MONITORING PROGRESS IN NATIONAL INITIATIVES ON DIGITISING INDUSTRY

Country report

Hungary

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Summary

Hungary ranks 23rd out of the 28 EU Member States in the 2018 DESI ranking after having progressed at an average pace over the last few years. Regarding connectivity, Hungary has a wide availability and a high take-up of fast and ultrafast broadband. However, half of its population does not possess the basic digital skills and there is a low number of STEM (science, technology and mathematics) graduates leading to a low score in human capital.

In 2017, the Hungarian economic growth accelerated again with a 3.8% GDP growth in the first three quarters of the year and reflects a continuous convergence of the Hungarian economy to the EU average. The main sectors in Hungary are automotive, electronics industry, pharmaceuticals & medical technology, ICT and food industry. Besides, the Hungarian economy is characterised by a high number of small and medium sized enterprises (SMEs). For small, especially for micro, family companies, digitalisation is rather challenging as they have less capital to invest and have a different approach to management.

Being aware of the challenges and the changing economy in the EU, the Hungarian government and industry associations, together with stakeholders from the academy, have launched a number of initiatives in the last few years. Hungary has also developed several strategies and action plans as well as an overall umbrella program for digitalisation, which indicates that digitalisation in Hungary is an important priority. The proactive approach of stakeholders outside the government shows that there is a real demand from the industry to engage in digital transformation.

Beside joint collaboration with other EU countries (Pillar 1 of the Digitising European Industry DEI), national initiatives along the different DEI pillars brought high hopes in Hungary. The initiatives altogether cover all pillars of the Digitising European Industry (DEI) initiative, particularly Pillar 2, 3 and 5. The overall funding of initiatives and support mechanisms is estimated to be around EUR 262.38 million. The Industry 4.0 National Technology Platform looks at future-related issues in the areas of digitalisation (Pillar 3 of the DEI) whereas the Model Factory Program aims to assist SMEs in their digital transformation (Pillars 2 and 3 of the DEI). Under Pillar 2 and 3, initiatives are estimated to cover a funding around EUR 26.11 million. The Digital Success programme with the Coordination Centres and selcted mentors is aiming to tackle the digital skillgap in Hungary and it is supporting Pillar 5 of the DEI. Here, the INPUT Porgram is specificially targeting startups in the ICT sector. For Pillar 5. it is estimated that a minimum of EUR 17,373,622 EU funding (ERDF) is allocated. Pillar 4 is covered by a number of Working Groups, among them Industry 4.0 Working Groups, the Artificial Intelligence Coalition and the FinTech Innovation Hub.These are supported by innovation vouchers for micro companies and SMEs, as well as a large pool of specific initiatives such as the Modern Enterprises' Programme, and the Incubator Investment from Hiventures.

The interviewed public authorities and associations do not feel that Hungary is lagging too much behind in digitisation, they rather perceive the country to be in a mid-range position in the EU. The data regulation in Hungary was considered to be pioneering 5-6 years ago. Since then however, a new regulatory environment should reflect the latest changes in the economy. The lack of ICT and engineering professionals together with the weak foreign language and management skills are expected to slow future innovation.

Table 1 below presents an overview of the main initiatives identified in Hungary, that will be further detailed in this report. Table 2 presents a short SWOT analysis of the Hungarian economy on digitalisation.

Table 1: Overview of initiatives in Hungary

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Industry 4.0 Development Strategy	2016	Sectoral Strategy	Sectoral Strategy	Industry	All	Mainly SMEs	Direct budget of EUR 4,629,344 to support SMEs. Additional EUR 12,344,917 allocated specifically to increase capacity
Digital Success Progr	2016	Umbrella program	Umbrella program	All	All	Mainly SMEs	EU funds (ERDF, ESF), loan and venture capital program, tax cuts,
Irinyi Plan	2016	Action Plan	Action Plan	green economy food industry vehicle production mechanical engineering pharmaceutical industry healthcare ICT tourism defence industry	All	Mainly SMEs	EU funds (ERDF, ESF) + national resources
National Smart Specialisation Strategy	2014	General Strategy	General Strategy	All	All	All	There is no independent funding allocated, it is linked to specific strategies.
Industry 4.0 National Technology Platform	2016	Pillar 3	Digital Platform	All	All	Mainly SMEs	Membership fees
"Model Factory" Program	2017	Pillar 2	Fablab	All	Production visualisation Supply chain visualisation	Mainly SMEs	National funding EUR 7,315,273 (June 2017 – Dec 2019)

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
					Supply chain collaboration Supply chain optimisation Predictive maintenance Big data Internet of things Modern warehouse and logistical solutions Robotics Augmented Reality 3D printing		
DIH Network	2017	Pillar 2	Digital Network	All	FinTech	Mainly SMEs	EU funding (ERDF and ESF)
Modern Enterprises' Programme	2016	Pillar 3	Comprehensive digital economy development program	All	All	Micro companies, SMEs	Split between EU and national funding (18.8 million EUR)

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Industry 4.0 Working Groups	2016	Pillar 4	Working Groups	ICT Transport Manufacturing	All	Mainly SMEs	N/A
Coalition for Artificial Intelligence	2018	Pillar 4	Working group/ Coalition	ICT Industry	AI	Mainly SMEs	N/A
FinTech Innovation Hub	2017	Pillar 4	Working group / Coalition	FinTech	FinTech	Mainly SMEs	N/A
Digital Success Coordination Centre	2017	Pillar 5	Coordination Centre	All	N/A	Mainly inhabitants, few SMEs	Split between EU and national funding
Digital Success Mentor Program	2017	Pillar 5	Training program	All	N/A	Mainly inhabitants, few SMEs	Split between EU and national funding
Digital Workforce Program	2017	Pillar 5	Training program	All	N/A	Mainly SMEs	Split between EU and national funding
INPUT Porgram	2016	Pillar 5	Training program	ICT	All	SMEs	EUR 17,373,622 EU funding (ERDF) and national budget

Initiatives	Starting year	Overall strategy/DEI Pillar/support mechanism	Type of initiative	Sectors targeted	Digital technologies targeted	Size of companies targeted	Budget
Innovation Vouchers	2016	Support mechanism	Innovation Vouchers	RDI	All	Micro companies, SMEs	EUR 190.5 million
Hiventures Plc. – Incubator Investment Construction	N/A	Support mechanism	Incubator Construction	RDI	All	Micro companies, SMEs	EUR 28,391,735

Table 2: SWOT of Hungary on digitalisation

Strengths:	Weaknesses:
- Strong entrepreneurial culture: in 2017, the share of people saying that they would set up a new business or take over an existing one if they had the means to do so has risen significantly - Favourable investment climate with low tax rates and easy access to loans create incentives for both domestic and international ICT enterprises to invest in the country - Both governmental and industry involvement in designing and coordinating initiatives - High interest of industry stakeholders in digitalisation	- Most of the Hungarian SME's have not yet recognised the business potential involved in the digitalization - Lack of ICT professionals - Weak management skills of SMEs - Weak language skills, particularly in English - Low level of understanding of initiatives available for SMEs
Opportunities:	**Threats**:
- Increasing value of investments and access to finance and entrepreneurial culture - Supportive tax policy: 25% of investments into start-ups can be reimbursed - Digitalisation could help SMEs in all areas to become more competitive - Cooperation and strong network between government, academy and industry stakeholders could result in complex, interdisciplinary solutions that address the issues of SMEs - Creating strong networks to leverage digitalisation with the V4 countries	- An out-of-date regulatory framework that could affect innovation and entrepreneurialism - Fragmented innovation system - Widening digital skill gap - There will not be enough (EU and national budget) resources for the development of the digitalisation of the Hungarian industry

1 General context

The objective of this report is to analyse the current status of national initiatives on digitising industry in Hungary. The analysis has been conducted against the background of the Digitising European Industry (DEI), which was the first industry-focused initiative of the Digital Single Market launched by the European Commission in 2016.

