ministry for Innovation and Technology

The importance of digitization in the Hungarian SME sector—outlook to the construction industry.

The most important thoughts on the issue.

- For the Hungarian government the situations of small and middle-sized enterprises are quite important so it intends to make every effort in order to improve the situation and support our enterprises where necessary.
- The Hungarian government intends to maintain the growth larger than the EU average in the Hungarian economy.
- The unemployment rate has a negligible level of 3%, which means that while in 2010 we experienced huge unemployment in Hungary, since 2018-19 there has been a significant labour shortage.
- However, the situation is almost the same in every V4 countries, they precede us in two aspects, moreover, in respect of the various other aspects EU member states are beating us. **Our country's competitiveness highly depends on the digitization level of the enterprises and companies.** According to the data in 2017, regarding the digitization level of the companies we can state that Hungary is the last on the list of the EU member states. This conclusion has been drawn mainly from the use of the ERP system at a satisfactory level in today's digital world.



- **Everybody can work who intends to do so, but companies are required to make further progress with the level of their digitization as this is the key point of their innovation and thus the whole Hungarian economy.**
- According to the government there is a very strong ground in Hungary based on creativity and which creativity **may be able to show itself in innovation**. Hungarian people should be motivated for and their creativity should be used for **increasing the innovation of the enterprises and make them move towards that**. What may be the key elements? **Obviously, we need a system of innovation and technology with its structure redesigned so as to target the support of innovation**. The education system should also be reformed so as to create a **labour market system**. Practically, the supply-based education system (**of higher and vocational education**) which it was in the past decades **should be transformed to a demand-based system**. It means that the market participants, namely, those enterprises situated in the demand-side who know which specialists they will need in 2-3-5 years **should have the possibility to make a decision on the educational material** as well as the form of education in each institution. **It is important that enterprises' added value should increase, the corporate added value should increase at the level of the national economy, as well.**
- A certain strategy should assign key industries **including construction industry and the economy of construction, certainly**.
- Digital consciousness and the recognition of digital systems is essential because they exist in today's society. **It requires an appropriate digital and communication infrastructure in Hungary**—which is also a requirement towards the government. We should have those systems which **provide communication of digitized technology, the relationship between machines supporting and assisting communication between robots**. **Government has a leading role in this process but the experience of enterprises and international experience is also very important**. This program scheme should be surrounded by such a development policy which is under the responsibility of the government.

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- To that effect, **with the participation of universities, scientists and the representatives of the strongest enterprises** there are such **platforms** where the level of digital preparedness should be made available for the enterprises according to their guidelines. There are four platforms: **1. Digital educational strategy and platform, 2. Industry 4.0 national technology platform, 3. 5G coalition platform, 4. Artificial intelligence coalition platform.** Each of them started their own work.
- What are the challenges? According to the comparison the productivity of the Hungarian enterprises has not reached the average productivity either in the V4 countries or in the EU28. In the V4 region the Hungarian enterprises approached the productivity of both the neighbouring countries and those having a close partnership and economic relationship. **Compared to them the performance of Hungary is around 90-97%.** Meanwhile, compared to the EU, Hungary has been lagging behind. **Aggregated data on the small and middle-sized enterprises show that the level of productivity in Hungary is around 40% of the average EU member states, and it is obviously not a complimentary data to us.** This is the information which shows that despite the favourable economic environment, the increase of digitization and effectiveness in productivity are the most problematic areas. **We urgently need a significant progress.** Regarding productivity, the government identified certain problems within the SME sector and it keeps searching for answers.
- **Knowing the needs of businesses is one of the challenges for the enterprises** and the government keeps trying to satisfy these needs. Simply, it means that a significant part of the enterprises **does not even recognise** the trend they should move toward. This data is based on public surveys among entrepreneurs. Providing information about the requirements of today's innovative world to enterprises in different situations and at different level of development **is actually the government's responsibility.** Obviously, both the associations and organizations for the representation of interests have a leading role in it, moreover, it forms one of the elements of the SME strategy, as well. Enterprises need to be strengthened. It has already been pointed out that **in the areas of innovation and digital technology and entrepreneurship education we experience such a lagging among the**



Hungarian enterprises. The measurements of the strategy require it to do so.