Similar country reports will be produced for each of the 28 EU Member States. These national reports allow to:

- Monitor the development of national initiatives on digitising industry;
- Compare different national approaches; and
- Identify best practices of national initiatives.

Monitoring and reporting on the development of the existing national initiatives is an important element of the DEI initiative, and this report should be seen as one part of it.

For more details about the DEI and our methodological approach for the country report, please consult the document attached.

1.1 Economic context and status on digitisation

General economic context

The Hungarian economy has been continuously growing since 2013. In 2014, the Hungarian economy expanded by 4.2%, which was followed by a rate of 3.4% in 2015 and – due to the cyclical nature of EU fund absorption – by 2.2% in 2016. In 2017, the Hungarian economic growth accelerated again with a 3.8% GDP growth in the first three quarters of the year. This growth rate was above the EU average, indicating a continuous convergence of the Hungarian economy to the EU average. Based on the current data from the third quarter of 2017, the Hungarian economy showed the eighth and, compared to the first quarter of 2013, the fifth fastest growth in the EU.[1]

According to the OECD, economic growth in Hungary will gradually slowdown in the next two years as capacity constraints tighten. As a result, domestic demand will be increasingly met by imports. Private consumption will continue to benefit from surging real incomes, while business investment will expand to meet rising capacity pressures. Housing construction will slow in response to the re-introduction of VAT on new dwellings from 2023. New industrial capacity coming on-stream will support exports, but rising unit-labour costs will decrease market-share gains and export market growth will slowdown.[2]

As for the main economic sectors in Hungary, automotive, electronics industry, pharmaceuticals & medical technology, ICT and food industry contribute the most the GDP. The automotive sector is one of Hungary's core industries and generates almost 21% of total exports. More than 600 companies employing a total of 100,000 people are active in the sector. The electronics industry is accounting for 22% of total Hungarian manufacturing production. Hungary's pharmaceutical industry with its century-long tradition directly employs approximately 15,000 people. The ICT sector accounts for 10% of total Hungarian GDP and it employs more than 100,000 people. Covering telecommunications, IT outsourcing, IT services, and software and hardware production, the Hungarian ICT market has grown fast in the last couple of years and leads the region in computer assembly and communications equipment manufacturing. Although its share in the output of Hungarian industry has decreased over the past decade, the food processing industry still remains one of the most important sub-sectors of the economy. The food industry employed 124,000 in 2011.[3]

Status of digitisation

According to the 2018 DESI Report, Hungary ranks 23rd out of the 28 EU Member States after having progressed at an average pace over the last few years (see Figure 1). Regarding connectivity, Hungary has a wide availability and a high take-up of fast and ultrafast broadband. However, half of its population does not possess the basic digital skills and there is a low number of STEM (science, technology and mathematics) graduates leading to a low score in human capital.[4]

Figure 1: Hungary in the DESI ranking (2018)

	Hungary		Cluster	EU
	rank	score	score	score
DESI 2018	23	46.5	43.5	54.0
DESI 2017	22	44.2	40.4	50.8

Source: DESI 2018 Country report - Hungary

The digital economy provides direct or indirect jobs to 400,000 people and accounts for more than 20% of the GDP.[5] For a number of years, Hungary has ranked among the top performers in Central and Eastern Europe (CEE) in the area of IT spending per capita, reaching EUR 260.2 in 2016. Companies and public institutions in Hungary are closing the gap on their counterparts in most developed EU markets in terms of IT development, with the share of ICT spending as part of GDP increasing to 4.3% in 2016 – among the highest in CEE. The Hungarian IT market represents 7.4% of the total CEE IT market and is the fourth largest in Central Europe. According to the International Data Corporation (IDC), the Hungarian IT market has proven to be quite resilient to the recent global and local economic downturn. Between 2009 and 2016, it increased by 38%, reaching EUR 2.83 billion in 2016. Infrastructure accounted for 50.2% of the total market, while the software segment accounted for 21.8%, and services made up the remaining 28%. The Hungarian IT market is expected to expand at a compound annual growth rate (CAGR) of 3.1% between 2017 and 2021, with a peaking growth in the beginning of the forecast period.[6]

Although there is overall a favourable economic environment, Hungary is lagging behind the EU average in terms of digitisation.[7] However, based on the feedback from stakeholders, Hungarians perceive themselves to be in the mid-range among the EU Member States. There is a general awareness of not being at the forefront of digital development, but they do not perceive themselves as a country with weak capacities. An important element is that most of the companies in Hungary are not only SMEs, but small, family businesses. The bigger, international companies that are present in Hungary, need less support to digitise their production, whereas a micro or small company has different perspectives. Because of weak management skills to plan long-term and to leverage the available digital tools, many companies did not plan to digitise themselves so far. Also, for small companies it is more challenging to make major investment that will only bring its benefits years later. To tackle these issues, Hungary will need to address its digital skill shortage and encourage, as well as provide support to small companies to digitise their processes and trigger an overall change in the mindset of people at management level.[8]

This will be a challenge for the country, as according to the Digital Transformation Enablers' Index (DTEI) that provides a ranking for Member States based on the assumption that infrastructure, access to finance, and the demand and supply of skills are the most important factors driving digital transformation, Hungary is among the countries that rank the lowest. Looking at the digital technology integration index, the situation is similar.

As regards Hungary's readiness for future production, the assessment carried out by the World Economic Forum in 2018 scores Hungary with 5.3 out of 10 for drivers of production and 7.0 out of 10 for the structure of production. A breakdown of drivers is provided in the figure below:

Figure 2: Hungary's readiness for future production

Drivers of Production			5.3
Driver	Weighting	Rank	Score /10
Technology & Innovation	20%	49th	4.4
Human Capital	20%	42nd	5.5
Global Trade & Investment	20%	44th	5.6
Institutional Framework	20%	44th	5.7
Sustainable Resources	5%	12th	8.0
Demand Environment	15%	59th	4.5

Structure of Production			7.0
Structure	Weighting	Rank	Score /10
Complexity	60%	14th	8.0
Scale	40%	26th	5.3

Source: World Economic Forum, Readiness for the Future Production Report 2018

The table below summarises some of the economic and digital indicators for Hungary.

Table 3: General economic and digital indicators for Hungary

	% GDP from manufacturing	% GDP growth	DESI position – and change	DESI sub-indicators Human Capital, Use of Internet, Integration of Digital Technology
Hungary	26.4% (2017)	4.1 % in 2017	23rd in 2018 22nd in 2017	• Human Capital: 21st in 2018, 18th in 2017 • Use of Internet Services: 12th in 2018, 12th in 2017 • Integration of Digital Technology: 25th in 2018, 24th in 2017

1.2 National strategies on digitising industry

The table below presents the main national strategies and umbrella programmes as well as their characteristics.

Table 4: Overview of national strategies on digitalisation

Name	Industry 4.0 Industry Development Strategy	Digital Success Program	Irinyi Plan
Type	Strategy of the Industry 4.0 Platform	Umbrella program	Action Plan
Starting date	May 2016	Officially launched in 2015, really started at the end of 2016/beginning of 2017	February 2016
Objective	Main objectives: • Enhance the flow of information, cooperation and the establishment of partnerships between all economic stakeholders • Accelerate innovation, with particular focus on digitisation and key areas of production, in particular cybersecurity • The digitalisation of the industry based on intelligent tools (e.g. in accordance with the goals set out in the Irinyi Plan – see beside) Further goals: • Strengthen domestic digitised production • Define the needs of digitisation, • Dissemination of professional culture and methods • Professional quality assurance of the process of transformation	• Make everyone become a digitisation winner; • Reduce the digital divide of society; • Turn Budapest into a start-up centre	• Accelerate innovation, with particular focus on digitisation and key areas of production, in particular cyber security • Contribution of industrial production to GDP of 30% by 2020 • Innovation-driven economy • Improve the competitiveness of SMEs
Ministry/ministries in charge (website, contact person)	Ministry for Innovation and Technology The Institute for Computer Science and Automation as part of the Hungarian Academy of Sciences (SZTAKI) https://www.i40platform.hu/	Ministry for Innovation and Technology https://digitalisjoletprogram.hu/	Ministry for Innovation and Technology http://www.kormany.hu/download/d/c1/b0000/Irinyi-terv.pdf
Scope of the strategy/action plan	National	National	Highlighted sectors: • green economy • food industry • vehicle production • mechanical engineering • pharmaceutical industry

Name	Industry 4.0 Industry Development Strategy	Digital Success Program	Irinyi Plan
			• healthcare • ICT • tourism • defence industry
Measures included in the strategy/action plan	5 pillars: 1. Digitisation and enterprise development 2. Industry 4.0 Manufacturing, Logistics 3. Industry 4.0 labour market developments 4. Industry 4.0. RDI 5. Industry 4.0 ecosystem	• comprehensive strategies • networking • coalitions • tax deductions	• Improving the competitiveness and innovation of Hungarian industry • Dual training, networking • Development of vocational training • Production of higher added value products
Overall funding and distribution by volume and source of funding (public/private, EU/national)	There is a direct budget of EUR 4,629,344 from which the Ministry for Innovation and Technology is supporting SMEs in their Industry 4.0 aspirations. There has been an additional EUR 12,344,917 allocated to increase capacity.	Loan program, tax cuts + EU funds (ERDF, ESF) (EDIOP).	EU funds (ERDF, ESF) + national resources

Industry 4.0 Industry Development Strategy

In May 2016, the Industry 4.0 National Technology Platform was founded with the support and commitment of the Hungarian Government, with the participation of 40 Hungarian companies, research institutes, organisations and educational institutions organised by the Ministry of National Economy and the Hungarian Institute of Computer Science and Automation of the Hungarian Academy of Sciences.[9]

In the spring of 2017, the Platform launched its Questionnaire project. It was the first time that this approach was used in Hungary to make such an in-depth analysis of the technological and business maturity of individual companies in digitalisation, while also taking into account the perspective of the current macroeconomic developments..[10] According to our interviewees, Hungary is perceived to be in the mid-range regarding digitalisation in Europe. The challenge for the digital transformation is to inform the industry actors about the established initiatives and how they can benefit from them. Besides, the initiatives will have to address the mindset of the management, meaning that SMEs need to understand the importance of digitalisation.

Digital Success Program

In the framework of the Digital Success Program, a Digital Success Strategy has been developed and several other strategies are currently in process, such as the Digital Educational Strategy, the Digital Start-up Strategy, the Digital Export Development Strategy, the Digital Child Protection Strategy and the Digital Healthcare Industry Development Strategy.[11]

Irinyi Plan

The main directions of the developments in the Hungarian industry are identified by the industrial strategy named after János Irinyi. The purpose of the Irinyi Plan is to create the driving force behind the long-term growth of the Hungarian economy. In order to modernise the structure of industrial production and move towards higher added value production, the innovation-led economy needs to be achieved, industry needs to rely on knowledge, research and development, higher education and vocational education. One of the main goals of the strategy is to increase the share of industrial production in the GDP to 30% by 2020.[12]

National Smart Specialisation Strategy

Developing smart specialisation strategies (S3) is not only a recommendation but is also embedded in EU legislation. EU Regulation 1303/2013 states that a Member State may only receive EU funds if the country has a smart specialisation strategy and the support is in line with its objectives. Therefore, the preparation of S3 planning documents in all Member States is a prerequisite for supporting research and development and innovation (so-called ex-ante conditionality). In Hungary, the Strategy adopted in 2014 aims to strengthen excellence and competitiveness, increase the performance of Hungarian science-technology and innovation actors and to develop a territorial approach to the knowledge-based economic development of regions.

The priority areas are[13]:
- Advanced technologies in the vehicle and other machine industries
- ICT and information services
- Sustainable environment
- Agricultural innovation
- Clean and renewable energies
- Healthy society and wellbeing

- Inclusive and sustainable society
- Healthy local food

The Industry 4.0 Industry Development Strategy, the Digital Success Programme and the Irinyi Plan are aligned with the priorities of the Smart Specialisation Strategy.

Impacts, challenges and perceptions

The development and implementation of these strategic documents are currently ongoing. Based on the feedback from Hungarian business associations and the Ministry for Innovation and Technology, there could be more emphasis on national digital industrial platforms, to develop a system of relationships between them also at the level of the Visegrad Group (V4). Furthermore, also based on the feedback from interviewees, there is a great demand and interest from Hungarian companies for digitalisation across the different sectors and industries. However, many companies, especially SMEs, are simply not aware of these strategic documents and the initiatives presented in the following sections. Therefore, one of the main challenges for the government in the future will be to promote the measures and to inform SMEs about how they can benefit from digitising.