- It is highly important that entrepreneurs **should get to know those latest innovative technologies** which are sector specific and represent the most modern technology in the neighbouring countries and Europe, not to mention the Asian and American regions; which technology belongs to our everyday life. The wider dissemination of these technologies is one of the key tasks for the SME sector, as well.
- **Within Hungary, territorial inequalities should also be managed.**
- It is also highly important that **in this world each enterprise should find their own values, the targets they want to reach. For it they need to prepare their own business strategies and the Hungarian government tries to provide assistance for it: on the one hand, software solutions and mentoring programs and on the other hand, with a sample factory system.** The government intends to provide a funding program, as well. It operates a supply program, a development program, the Industry 4.0 development program as well as programs for developing sector level technologies. Certainly, a part of these programs is financed by the EU, the other part is financed by the Hungarian central budget.
- What special problems do the construction industry and the economy of construction—as one of the focal industries—have? The Ministry for Innovation and Technology, established in 2018, determined the focal industries in Hungary, which have a major strategic importance in Hungary. It contains the automotive industry, the constructional engineering, the agricultural engineering, the food industry, the health economy and the creative industry, as well. Certainly, construction industry also belongs to it.
- **The development of the economy of construction, the construction industry, our working, living and infrastructural environment have an impact on our lifestyles, the quality of our lives and our entrepreneurial activities.**
- **In Hungary we surveyed the volume of orders to be fulfilled by the construction industry between 2018-2023. We found that it is an amount of approximately 25000 billion HUF of orders. 60% of that is for orders of the state and local councils, and approx. 40% of it is for**



orders in the private sector. In 2018 the output of the construction industry did not reach the level, which—as an average for the next 6 years—would make it possible to fulfil the 25000 billion HUF of orders had been forecasted by that time. In 2017, the output in the construction industry was 3400 billion HUF. It means that if we multiply it for the period of 6 years between 2018-2023, it presumes a 21000 billion HUF of output to be fulfilled. The difference between the two numbers gives the impression that under 6 years the construction industry should perform the output of 7 years. Well, at the level of the national economy, this is the essential problem for the construction industry. From the aspect of its fulfilment, we may consider it a problem. Meanwhile, we may consider it a huge challenge, as well, because it means that workers in the construction industry have orders and work enough as the orders of the state, the local councils and the private sector have significantly increased. **Well, the situation has changed.** Some years ago, participants in the construction industry complained about the scarcity of work. **This time there was a significant migration in the construction industry from Hungary. Later on, when the number of the orders regenerated by the support of state and local councils as well as the state level support of the private orders, the sector started to increase again. Enterprises experience a shortage of approx. 50000-100000 skilled workers today, who disappeared from the sector after the economic and financial crisis in 2008.** Which may encourage us is the fact that in the past 3 years the output of the construction industry increased with a total of 80% which indicates the tendency how this sector keeps trying and is able to fulfil the orders.

- Practically, today a huge amount of orders arrives into the construction industry in Hungary. The government tries to compensate it by the **clarification of the timing** for state and local council orders. This helps those construction enterprises which intend to participate in state and local council orders as building contractors, designers or any kind of subcontractor **schedule the huge amount of orders in time. For the participants of the economy of construction, the government aims to create predictable and foreseeable markets as well as a model of a reference database of costs which contains the database of itemized**



costs of past investments. On the basis of it, despite the possible increase in the prices, it may help establish the budget and financial framework for coming investments.

- **The government plans** to boost the productivity of the enterprises by **various aid schemes**. These schemes are available mainly to small and middle-sized enterprises. They started in 2018 and it is the fourth scheme becoming available at the moment. In 2018 the government allocated 16 billion HUF, in 2019 and 2020 12 billion HUF to the SMEs **so as to acquire innovative technologies such as management systems, designing software and those technologies which are able to join the above two via the central budget of Hungary**. Technological change does not include new devices and software only, but having a harmonized structure of them. In order to motivate the technological change, there will be **an innovative platform in the economy of construction** which will be created according to the platforms mentioned above.
- **The new platform aims to prepare a BIM related national strategy. Actually, BIM is not a software or a product sold in a box or a system which is easy to learn!!!** This system **joins** each sector within the construction industry; practically, it **joins the stages of material production, designing, building construction and operation, providing such a base for the entrepreneurs which ensures predictable synchronous designing and building construction works, as well as the evaluation of operation costs yet in the stage of designing.**
- One of the key elements of the **platform of the economy of construction is to be implemented in the education system to be converted**, as well. Innovative information, which is acquired by those enterprises using modern technologies or international companies, should also be introduced in both vocational and higher education systems. Let's drop the idea of a conventional vocational school in construction! We should not think that if we send our children to a secondary school in construction, they will have to stand on a ladder carving the walls by screwdrivers. **In fact, we need to restore the sector's prestige and popularity. We should not associate it with those simple techniques or technology used to teach at schools decades ago, but actually the**



robotised technologies used by BIM as well as larger enterprises. Well, today this knowledge should be transferred to students.