1.3 EU cooperation in the field of digitising industry initiatives

Visegrad 4 cooperation

Hungary is involved in close regional collaboration with the other Visegrad countries (the Czech Republic, Hungary, Poland and Slovakia). The Visegrad 4 cooperation builds on a joint declaration on the Future of Economic operation called the BUDAPEST Declaration, that encourages close cooperation of Industry 4.0 Technology Platforms.[14]

Common testbed project with Slovenia and Austria

Hungary cooperates with Slovenia and Austria regarding a specific test trackbed project in Zalaegerszeg (Western Transdanubia region). This test trackbed will be the test ground facility for intelligent transport systems, connected and autonomous driving, smart city, and infrastructure (Zalaegerszeg, Trans-Danubian region). Negotiations with the other two countries have started in 2018. The overall aim for Hungary is to improve its international position in the automotive industry. The construction of the Ttest ground track and 5G infrastructure is being built planned in Zalaegerszeg with private involvement and regional cooperation, as well. In this case, the target sector is the automotive industry: connected and autonomous driving, car manufacturing, ICT technologies, transport systems, communication infrastructure, 5G development and test in real environment, testing use cases. The value resides in the development of an iIndustrial innovation infrastructure and testbed open testbed for the region and for European manufacturers, SMEs and start-ups. The main technologies involved are those related to connected and autonomous driving, intelligent transport systems, road infrastructure, 5G, cyber security, cloud technologies, standardisation with a vision on legal environment.[15,16]

The coordinating managing and implementation body of the project is the Automotive Proving Ground Ltd. Automotive Testbed Zala llc. Their primary aim at the current stage is to find further investors. The Budapest Technological University of Budapest Technology and Economics, the University of Graz and the University of Ljubljana have already signed a declaration for further cooperation.[17]

InnoEnergy hub network

Hungary has joined the InnoEnergy hub in 2017. The primary task of InnoEnergy hubs is to find and support enterprising ideas for promising sustainability and energy. In addition, the involvement of various industry stakeholders, investors and the organisation of mentoring programs for members of the InnoEnergy community play an important role. The InnoEnergy Hubs are functioning in 13 countries and are designed to build a network that connects regional innovation communities and provides services to local energy and sustainability start-ups. [18]

EU Coordinated Plan on Artificial Intelligence

There is a close link between the national initiatives of digitalisation in Hungary and measures envisioned in the EU Coordinated Plan on Artificial Intelligence. The key areas defined in the plan are increasing investment, making more data available, fostering talent and ensuring trust.[19]

ECSEL Joint Undertaking

Hungary is also participating in the ECSEL Joint Undertaking (JU), which is the Public-Private Partnership for Electronic Components and System. It funds Research, Development and Innovation projects for world-class expertise in these key enabling technologies, essential for Europe's competitive leadership in the era of the digital economy. Through the ECSEL JU, the European industry, SMEs and Research and Technology Organisations are supported and co-financed by 30 ECSEL Participating States and the European Union.[20]

2 Other policy support to digitising industry

2.1 Boosting innovation capacity

In the last two years, there have been a number of initiatives to boost the innovation capacity in Hungary.

The table below presents an overview of the main national initiatives to boost innovation capacity. (Pillars 2 and 3).

Table 5: Main initiatives to boost innovation capacity (pillars 2 and 3 of DEI)

Name	Industry 4.0 National Technology Platform	"Model Factory" Program	DIH network	Modern Enterprises' Programme – Digital Entrepreneurship
Type	Digital Platform	FabLab	Network of DIH	Comprehensive digital economy development program
Starting date	May 2016	2017	2017	2016
Objective	The goal for Hungary is to benefit from digitalisation. In order to enhance the achievements of global competitiveness, members are encouraged to further deepen the established partnerships and to develop an intensive and activity-oriented system of co-operation in line with European best practices. Another objective is to make the platform functioning as a forum for lobbying and as an advisory body.	The aim of the project is to support the digital and automation development efforts of SMEs in the production through the design of Industry 4.0 Model applications.	In line with the Digitising European Industry initiative, Hungary also aims to have DIHs that make available to all businesses the latest digital technologies (Artificial Intelligence, cyber security, high-performance computing) and help SMEs and public administrations widen digital transformation.	The main objective of the project is to develop domestic SMEs' IT skills, thereby to increase their competitiveness and facilitate the digitisation of businesses (included industrial firms)
Relevant for Pillar 2[21], Pillar 3[22] or both	Pillar 3	Pillar 2	Pillar 2	Pillar 3
Short description	It provides the Government with a tool to implement the Industry 4.0 Industry Development Strategy, which, in line with the Irinyi Plan, along the real market needs, supports a digital transformation of industry based on intelligent tools, with a new approach and international trends.	Industry 4.0 Model Workshops are demonstration sites where advanced industry 4.0 solutions can be viewed in an operational environment, involving local experts (engineers, technicians) who will also be able to provide additional theoretical knowledge on technology and business solutions. In the 6 Industry 4.0 Model Factories, companies present how they use industry 4.0 management concepts (e.g.	There are several active innovation hubs in Hungary, while several are under preparation. E.g.:am-lab (Szombathely), Demola Hungary (Budapest), Industry 4.0 National Technology Platform (Budapest), Innomine (Kecskemét), EIT Digital Budapest Node, Zalazone (Zalaegerszeg).	The main task of the project is to conduct awareness-raising activities (consultancy, services, events) which can help the (industrial and other) SMEs get rid of their distrust towards the info-communication tools, convince them that the introduction of advanced tools can serve the businesses' more efficient operation, and by decreasing their handicap in the digital field they can increase their own competitiveness.

Name	Industry 4.0 National Technology Platform	"Model Factory" Program	DIH network	Modern Enterprises' Programme – Digital Entrepreneurship
		lean), business solutions and technologies (e.g. collaborative robots, RFID). Model factories include SMEs and large companies, process and discrete production.		
Granting organisation	• Ministry for Innovation and Technologies • The Institute for Computer Science and Automation of the Hungarian Academy of Sciences	• Ministry for Innovation and Technologies • Association of ICT companies • IFKA Industrial Development Public Nonprofit Ltd.	EU	• Ministry of Finance • Hungarian Chamber of Commerce and Industry,
Participating organisations	• Some 40 Hungarian companies, research institutes, organisations and educational institutions	• 6 factories providing demonstrations for visiting companies. • It is expected to continue with more factories joining.	N/A	• Ministry for Innovation and Technology • IT pro Society Association • Governmental Information-Technology Development Agency. Regional chambers of commerce and industry
Sectors targeted	All	All	All	All
Technologies targeted	All, in particular digital production and Internet of things (IoT)	The usage of the following technologies is presented throughout the factory visits: [23] • Production visualisation • Supply chain visualisation • Supply chain collaboration • Supply chain optimisation	All, in particular FinTech, Artificial Intelligence, cyber security, high-performance computing	All business digital technologies, products and services

Name	Industry 4.0 National Technology Platform	"Model Factory" Program	DIH network	Modern Enterprises' Programme – Digital Entrepreneurship
		- Predictive maintenance - Big data - Internet of things - Modern warehouse and logistical solutions - Robotics - Augmented Reality 3D printing		
Funding (split by private/public and national/EU), state period/annual funding	Membership fees	National funding EUR 7,315,273 (June 2017 – Dec 2019)	Direct EU funding	Split between EU and national funding (18.8 million EUR)
Current status of initiatives	Ongoing	Ongoing	Ongoing	Ongoing

Industry 4.0 National Technology Platform

Linked to the National Industry 4.0 Industry Development Strategy, nearly 40 educational institutions, research institutes, sectoral professional representations and companies joining the Platform have the purpose of drafting suggestions and recommendations for the government as a flagship of industrial digitisation, encouraging cooperation between its members in the domestically relevant key areas of Industry 4.0, especially digital production and Internet of things, and support of dissemination of good practices in the country.[24,25]

The members of the Platform aim to improve SME ecosystem by helping SMEs get better access to information. Besides, they prepare them to digital transformation, present them opportunities and promote the development of practical-oriented trainings related to the needs of enterprises and the adaptation of education systems. By having the Association of ICT companies joining, Hungarian information and communication companies are able to participate in the industry's 4.0 strategy in Hungary and participate in the domestic process of industrial digitization.[26] The Industry 4.0 National Technology Platform operates various Working Groups, which elaborate responses to the challenges presented in the form of proposals (see Section 2.2).

The feedback from Hungarian stakeholders confirms that there are huge expectations around the initiative. However, there are also a number of issues and challenges related to the Platform. One problem is that mostly big companies dominate it who do not face real digitisation challenges compared to smaller SMEs which are usually family businesses and do not possess the knowledge and adequate resources to invest into digitisation. This is a specific element of the Hungarian economy which requires a dedicated approach when designing measures to support the digital transformation. Another challenge is that Hungarian firms are facing managerial problems, meaning that the mindset and lack of strategic planning, proper digital skills of the workforce are delaying the way for successful digitalisation.[27]

"Model Factory" program

Under the Model Factory Program, small industrial producers in the convergence regions are provided with knowledge, enabling these SMEs to start digitising themselves. This program is therefore raising awareness, changing the mindset and approach of SMEs and educating them about their opportunities.[28,29]

The Association of ICT companies together with the Industrial Development Public Nonprofit Ltd. coordinate the initiative together as a bottom-up, pilot project. The model factory project is dedicated to developing the skills of SMEs.[30]

The overall funding of digitising SMEs can be broken into four categories:

- Support for small SMEs,
- Support for bigger SMEs,
- Training and developing skills of SMEs,
- Digitising SMEs.

The Model Factory Program has three main pillars: improving management, IT capacities and production management.[31] The three main phases of the projects are the following:

1. **Demonstrations**

So far 100 SMEs have participated in visiting five Model factories. The factories have opened their doors to show SMEs how they use digitalisation in their processes and in return, they get EU funding (ERDF and ESF). At the beginning, the designers of the initiative thought that

establishing a communication website will be enough to inform and attract the potential SMEs. Because people on the management level seem not to be interested in leveraging modern digital tools, a different approach has been taken. Currently, 6-7 experts are touring the country and visiting different cities to advertise the opportunity to SMEs (presale).

A mentoring network with seven lean experts also belongs to the initiative. The currently involved SMEs are those who had previously established relationships with the associations and were therefore easier to approach for the designers of the project.[32]

2. Knowledge transfer

There is a two-day long lean training (10-15 SMEs have participated so far) organised for the SMEs to educate them about digitising, Industry 4.0 and designing A3 strategy.[33] The measure is aiming to solve one of the biggest challenges of digitalisation in Hungary which is the weak strategic planning. In order to digitise, companies need to have an established strategy for at least a two-year period. For this, participants make case studies to learn about project management and different skills. The project is run by the Association of ICT companies and the Industrial Development Public Nonprofit Ltd. as a consortium, but they also have contracts with the Budapest University of Technology and Economics, where companies can consult academic professionals to discuss their unique, logistical challenges. The general feedback is that most SMEs have an inadequate and weak IT infrastructure which together with fragile management skills and weak strategic planning hinders the digitisation of their productions.[34]

3. The future – A3 strategy design

After mid-February 2019, the first SMEs that completed these trainings will consult their mentors to design their A3 strategies. A3 strategy is a one-page storyboard on an A3 paper that helps companies visualizing their goals in the future. SMEs need to be able to create a long-term vision, thus there will be a whole day dedicated to how to build up their long-term strategy. SMEs that complete this step will get a silver Industry 4.0 certificate. 50 SMEs with the best A3 strategies will receive golden certificate.[35] The consortium plans to include:

- 1,000 SMEs in the demonstrations
- 380 SMEs in trainings
- 350 SMEs in A3 strategy design

In the following programs, only SMEs with certain certificates will be eligible to participate.[36]

The Model factory Program is in line with the goals and approach envisioned in the National Smart Specialisation Strategy which is to develop a territorial approach to the knowledge-based economic development of regions.

"Modern Enterprises' Programme – Digital Entrepreneurship"

The Hungarian Chamber of Commerce and Industry launched the Modern Enterprises' Programme (MVP) in 2016, which aims to help digital switchover among businesses, especially SMEs. The 5-year program is beyond the halftime, and it is planned to extract the program for companies in the most economically developed region of Central Hungary, which has so far been a territorial exclusionary condition.[37]

The program aims to help local micro, small and medium-sized (included industrial) enterprises to apply state-of-the-art IT solutions. The Modern Enterprises' Programme has been trying to help businesses over the past two years, guiding them towards the digital transformation. The program conducts surveys, proposes IT developments, proposes solutions, makes available discounts,

events, and self-developed view-forming content bringing the IT world closer. Its five-year cycle is specifically designed for rural businesses, with the exception of Central Hungary and agrarians. The program is run by the Hungarian Chamber of Commerce and Industry.[38]

The Program was co-funded by the European Union, funded by the European Regional Development Fund. The project is a consortium, coordinated by the „Hungarian Chamber of Commerce and Industry". Other members of the consortium are the „IT pro Society Association" and the „Governmental Information-Technology Development Agency". Additional cooperation partners of the project are the regional chambers of commerce and industry.

Main achievements of the Programme so far (end of March 2019): near 10 000 company (from which approximately 2000 industrial enterprises) audits, more than 6700 „Digitally Qualified Enterprise, DQE" classification, 202 events, 614 suppliers (with 1837 IT products / services) have been included in the programme.

Impacts, challenges and perceptions

Beside the mentioned issues such as the weak knowledge and managerial skills of SMEs, one of the main overall challenges in Hungary is the lack of strategic planning Even though there is a great interest surrounding the Model Factory Program, the companies are not yet ready to implement the changes. According to the Hungarian stakeholders consulted, there would be a general need to establish sectoral action plans and coherence among the existing initiatives. The budget is already available, but the comprehensive governance is missing to achieve a step forward in digitalisation.[39]

The interviewed stakeholders from public authorities and associations perceive the country to be in a mid-range position in the EU regarding digitalisation (2.6 on the scale from 1 to 5 where 1 is low and 5 is high). The important aspect here is really to differentiate not only between IT and not IT sectors but between large companies and SMEs. The effectiveness of the initiatives is also considered to be average (3 on a scale from 1 to 5) by the interviewees. The contribution of the initiatives to the uptake of digital technologies is considered to be moderate (2.6 on a scale from 1 to 5). This is explained by the fact that many Hungarian companies are not aware of the programs and the benefits they can get.

There are 16 new incubators in Hungary financed from ERDF through two different programs (GINOP and VEKOP). For each incubator, there is EUR 240,071,862 funding allocated. In 2019, there are 1700 start-ups in Hungary.