- **The building codes are required to be under continuous amendments and corrections.** Practically, the results reached in the last years at the level of economic growth may be protected by the government with providing Hungarian families and enterprises such **legislation which improves their activities instead of setting them back.** Regarding the construction industry, we should think about **the precise definition of the various circles of responsibilities**, the way of their strengthening and the imaging of their relationship, as well. Namely, these are the responsibilities of the design engineer, the building constructor and the operator.
- In the construction industry **black and grey employment** are very typical. During my presentation I mentioned before that in the construction industry, the **boost of productivity and the presence of skilled-workers are in a very close contact.** We must draw the attention to the fact that **so as to maintain workforce and boost the productivity, it is essential to provide declared work for skilled-workers in the construction industry. Thus, it may be avoided to let those workers move from construction to construction who are a bit better than the average.** Regarding the labour and fiscal measures, the government may be even more attentive to the construction enterprises, however, enterprises need to play an active role in declaring those workers with higher salaries who they employ.
- Within the framework of the aid scheme mentioned above, there are several billion forints transferred to the construction entrepreneurs, determining certain criteria for the participation in the tender, which results in a certain level of gross average wage. **The level of gross average wage in the national economy is indicated in the call and who pays for the contractors under this level of amount, will not be entitled to participate in the scheme.** By this method, the government intends to encourage the enterprises to pay suitable amounts of wage.
- There are two other important issues in the construction industry. **On the one hand it is essential to provide the continuous extraction as well as the appropriate amount of construction materials or raw materials**

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such as gravel and pebbles. There are some areas where, due to **certain regulations—especially for environmental protection or nature conservation**, mining activities are impossible to be completely exploited. In the next months, these obstacles are tried to be compensated by the government with the establishment of a system which complies with all regulations.

On the other hand, the integration of those innovative products which are manufactured by the most modern Hungarian enterprises into the Hungarian construction industry should also be incited. **Actually, neither designers and building constructors, nor operators know about those Hungarian products with national added value, which are manufactured by using innovative technology.** Designers and building constructors should be encouraged to get to know and use these products while the process of construction.

All of these were confirmed by the reports of the representatives of more developed countries invited to the conference.

5. Experience of Western European lecturers

I.

Viewpoint of the European SME organizations in the construction industry
Philip van Nieuwenhuizen, Vice president, EBC (European Builders Confederation)

Within the framework of the project, Mr Philip van Nieuwenhuizen the Vice President of the European Builders Confederation and the Netherlands Construction Association also expressed his views.

The EBC was established in 1990. Mr Nieuwenhuizen referred to the fact that at **the moment 9% of the European enterprises are engaged in the construction industry, it covers 3 million enterprises and 18 million employees. 90% of the employees are males, 10% are females, and 8% of the employees are younger than 25 years old.**

94.1% of this large group of enterprises are micro enterprises having less than 10 persons employed. 5.3% of the group is a small enterprise having 10 to



49 persons employed. 0.5% is a middle-sized enterprise with 50 to 249 persons employed and 0.1% of the group is a large enterprise having over 250 persons employed. **These numbers show that the issue of digitization is impossible to be analysed without the construction industry and without the examination of the situation of micro and small enterprises. Let us remember that a chain is only as strong as its weakest link.** And if we fail to involve this large amount of micro enterprises in the digitization process, then our chain will be broken. At the moment nobody knows about the rapidity of the impacts of digitization on this sector. It is sure that in the interim we should take our time to prepare for it. Thus, from the aspect of digitization, the EBC has a special attention to micro and small enterprises.

Starting from standardization to each area of that, the EBC has a particular attention to the Construction 4.0. But what does 4.0 mean in the construction industry?

- **Appearance of the Internet in the construction industry**
- **Appearance of BIM, thus the spatial modelling and information storage in the construction industry**
- **3D printing, pre-assembled units**
- **Appearance of new materials: nano materials and robotics**
- **Appearance of artificial intelligence, virtual reality (VR), extended reality (XR)**
- **It modernises and makes construction industry attractive cleaning it from the negative visions**
- **Increasing cost efficiency and promotion of the global sustainability of the sector**
- **Decreasing physical exercise so as to make the sector more attractive to the employees**
- **Improving maintenance and management of the building through its complete life cycle**
- **Improving energy efficiency, thus lessening the costs of the buildings while complete maintenance.**
- **Supporting communication and encouraging faith between the downstream operators.**

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But we must make it clear that **digitization is not a target, but an instrument.**

And it should be used only when and to the extent **it is easily accessible and financially affordable for a small enterprise or a craftsman and it really means added value for their activities.**

And what about digitization in Europe?