2.2 Regulatory framework for digital age

The table below presents the main initiatives related to a digital regulatory framework (Pillar 4).

Table 6: Main initiatives under Pillar 4

Name	Industry 4.0 Working Groups	Artificial Intelligence Coalition	FinTech Innovation Hub
Type	Working Groups	Working Groups/Coalition	Working Groups/Coalition
Starting date	2016	2018	2017
Objective	The goal is for Hungary to take advantage of new technologies, the development of the internet economy, and to find a quick and effective response to the challenges that arise.	The founders of the Coalition intend to jointly define the directions and frameworks for the development of Artificial Intelligence in Hungary, providing a permanent forum for professional and collaborative forums for AI developers, market players and state actors representing the user side of AI, academia, professional organizations and state between institutions. The AI Coalition also participates in the development of the AI strategy in Hungary, as well as the analysis of the social and economic impacts associated with the spread of AI.	The aim is to establish an innovative test environment that could serve as a safe deposit for financial initiatives.
Short description	The Industry 4.0 National Technology Platform operates various Working Groups in order to fulfil its mission statement. They therefore address the specific issues of a particular area related to I4.0 and the elaboration of responses to the challenges presented in the form of proposals.	The goal of the Coalition is to become the leading edge in Artificial Intelligence developments and applications in Europe and become an important member of the international MI community. The AI Coalition, which includes more than 70 international and domestic companies, universities, scientific workshops, professional and public organizations (such as the Hungarian National Bank), is provided by the Digital Success Program (DSP).	In the second half of 2017, the Hungarian National Bank carried out a comprehensive survey of FinTech innovation initiatives, both for market participants and consumers. Based on the results of the survey, taking into account international best practices and financial stability considerations, the central bank has developed a possible regulatory concept to stimulate domestic FinTech innovations.
Sectors targeted	• ICT • transport • manufacturing	• ICT • Industry	• FinTech

Industry 4.0 Working Groups

The Industry 4.0 National Technology Platform operates various Working Groups in order to fulfil its mission statement. The Working Groups are therefore linked to the national strategy and the platform itself. They address the specific issues of a particular area related to I4.0 and the elaboration of responses to the challenges presented in the form of proposals. Members of the delegates representing the given field participate in the Working Groups. Their work is carried out in close cooperation with the governmental policy forum, thus they can contribute to the achievement of the government's strategic goals.[40]

The Industry 4.0 Platform has seven working groups in the following areas:

- Strategic planning
- Info communication Technologies
- Employment, education and training
- Industry 4.0 Experimental Systems
- Definition of legal frameworks
- Manufacturing and Logistics
- Innovation and business model[41]

Artificial Intelligence Coalition

The Hungarian Artificial Intelligence Coalition (AI Coalition), initiated by the Minister for Innovation and Technology, aims to make Hungary a European leader in Artificial Intelligence development as well as an important member of the international AI community. The AI Coalition was established within the Digital Success Program. According to the Coalition, the rapid technological progress digitalisation and the development of autonomous vehicles and 5G mobile technology will put Hungary at the forefront of development in AI.[42]

The intention of the founders of the Coalition is to jointly define the directions and frameworks for the development of Artificial Intelligence in Hungary by providing a permanent forum for professional and cooperation between the AI developers, the market and state actors representing the user side of the AI and the academic sector, professional organisations and between state institutions. The AI coalition also participates in the development of the AI strategy in Hungary and analyses the social and economic impacts associated with the spread of AI.[43]

FinTech Innovation Hub

Up to now, 12 regulatory support requests have been received by the Hungarian National Bank, since the launch of the Innovation Hub. About one-third of these requests have been made by "classic" financial institutions with central bank supervisory licenses, while two-thirds of the "fintech" companies have requested central bank's guidance on clarifying financial issues in connection with their planned innovations. New fintech initiatives affecting the financial, insurance and capital market sectors include, inter alia, more effective, simpler relations with customers.[44,45]

In 2018, after half a year of operation, the Hungarian National Bank (MNB) works with fintech firms and financial institutions in connection with dozens of fintech innovation initiatives. The digital financial solutions are gaining momentum which is reflected in the fact that one of the world's leading mobile and online payment platforms will start operating in Hungary next year. In the future, an innovative financial test environment could provide a safe place for further developing fintech initiatives.[46]

Impacts, challenges and perceptions

According to the stakeholders interviewed, the data regulation in Hungary was considered to be pioneering 5-6 years ago. Since then however, a lot has changed, and a new regulatory environment should reflect the changing nature of economy. The interviewees were not aware of any major changes related to the regulative environment, but they all agreed that even though it is not the main barrier for companies to digitise, soon it will become necessary to adjust the regulations to the new, digitalised world.

2.3 Skills development

The small amount of digitally prepared workers is increasingly critical for Hungarian companies and the competitiveness of the national economy. The much-talked-about 22,000 vacant IT posts are just the tip of the iceberg: hundreds of thousands of digitally-trained professionals are needed in the digital economy, as digital transformation does not leave a single corner of business.[47]

The table below presents the main initiatives related to skills development (Pillar 5).

Table 7: Main initiatives under Pillar 5

Name	Digital Success Coordination Centre	Digital Success Mentor Program	Digital Workforce Program	INPUT Program
Type	Coordination centres	Training program	Training program	Training Program
Starting date	2017	2017	2017	2016
Objective	To ensure that every citizen and business in Hungary recognizes the importance of digital transformation and that everyone is involved in the process.	To establish accessible public space with adequate Internet access and information communication tools for everyone.	The goal is to provide training to at least 20,000 IT professionals within the next 3 years. At the same time, it is essential to increase the capacity and to update the content of traditional training systems to develop alternative training pathways that provide the digital economy with IT and digital workforce.	The Program aims to promote the efficiency and profitability of the start-up, micro and small businesses of the domestic info communication sector, while at the same time encouraging them to increase their export activity. The goal of INPUT is to involve altogether 350 start-ups from the ICT sector and natural persons initiating innovative IT projects. More than 250 free trainings and events related to the program will take place until April 2021.
Short description	The Digital Success Coordination Centre, which operates under the auspices of the Ministry for Innovation and Technology assists the Ministry in developing digital ecosystems, increasing the level of digital literacy and coordinating programs in this field for non-school education and professional coordination of the DSP network results, informs relevant actors, oversees and coordinates Digital Care Program Mentors (DSP Mentors). It is engaged in training and development of the information society and adult training activities related to the	In 1,173 places at 1,415 dedicated Digital Success Program Points, some 2,116 mentors work to reduce digital illiteracy.	Within the framework of the Digital Workforce Program, the Hungarian Government presents significant, forward-looking changes e.g.: introducing short-cycle training courses that respond quickly to labour market needs, introducing new target groups into training, reducing barriers to training through extending e-learning opportunities at all levels, as well as extending student benefit and support.	Personalised development, a complex knowledge base: One of the key elements of the program is free education, training and change of attitudes tailored to the needs of start-ups and areas to be developed. Going around the different start-up themes, lectures and workshops help them with e-learning materials. Mentoring: A pro bono mentor team is ready to share their experiences and knowledge to bring the best innovators. International market access: The mentors aim to build and maintain strong relationships between

Name	Digital Success Coordination Centre	Digital Success Mentor Program	Digital Workforce Program	INPUT Program
	professional coordination of the DSP Network.			international partners and domestic start-ups.
Granting organisation	Coordinating body: Ministry for Innovation and Technology	N/A	Hungarian government	Hungarian government
Participating organisations	N/A	N/A	N/A	A network of 12 Universities, associations and companies
Sectors targeted	All	All	All sectors, mainly targeting SMEs	Start-ups in the ICT sector
Funding	EU and national funding	EU and national funding	EU and national funding	EUR 17,373,622 EU funding (ERDF)
Current status of initiatives	Ongoing	Ongoing	Ongoing	Ongoing

Digital Success Coordination Centre and Digital Success Mentor Program

Within the Digital Success Program (DSP) there is a network of DSP actors throughout the country, and the Digital Success Program (DSP) Mentors are helping Hungarian citizens learn basic digital competences, secure and safe use of the online world and smart tools. Digitisation and Internet use now fully define our everyday lives, from the world of work to private life. The Digital Success Program helps to spread digital solutions in Hungary at the social, economic and administrative levels, along different strategic directions.[48]

For the effective management and coordination of the Network, DSP Network Regional Leaders and County DSP Network Leaders help the DSP Mentors work. DSP County Executives keep active contact with DSP Points and DSP Mentors. They contribute to disseminate best practices and solutions and help to communicate between DSP Mentors and the Digital Success Coordination Centre.[49]

The priority tasks of the Digital Success Coordination Centre include:

- guiding, supervising and monitoring the functioning of the DSP Points through a unified system of requirements, assisting the work of DSP Mentors;
- professionally supporting the training and further training of DSP Mentors based on centrally developed licensed training programs;
- participation of citizens in programs and projects related to digital competence development;
- engagement in lobbying to create the operating resources of the DSP Network;
- collecting and providing data for program makers continuously.[50]

So far, 1,400 winners of the project have been announced and up to 600 points have been added. The first renewed Digital Success Point was handed over to Várpalota. The province of Veszprém will provide additional 51 locations. Installing new devices is scheduled everywhere in the country. The aim of the program is to develop digital basic skills, increase digital literacy and community visitors, thus gaining benefits in the labour market and building stronger community relationships.[51]

The Digital Workforce Program

One of the main obstacles for the development of the digital economy in Hungary is the low number of digitally qualified workforce. There has long been a need to address the pressing issue of the lack of qualified informaticians as the market would have demand for tens of thousands of such professionals. Today, there is also an additional need for digitally highly qualified people. The Digital Success Program therefore supports the development of the Digital Workforce Program (DWP), which includes short- and medium-term solutions to mitigate IT and digitally qualified staff shortages.[52,53,54]

The Hungarian government's determined aspiration is to digitise more new jobs with high added value than the number of jobs that disappear. To achieve this, the country needs to make significant progress both in the business approach and in the digital readiness and the digital workforce. The Hungarian Government has reacted in a coordinated manner to the phenomenon bythe Digital Workforce Program (DWP) and the digital education strategy which target is the digital education of students at various levels of the education system.[55]

In the first phase of the implementation of the DWP, the emphasis is on short-cycle non-traditional IT training programs. The goal is to provide at least 20,000 additional IT educators. At the same time, it is essential to increase the capacity and to update the content and curricula of traditional

training systems and to develop alternative training pathways that provide the digital economy with digitally skilled workforce.[56]

Main challenges and perceptions

According to Hungarian stakeholders, the reform of the Hungarian education system would be very much needed in the sense that it should be synchronised with what the industry has demand for, such as the adequate skills for corporate collaboration. Besides, vocational training also needs to be adjusted. Today, the lack of professionals in certain fields (such as engineering) is causing assymetries on the labour market and a severe lack of skilled workforce. The lack of knowledge in English is also likely to hinder future development, therefore, trainings in this field are especially important.

2.4 Support mechanisms

According to the PwC Digital tax Index 2017 Hungary is the 3rd most attractive European country for digital business development, with a Tax Index of -6.85%. The Hungarian tax system is attractive to foster foreign investment on Industry 4.0 developments for digital technologies such as cybersecurity, high-performance computing (HPC), big data and Cyber-Physical Production Systems (CPPS technologies). These are priorities for the National Smart Specialisation Strategy which has already budgeted for EUR 2.35 billion of financial instruments to foster innovation and digital business developments in the country.[57]

Innovation vouchers

The innovation vouchers aim to advance the involvement of micro-, small- and medium sized enterprises in the innovation chain and thereby increase their RDI activity. By analyzing the corporate sector's performance, the National S3 Strategy concludes that innovation expenditures generally started to grow. In order to keep up the favourable recent trend, it is needed to stimulate research, development and innovation of micro-, small- and medium-sized enterprises through collaboration with universities and research organizations (both private and public) in order to develop new, innovative products, processes or services. The innovation voucher is a tool that contributes to the innovative capacity of SMEs, enabling them to support their RDI activities by purchasing RDI services on the market. As a result, SMEs will get more involved in the innovation chain, and increase their RDI activities. The call is available under the Economic Development and Innovation Operative Programme for applicants outside the Central Hungary region, with a total budget of EUR 190.5 million.[58]

Hiventures Plc. – Incubator Investment Construction

Incubation Investments support microenterprises that carry out research, development or innovation (RDI) activities where the product or service idea already exists, but the concept is still being considered and finalised and filled with business content. The investment horizon is 3-7 years. Funding is in the form of a capital increase (share capital + capital reserve). Incubation Investment offers businesses a uniform capital of EUR 28,391,735. In exchange for the capital, Hiventures asks for a 9% ownership in the supported company.[59]

3 Conclusions

A specific element of the Hungarian economy is the high number and importance of SMEs. Most initiatives for digitalisation across all pillars are therefore mainly focusing on digitising SMEs. The following table provides an overview about the funding of these different digitalisation initiatives in Hungary:

Table 8: Breakdown for the financing of the initiatives

	Pillar 2 **Digital Innovation for all**	Pillar 3 **Partnerships and industrial platforms**	Pillar 4 **Regulatory framework for digital age**	Pillar 5 **Preparing for digital future (skills)**
Industry 4.0 National Techno Platform		Membership fees		
"Model Factory" Program	EUR 7,315,273 (June 2017 – Dec 2019)			
DICH Network	N/A			
Modern Enterprises' Programme		EUR 18,8 million		
Industry 4.0 Working Groups			N/A	
Coalition for Artificial Intelligence			N/A	
FinTech Innovation Hub			N/A	
Digital Success Coordination Centre				N/A
Digital Success Mentor Program				N/A
Digital Workforce Program				N/A
INPUT Porgram				EUR 17,373,622 EU funding (ERDF) (2016-2021)
Innovation Vouchers	EUR 190.5 million			
Hiventures Plc. – Incubator Investment Construction	EUR 28,391,735			
Total spending (2018)	EUR 262.38 million (June 2017 – Dec 2019)			

Hungary is facing a number of challenges regarding digitalisation, such as digital and management skill shortage and the companies' weak knowledge about the initiatives available and how they can best capitalise on them. These issues are also reflected in the Digital Transformation Enablers' Index and the Digital Technology Integration Index which ranks Hungary as the countries lagging behind.