- In Western Europe more than 1/3 (36%) of the construction industry uses BIM.
- 47% of its users are architectures and 38% of them are engineers. However, only 24% of the building constructors use it, it is important to notice that 68% of them started to use it in the past 3 years.
- 45% of the BIM users declare themselves to be professionals in using it. Nevertheless, it is a questionable factor.

The Vice president, Mr Nieuwenhuizen emphasized that regarding the whole issue, it is such a great challenge and **the path ahead of us will be long.** Challenges particularly have an impact on SMEs because smaller enterprises **have not much turnover and income, thus they are unable to invest a lot of money into digitization.** Certainly, in the case SMEs have higher turnover they supposedly will invest more.

The compatibility has a higher importance in the process of digitization: cheaper and more simple devices should be developed so as to be accessible even for the smallest enterprises as well as to be compatible with other programs used in the area.

The EBC issued a proclamation so as to support the digitization in the construction industry, however, it emphasized that **digitization process should be acceptable to all enterprises including the smallest and the largest ones.** Moreover, they clearly defined the fact that digitization should be available at the lowest levels as well, for example for non-skilled workers so as to improve their abilities to work, and for it, financial resources should be provided. Otherwise, they will not be able to take this challenge.

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Digitization has a leading role in the regulations of occupational and building safety, as well. Both in the Netherlands and Brussels there are such safety precautions which make the entering persons read certain instructions on their mobile phones and they are allowed to enter into the building following a short test and giving their signature.

The EBC conducted courses, especially to SMEs within the framework of the following projects: BIM4Ren, BIM-SPEED, CONDAP, which intend to have user-friendly apps and decrease the costs of their preparation and implementation.

The BIM4Ren develops BIM devices for energy recycling projects at three locations: in San Sebastian, Venice and Paris.

The BIM-SPEED project created an open, cloud-computed BIM platform which is easily accessible, user-friendly and decreases the length of the overall projects. It is going to be tested on 12 buildings.

The DigiPLACE project is a collaboration project with involving the wide range of participants in the construction industry and with the support of the German, Italian and French ministries.

Taking a place in the competent technical committee, the EBC participates in the standardization of the construction digitization.

In the Netherlands every application becomes public and if somebody intends to take part in it, it is required to submit a digital registry. The European Commission requires every process to take place digitally. SMEs in the Netherlands slowly get used to it because its administration tasks are less burdensome and it is faster than personal administration.

Digital devices of **lower prices** or free are also required. There are several very good ones in the Netherlands, which are easy to use and used, as well. Because they are **free and easy to download and install them on smart phones**.

We consider it important that **the level of non-skilled workers and their working abilities should also increase**. The state should invest into it, as well, they also need to be prepared for the digital challenges.

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As for the safety precautions, if a worker enters into his workplace, first he is required to read some instructions. Then, he has to pass a test and sign for it, and finally he is allowed to enter into the building.

The EBC aims to exchange best practices as well as to appear at both international and European levels, and it is a huge challenge. The EBC conducted a course, especially for SMEs. The BIM and The European Committee for Standardization exist and it makes surveys and conducts researches. The EBC has always tried to focus on digitization tasks.

We have mentioned **BIM4Ren** project before. This project is a BIM system for renovation and reconstruction works. It may be easily implemented and for the energy projects there are sample sites in San Sebastian, Venice and Paris. These projects go well and they are very successful and completed by SMEs. The results will be collected by the EBC and will be joined to other projects such as the BIM-SPEED which is an open platform. These projects are to be user-friendly and to shorten the process of realization. We will be able to draw a conclusion on the realization of them with the assistance of the SMEs.

A proclamation, which was released by the EBC so as to build a digital network, was signed by 21 key partners. In it we stated our belief in creating a cooperation chain within the construction industry, which is advantageous for every participant and is going to be the most important political priority within the EU.

An assessment on the impact of digitization on smaller enterprises should also be necessary so as to protect them from the burden of digitization.

Today, the level of technology allows placing sensors onto the buildings so as to gain information on any technological maintenance, for example for boilers or the heating system or when some parts need to be repainted. These technologies have already existed for a while.

Without government measures and interventions digitization will not be effective for the smaller enterprises. For public procurement, governments and decision-makers search for the cheapest solutions. They should improve innovation so it would be advisable to focus on development instead of low prices when awarding contracts. It is a huge challenge.

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Governments should support innovation instead of impede it by the reason of financial incentives.

The EBC highlighted that developing digital innovations in the construction industry, it is essential to have suitable infrastructure, especially **physical infrastructure**, as well.