To address these issues, the Government of Hungary – as well as the Association of ICT companies and the Institute for Computer Science and Control at the Hungarian Academy of Sciences – have become extremely active in the last few years and put forward measures to boost innovation capacity and knowledge transfer towards SMEs. In this sense, Hungary has very active actors in all sectors (government, industry, academy) who push towards a digital transformation. The number of strategic documents and the Digital Success Program with its wide scope suggest that the Hungarian government sees digitalisation as an important priority and is willing to cooperate with the Industry, academia and universities to launch new initiatives.

The Industry 4.0 Platform (Pillar 3 of the DEI) looks at future-related issues in the areas of digitalisation. The aim is to tap into the potential of digitalisation for the Hungarian industry, and particularly for SMEs, in conjunction with other stakeholders. The platform also organises network events across the country, at which companies – particularly SMEs – receive information on the digital transformation and can be aware of the possibilities of Industry 4.0. The Platform has also

established Working Groups (Pillar 4 of DEI) that work on future related issues regarding digitalisation. Besides, there is a strong DIH network operating in Hungary (Pillar 2 of DEI) and a well-developed Model Factory program (Pillar 2 of DEI) is mentoring and providing SMEs with practical knowledge for their digitalisation. To adjust the related regulatory framework to a modern, digitised industry, there is the Artificial Intelligence Coalition and a FinTech Innovation Hub working on a future-proof vision for specific regulations (Pillar 4 of the DEI). The Digital Success Program coordination centres and mentors and the Digital Workforce Program aim to assist SMEs in the digital transformation (Pillar 5 of the DEI) as the majority of companies in Hungary belong to this category. The Input Program also specifically targets start-ups in the ICT sector to help them gain more competitiveness.

These initiatives altogether cover all pillars of the DEI and provide the basis for a complex digital transformation of the Hungarian industry. However, the initiatives still need to be better advertised and monitored in order to achieve an effective outcome. The weak strategic planning and the mindset of the management in Hungarian SMEs need to be addressed with initiatives targeting the business mindset in the country. Besides, a new regulatory environment should reflect the changing nature of economy and ease the digital transformation. The shortage of ICT and engineering professionals, together with the weaker management and language skills continue to be barriers for digitalisation. These issues are addressed by the measures along each Pillar, but the challenge is to involve as many Hungarian companies as possible.

Among the wide array of initiatives, one program particularly stands out by targeting the large number of SMEs and their slow uptake of digital technologies. Providing complex guidance for SMEs in digitalisation is best reflected in the Model Factory Program, where SMEs are taught how to develop their long-term strategies while also getting hands on knowledge about how they can integrate modern, innovative digital solutions into their businesses. The Model Factory Program has a well-developed framework that sets high hopes for the industry associations as well as the government.

Box 1: Good practice

<u>Model Factory Program</u>

The Model Factory Program is a unique initiative which is addressing the most important weaknesses of Hungary. Within the program, small industrial producers in the convergence regions are provided with knowledge, enabling these SMEs to start digitising themselves. It is therefore raising awareness, changing the mindset and approach of SMEs and educating them about their opportunities.

The three main phases of the program are building up on each other, ensuring that SMEs are acquiring all the basic knowledge before taking the next step forward. The specific elements of each SME are taken into account along the way and mentors are there to help them address their business questions.

So far 100 SMEs have participated in visiting five Model factories, which is the first phase of the program. In the second part, which is completing a two-day long lean training, 10-15 SMEs have participated until the end of 2018. After mid-February 2019, the first SMEs that completed the trainings are planned to consult their mentors to design their A3 strategies

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To conclude, the table below provides a general overview of the main digitalisation initiatives implemented in Hungary, the level of take-up and perception of their impacts as well as the overall progress the country has made so far with regards to digitalisation.

Table 9: Total input-output overview

		Pillar 2	Pillar 3	Pillar 4	Pillar 5
		Digital Innovation for all	**Partnerships and industrial platforms**	**Regulatory framework for digital age**	**Preparing for digital future (skills)**
Application	Name of key initiatives (start dates in brackets)	"Model Factory" Program (2017) DICH network (2017)	Industry 4.0 National Technology Platform Alliance (2016), Modern Enterprises' Programme (2016)	Industry 4.0 Working Groups (2016) Coalition for Artificial Intelligence (2018) FinTech Innovation Hub (2017)	Digital Workforce Program (2017) INPUT Porgram (2016) Digital Success Coordination Centres and Mentor Program (2017)
	Funding (total amount and period)	EUR 7,315,273 (June 2017 – Dec 2019)	EUR 18.8 million (2016)	N/A	EUR 17,373,622 EU funding (ERDF)
	Industries addressed	All, mainly targeting SMEs	All, mainly targeting SMEs	ICT, transport, manufacturing	All, mainly targeting SMEs
	EU programme involved	Yes	Yes	N/A	Yes
Usage	Perception of initiative	The usefulness of the initiative is perceived as moderate (3/5)	The usefulness of the initiative is perceived as moderate (3/5)	N/A	N/A
	Take-up	The level of take-up of digital technologies is perceived as moderate (2/5)	The level of take-up of digital technologies is perceived as moderate (3/5)	N/A	N/A
Outcomes	Perception of outcomes	The level of take-up of digital technologies is perceived as moderate (2/5)	The level of innovation in digital industries is perceived as elevated (3/5)	N/A	N/A
	Outcome metrics	DESI ranking on integration of Digital Technology: 25th (2018)		Between 2015 and 2017, total capex spending in Hungary increased by 5,75%.	The proportion of enterprises employed with ICT specialists among all enterprises increased by 0.02% between 2015 and 2017. In the same period, the share of enterprises providing training to develop ICT skills increased from 16% (2015) to 17% (2017).
	Change in outcomes	From 2017 to 2018, Hungary fell back from 24th to 25th rank in the DESI ranking on integration of Digital Technology			
End-goal	Productivity growth	Between 2008 and 2016, the real labour productivity per person employed in Hungary fell back, reaching a 0.4% decrease in 2016.			
Summary		Hungary has launched a number of initiatives in the last few years with a particular focus on pillars 2, 3, and 5 but it is still too early to determine the outputs and outcomes of these. Initiatives regarding pillar 4, such as the Working Groups are currently being set up.			

Annex: List of stakeholders consulted

Type of stakeholder	Name of organisation
Government representative	Ministry for Innovation and Technology, Department for Digital Economy and Innovation
Government representative	Ministry for Innovation and Technology, Department for Digital Economy and Information Society Development
Industry association	Association of ICT companies, Industry 4.0 Expert
Industry association	Association of Agricultural Cooperatives and Producers

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33 The concept originates from Japan where the decision makers are using an A3 sheet to present their long-term goals and the steps as to how they will achieve them.

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