In Budapest we have such a high-quality infrastructure. In the Netherlands it is also known that the capital city has the highest quality infrastructure. But in some other parts of Europe even internet service is sometimes missing. Today almost everything may in principle be managed by remote controlling but if somebody works next to the Mount Blanc it may not be so simple at all. **Thus, we must focus on this issue, as well.**

The main contractor may do his best for developing digital innovations **but if the subcontractor does not do so, then it will not work.** It is essential to provide information for the SMEs in order to highlight the necessity of their innovation.

The point is that such a **series of video instructions** is necessary which **presents instructions for non-skilled workers for example on safety issues and it also allows them to take examinations with the help of a mobile phone. If they pass the exam, they will receive their certification.** I think that in the Netherlands this concept will be realized in 1 or 2 years in every site. Besides this, **appropriate devices must be provided for both the educational institutions and the trainers.**

These are technical systems of the highest technologies which have been developed by the largest enterprises, the IT companies. But we also have to mention that all of these can work only when SMEs are able to use it and communication between these technical systems are worked-out by them. Hence, they may be accessible and understandable for the SMEs.

II.

Experience in the digitization of SMEs in the Italian construction industry

Andrea Dolci, Head of department, Internationalisation and Competitiveness, Confartigianato Bergamo

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Lombardy has one of the strongest economies among the administrative regions in Italy. In this region the strongest crafts organization is the Confartigianato. Its representative from Bergamo—who has 14000 member companies—participated in the project and introduced digitization in the construction industry in Italy. More than 50% of their member companies are involved in the construction industry. The main findings are the following:

According to the Italian viewpoint, regarding the Digital Index Italy is a little bit less developed than Hungary. Considering the 27 member states, Italy is situated at a lower level of development in Europe.

For digitization, large enterprises and SMEs have different reactions. Large companies have the possibility to digitize processes as well as they operate a production network or production chain which allows them to cover larger areas. But **as for the SMEs**, regarding digitization there is a lower level of intervention and they have **a smaller area** to focus on but to reach the same effect. This is why it must be highlighted that **for the SMEs it is important to recruit and train those younger people who will be able to support them later in the digitization process of the company.**

Digitization helps involve a high number of younger people. Italy has a lot to do in order to reach the appropriate level of digitization in the SME sector, thus, **from this aspect Italy is at the same level as the V4 countries.** According to the Italian statistical office **digitization is a problem for 80% of the Italian enterprises.**

In order to make the enterprises implement digitization at a broad scale, they need **some motivation.** **Without state intervention the SMEs will not turn towards digitization. The construction industry is a highly important sector and so as to let digitization start, it needs a new state strategy for that. This is particularly true because a significant part of the construction sector is run by the state, thus the state will spend on it.**

Overall, Italian enterprises are on the websites: 79.5% of them have a website, 73.6% use the social media and 16.4% sell its products via its website.

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Particularly **the construction industry faces with the most difficulties** regarding online availability and having a website. These enterprises have not considered websites important because nothing motivated them to do so. Now that social media has helped to point out the importance of online availability, **40% of the SMEs use these social media interfaces, however, the online availability of the construction industry is in a smaller proportion than other enterprises.**

In Bergamo, 51% of the SMEs are active in the construction industry. Every enterprise knows that so as to be successful, they are required to reach a certain level of digitization. And as for the construction industry, **the state, itself created two compulsory and free platforms:**

In the plumbing and heating sectors, the Italian national and regional laws require the use of at least 2 different public online FREE platforms:

-**Curit:** it's the regional database where information about every thermal plant in Lombardy is collected. Any intervention, service or maintenance is notified through the website or, in many cases, through the use of third-party software developed to send information to the public database.

-**Fgas.it:** any business working with fluorinated gases is contained in this database. Every time they install, modify or dismantle plants of fluorinated gases, they must have an access to the platform and communicate the information required by the law.

Plumbers, heating workers and electricians are required to use modern devices and software so as to perform their job correctly.

Thanks to tablets, smartphones and dedicated apps, it is possible to solve many problems even more efficiently.

Digitization requires to invest time and money in devices and training. Companies should also understand that at the beginning there will be some issues/errors.

However, after this first period, reducing the time of the intervention and having a warehouse organized and always ready to use, the business will be even more efficient.



These are free platforms. Via them enterprises receive important information which will be collected. Every time there is a work for a plumber, **he should be notified via these platforms with the usage of software provided by a third party.**

At the same time, it is also important to mention that each website which cooperates with a certain enterprise has an access to the platform, thus any kind of intervention is possible. **This way the government forces the enterprises to access these platforms and provide information (data) to them, since today it is impossible to operate a company without these platforms.** Plumbers are required to use such devices as tablets or smartphones, which improve the efficiency and quality of services.

Following the first period full with difficulties, it seemed to be a very important step because with it an even more effective company was created—**as a great amount of money was invested and even a training was organised.**

For example, despite they are not obliged to work with state websites, for plumbers and heating repairmen the government introduced a free software, which forced every enterprise to log in, **it means that they have to be registered on these platforms.** Otherwise, they are not able to work and cooperate with other enterprises.

The **organization in Bergamo** supports this process by **giving advice.** From the aspect of digitization, it generally provides information on the use of the state platforms as well as modern technology, social media or **filling in forms for the availability of certain services.**

If construction enterprises did not want to use digitization, as **because of the new regulations and compulsory platforms they would be forced to do so, thus their attitude changes and they turn towards digitization.**

Digitization is also one of the preconditions for the access to financial resources. There are resources especially for the SMEs in Italy, but this time it is not about larger enterprises. **Industry 4.0 used to focus on larger enterprises. This time the new law is rather for smaller enterprises and it aims to realize digitization in every sector of the Italian economy. It also proves that smaller enterprises represent real economic strength within Italy.**



These steps of the strategy are mainly free improving the local businesses. For example, in the region of Lombardy, where the organization in Bergamo is located, there are two types of solutions as well: **one of them originates from the province itself and the other is offered by the ministry of economic development.**

Every local chamber prepared a program by which they support the SME sector, moreover, **they conduct digitization trainings and they estimate the level of digitization for the enterprises. Thus, there is a certain technology cluster, a kind of group of businesses, where the different business organizations, the local chamber of commerce and the professional organisations together provide education and support for the SMEs so as to help them realize innovative investments, while providing access to both private and state funds. They also provide them information on digitization, as well.**

Together with professional organizations the chambers of commerce established those so-called competence centres which have brought **universities and Italian enterprises—especially SMEs into contact with each other.** This is very important for the SMEs because this relationship ensures the technological development for them in the future. **Within the framework of Enterprise 4.0, these universities support the SMEs’ experimental activities with new technologies, and actually, the various activities are coordinated by these competence centres located in different cities which also cooperate with several other European countries.**

Confartigianato in Bergamo is a regional organization. Its representative introduced the areas—including digitization as well—where such a regional or local organization may provide support to its member companies:

- **Consultancy** in relation to digitization
- **Conducting trainings on the use of public state websites**
- If requested, **assisting its member companies in the correspondence with state authorities**
- **Calling the attention of construction enterprises for the advantages of using the Internet**

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- Conducting seminars, meetings and **exhibitions on technology and innovative devices**
- **Evaluation of the level of digital competence of the enterprises**
- Assisting the digitization of local enterprises via variable special support schemes (e.g. via **digital voucher**)

These competence centres which have relationships with universities and various research centres as well, have a very important role because **besides conducting trainings, they also introduce new technologies and devices.**

The Industry 4.0, started in 2017, has been renamed to **Enterprise 4.0** so as to make it easier to **involve the complete SME sector including the smaller enterprises** in the digital technological renewal as well the distribution of digital knowledge. And competence centres are important fields for this activity.

One of the most important local measures is called the **Digital Voucher**. It supports training programs and consultancy services for enterprises **taking 50% of the costs over up to 15000 euros. A certain part of this financial support may be used for purchasing hardware and software!!!!**

At county-level, there is a certain support scheme which improves the establishment of optimal production conditions as well as the boost of efficiency in water and electricity supply systems, and waste disposal. It is also a financial support scheme, a voucher up to 30000 euros, which covers 40% of the costs. Well, it is not an application, but a support scheme which is available for everybody who meet the requirements!!!!

Besides, there is a certain support scheme at the state level, as well. **It is called the Innovation Manager Voucher managed by the Ministry for Economy which intends to assist the strategy of Enterprise 4.0. It is also a financial support scheme up to 40000 euros, which covers up to 50% of the costs. It provides a possibility for micro, small and middle-sized enterprises to use an external expertise in the digitization of their business processes. It also gives a helping hand in technological innovation as well as digital marketing activities for 9 months.** So, it is not about purchasing technology but using an expert so as to increase the level of digitization!!!!

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Besides, the organization in Bergamo provides its member companies help with the various state and EU tenders and inform them on support schemes.

It has also been highlighted by the organization in Bergamo that **Italian enterprises face with almost the same problems as the V4 countries.**

Digitization strategy is impossible to be worked out without the support of the government, although, it is also wrong when this strategy is worked out by the government exclusively. Small sectoral organizations, especially in the construction industry, will greatly help the government with the digital strategy by introducing the new plans and concepts for the infrastructure.

It is an important fact that **administrative burdens are very heavy and the enterprises have to do a lot of paperwork.** So, it would be quite important to make administration available in the internet. **Certainly, the government can improve its level of digitization, but it is important that it should decrease workload as well. The government should be aware of the fact that small enterprises do everything on their own so they do not waste too much time on administration work instead of working!!!!**

III.

Experience in the digitization of Austrian SMEs in the construction industry

Austrian experience has been summarized by **Mag. Claudia Scarimbolo, Head of Department of WIFI SME Support Centre.**

Representing the Austrian opinion, Mag. Claudia Scarimbolo considered this V4 project very useful and urged to have more international discussion panels **so as to share experience on digitization.**

After attending several international conferences, Austrian specialists have drawn the conclusion that **from the aspects of digitization and technological innovation for the SMEs the future will be unpredictable and difficult.** Thus, before 2017 heads of the economic chambers of the 9 Austrian provinces came together to analyse the situation and decide what to do.



For this reason, in 2017-18 they worked out and implemented a program so as to support the enterprises' digital transformation. The program's background and targets are:

- Large enterprises have already been involved in the Industry 4.0 so they do not need the support of the economic chamber. They have their own specific departments where they carry out researches, they have access to financial resources, and their specialists are young who establish start-ups with the support of the multinational company itself. Meanwhile, as for the SMEs, **similarly to other countries, also in Austria 95% of the enterprises is an SME, who usually takes less proactive activities in the area of digitization.** They suffer from the **lack of information** and the **lack of consciousness**. They do not know about their possibilities and challenges. **Also, in Austria a lot of SMEs say that they do not have time for new solutions because they have to work:** they have to deal with the marketing, the measures, the implementation and the construction works on their own.
- With this background given, the economic chambers sat down with the Federal Ministry Republic of Austria Digital and Economic Affairs and based on the German model, they received 6.7 million euros so as to implement a program **on the digital evaluation and support of the SMEs** www.kmudigital.at. Austrian experts pointed out that within the framework of the program, in Germany 80 million euros were given and as because Austria is 10 times smaller than Germany, thus 1/10 of the original amount should be used for those purposes mentioned.
- The program itself included **4 steps**. The **first step** was to implement an **online data collection** among the enterprises, emphasizing its optional feature. Huge amount of data had been collected because **the second step was to conduct a free workshop with the participation of mentors**. It was a half-day training where a high number of enterprises participated. This workshop introduced the current situation and the opportunities for further progress. **As the third step**, there was a **consultancy service** organized for enterprises and 50% of its cost was covered up to 1000 euros. **The fourth step** was to **conduct trainings** for the enterprises and 50% of its costs were covered up to 1000 euros.



The topics which the enterprises had to deal with within the digitization were determined by cards. There were 50 cards and each enterprise had to choose 6 ones in which they were interested. The cards included issues such as the BIM. In the workshops, enterprises characterized their level of engagement in the issues chosen as well as the next steps to be done and their goals in digitization.

The program finished in October 2018 because financial resources exhausted. Within the program there were **3438 enterprises evaluated and supported**, of which **10.24% were located in the construction industry**. **The issues, in which these enterprises were interested in relation to digitization**, were also studied. **31% of them considered digitization important in marketing and customer relations. 25% of them chose the optimization of their services and products. 22% of them consider digitization important in the improvement of their processes and procedures, and only 11% thought about a new business model and a new value chain. 10% of the enterprises consider digitization highly important in the improvement of the cooperation between the employees and the management.** It should be noted that the sizes of the enterprises, namely the dispersion of micro and small enterprises. According to the data we can see that mostly the small enterprises of grater size were involved in the project.

Risks of digitization have also been surveyed. **According to 38%, data protection seemed to be the highest risk!!!!** If for an enterprise digitization exceeds a certain level and its safety is not guaranteed, then competitors may take the clients, as well as developments and potential orders of the enterprise.

According to a lot of viewpoints **(90%) digitization is necessary and there should be something to do, but later on only a small part of it is willing to anything. 93% of the people think that digitization will have an effect on every process. So, micro and other enterprises also agree with that. At the same time, only 22% plans to do something with the micro enterprises.**

Training and the development of digital skills are highly important, as because:

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- 1/3 of the SMEs thought that digital competence of their employees is enough
- At approx. 20% of the enterprises, employees refuse on-the job trainings
- 15% of the entrepreneurs feel their digital competence appropriate, but it also means that 85% of them feel the lack of that, at the same time.

According to a study conducted in 2016 by the OECD, in Austria due to automation, there will be a great change in 40% of the jobs and 12% of workplaces will get into a serious danger.

In Austria these skills profiles are expected to change in the next 10 years. **For example, the importance of physical and manual skills will decline from 32% to 25%. At the same time, demand on interpersonal task performance as well as social skills will increase, moreover digital knowledge will become more and more important.**

According to the expertise involved in the digitization project, as for the support of digital competences **the main issues** are:

- continuous vocational training of the employees (according to 78%)
- Investing in new software
- Strengthening internal innovation
- Modernising digital infrastructure
- Establishing a more modern background for the employees
- Harmonized development of the task performance within the enterprise.

These statistics clearly show that a significant part of the surveyed enterprises had more than 10 persons employed, as only they asked for advice voluntarily.

We found the reactions of the enterprises given for the digital transformation similar to a pyramid. The lowest layer clearly refuses digitization. The next layer is very thick, they are very concerned about digitization processes. The next layer is smaller, it is the group of those enterprises who became curious about it and are willing to join. Then comes the last and smallest layer, the group of those who are able to adapt themselves to digitization easily and is ready to use it for many purposes.



The preparation and the implementation of this project has proven that first, we need to have an idea or a concept, then we should get into contact with the government asking it for help. The governments are obliged to report their actual activities related to digitization to the European Commission. Ideas originate from platforms, international meetings, national communication panels where viewpoints, opinions and experience may be discussed and where there are micro and small enterprises as well as their representative organizations in the same proportion.

Conclusions

- None of the enterprises disputes the importance of digitization, although **every section within the construction industry interprets the issue differently and different things are important to them, as well.**
- Regarding the number of persons employed, construction enterprises are like a pyramid. The lowest layer is the widest where the most enterprises are located. They agree with digital transformation only **to the extent it is necessary and sufficient** for them, or they completely refuse it.
- There are three things necessary for the digitization: **information, training and above all financial resources.** The smaller the enterprise is, the less of these factors it holds.
- Also, from the aspect of the SME sector, the importance of national digital strategies and the government itself is increasing. **Smaller enterprises must be involved and a special strategy for micro enterprises must be carried out for them, as well.** It is necessary because when defining the aspects of digitization, strategies deal with mainly the latest technologies and the largest enterprises capable of exporting as well as the largest investments. **Meanwhile, most of our buildings are the parts of our built heritage, thus their repairment and maintenance work as well as the services provided to the population should be fulfilled by family, micro and few small**



enterprises located at the lowest level of the pyramid. For them the aspects of digitization are different.

- The needs of the population as well as the maintenance of their subcontractor positions force smaller enterprises to keep up with the innovation of digital technology. **For this reason, for small enterprises located in the construction industry, it is highly important to establish such platforms and competence centres, which focus on their needs and introduce them technology which appears within the sector.**
- In the project several Western European countries proved that the acknowledgement of it is higher than in the V4 countries.
- Without state intervention and greater support, the advantage of the more developed countries will increase within the area, because they have already taken a lot of steps even towards the smaller enterprises. Besides chambers, organizations of micro, small and middle-sized enterprises have also been involved in the decision-making process.
- **There is a need for conducting more surveys in the sector of micro enterprises as well as statistics on the lowest level of the pyramid.**
- **There is a need for extending the range of services in the field of digitization, particularly in the sector of micro enterprises and in this process both chambers and professional organizations should be involved.**
- As for the services, **training, information, the decrease of bureaucracy, the introduction of new technologies, strengthening digital safety, and wider consultancy services are the most important.**
- Most of the small enterprises use digital technology only to the extent it is necessary and sufficient for them. They do not have financial resources to invest, they are fully overburdened by their service providing activities and they suffer from the shortage of skilled workers. This is why it is quite hard to motivate them. They are aware of the importance of digitization but they are less engaged in it. So, finding the appropriate way for motivation is key important.
- **For small construction enterprises, digitization is a longer-term problem full with the difficulties of generation gaps.**
- For the self-employed, micro and small enterprises, it would be useful to establish such competence centres, where **this entrepreneurial class**

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would be able to develop integral relationships with the secondary vocational education as well as universities. There is a need for developing cheaper software which can join huge BIM systems.

- The sector of micro and small enterprises is quite an innovative sector, under the pressure of retail services provided to the population, it intends to deal with new technologies. This is why, compared to the Western European standards, their professional lagging is not significant within the construction industry, because they are able to integrate into foreign markets easily where they perform well. They have so much work thus they intend to use digital technology only to the extent it is necessary and sufficient for them.
- **There is no alternative to the cooperation of small and large enterprises in the future.**

I would like to express my appreciation for those organizations and their members and colleagues who contributed to the implementation of this project by providing information and support.

This study had been conducted in accordance with information collected before the outbreak of the pandemic.