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THE FOURTH INDUSTRIAL REVOLUTION – METAMORPHOSIS OF THE BUSINESS ENVIRONMENT

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This Work Project and survey were conducted to explore the opportunities, risks and challenges of the fourth industrial revolution. Further it should highlight key findings on how companies can prepare to guarantee a successful transition from a 3.0 to a 4.0 enterprise. The conducted survey explores the opinions of digital natives on increasing digitization. It gives an indication on how a blueprint for digital readiness can look like and how companies can successfully transform by acquiring and using digital capabilities.

WORK PROJECT KEY WORDS

DIGITAL TECHNOLOGIES

INDUSTRY 4.0

DATA & DATA PROTECTION

DISRUPTION

COST AND PRODUCTIVITY OPTIMIZATION

CUSTOMER EMPOWERMENT

CHANGING SKILLS

TRAINING AND EDUCATION

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The Fourth Industrial Revolution - Introduction

The first industrial revolution used water power and steam to mechanize the production process. Electricity was the driver of the second industrial revolution and enabled mass production. The third has electronics and information technology at its basis to automate wide parts of production. Now, we are on the brink of a technological and industrial revolution that will change and redefine the way we live, work and communicate with one another. The extent of these changes is currently not very clear but has to be dealt with caution and thoughtfulness and include every individual of our society. In the fourth industrial revolution, new disruptive technologies and innovations are being introduced at a much faster pace than in the previous ones. The scientific breakthroughs that were made in the last years and the new technologies that have emerged seem infinite. Also, they all have the same key feature: the powerful use of digitization and information technology. The digital megatrends are clustered in three groups. The fourth industrial revolution combines physical, digital and biological megatrends [1]. The combination of these technologies allows the emergence of disruptive waves in the business environment. This has led companies to change their corporate strategies and research agendas and put their focus on the use of these mentioned technological megatrends. Using the advantages of interaction between physical, digital and biological technologies distinguishes this industrial revolution from the ones before.

The fourth industrial revolution implies the transformation of companies on an organizational and operative level as well as achieving digital success to stay competitive and exploit first mover advantages. This digital transformation - characterized by the digitization of horizontal and vertical value chains, the improvement and digitization of product portfolios, shorter

[1] Schwab (2016) clusters the emerging and disruptive technologies as followed:
Physical megatrends include autonomous vehicles, advanced robotics, 3D printing and new materials.
Digital megatrends include the Internet of Things, Big Data, algorithms and blockchain technology.
Biological megatrends include optimized gene sequencing, synthetic biology and gene modification.

innovation cycles as well as new data driven business models – has reached enterprises in all industries around the globe.

Executive Summary - Survey

This Work Project and the underlying survey explore the opportunities, risks and challenges of the fourth industrial revolution. Further it should highlight key findings on what companies and employees should take into consideration to guarantee a successful transition from a 3.0 to a 4.0 enterprise. Graphs 1 to 5 and table 1 in the appendix show the data characteristics of the survey. These range from gender, age, country of origin, employment status, university education to the faculty or major of the respective respondent.

44% of survey participants are female and 56% male. 134 (93%) are between the age of 18 and 29. Another 9 respondents (or 6%) are between the age of 30 and 49 and 1 participant (0.6%) is 65 and older. Most respondents are from Germany (46%). 18% are from Portugal and 16% from Italy (the spread between the remaining countries can be seen in the appendix – table 1).

The majority of participants are students (62%), followed by people who are employed for wages (28%). 5 % are self-employed and 2 % are currently out of work and looking for a new job. 71 % of all students are currently doing their master´s degree, 25 % their bachelor´s degree, 3 % their PhD and the remaining 1 % a MBA. Most of them studied in business related fields such as management (62%), economics (14%) and finance (7%).

The first part of the Work Project will lead through and explain the seven survey questions and their respective graphs. The second part will pool together the survey answers and describe the 5 key findings that were distilled from the participants responses.

Survey questions and responses

Benefits created through Industry 4.0 initiatives

Graph 6 shows the weighted responses to the question "How important are the following benefits for companies created through Industry 4.0?". Each listed benefit should be categorized by the respondents as either being extremely important, very important, moderately important, slightly important or not at all important. Four listed Industry 4.0-benefits were said to be extremely important by over 50% of respondents. These are, the improvement of worker productivity (53.6%), the reduction of operational costs (53.0%), the creation of new revenue streams through new products and services (52.3%) and the enhancement of customer experience (50,3%). The three remaining benefits which were identified as being very important are the following: The optimization of asset utilization (45.7%), the enhancement of worker safety (42.4%) and the improvement of sustainability (38.4%).

The survey shows that the respondents strongly believe that companies will not only cut costs dramatically and improve productivity, but also generate additional revenue streams. Through the automation of processes using Big Data, algorithms, sensors and artificial intelligence, companies will be able to improve both the bottom and top line. These cost reductions and productivity gains can be reached through better asset utilization in the form of smart manufacturing initiatives.

Qualitative advantages created through Industry 4.0 initiatives

Graph 8 shows the responses to the question "How high or low will the impact of the following qualitative advantages be for a company?". The respondents should rate each listed qualitative advantage as either being high, medium or low. The following qualitative advantages were rated as having a high impact on a company: Better planning and controlling, for example in production and logistics (74.8%), higher customer satisfaction (67.5%), higher flexibility in production (60.3%), higher quality (54.3%) and individualization of products (51.7%).

Decreased time to market was rated by 53.0% of respondents as having a medium impact on a company.

These results strongly correlate with the results from graph 6, showing the survey participants opinions on benefits by Industry 4.0 initiatives. Both graphs indicate a tendency towards generating additional revenue, lower costs, higher efficiency and greater customer satisfaction.

Barriers preventing adoption of digital technologies

Graph 7 shows the responses to the question "What do you think are the biggest barriers that prevent companies from adopting digital technologies. Each participant could choose five main limitations to digital technology adoption. 118 survey respondents voted for privacy concerns being the biggest barrier to digital technology adoption. This suggest rising concerns among digital users about their private data. This suggest that the respondents are aware that growing digitalization also shows growing caution on how private data is collected, distributed and protected. Lack of skilled workers was selected 115 times and ranks as the second biggest limitation. This suggests, that respondents are aware of changing skills and job competencies in the future business environment [2]. The third commonly selected limitation are the uncertain returns on investment with 111 responses. This barrier to investing in digital technologies shows that the survey participants know of the difficulties to quantify the impact of digital transformation. This implies that a lot of investments are not based on sound ROI calculations and therefore cannot capture the full impact of the new emerging technologies, making investments seem like more of a risky bet. This point correlates with another highly voted barrier: the lack of interoperability or standards (85 responses). Suggesting that the uncertainty to invest ground on uncertainty of the maturity and soundness of the digital technologies. The

[2] According to Schwab (2016), leading global companies' think that cognitive abilities, complex problem solving and societal competencies will be much more needed than physical and technical competencies.
Also, Bonin et al. (2015) suggest that the digital transformation will highly affect the job structure in the future, especially repetitive tasks that require a low-skilled and low-income work force.

fourth biggest barrier with 101 responses are security concerns. This goes hand in hand with the number one limitation, privacy concerns. The limitations that occupied the end of the scale are the lack of proper equipment (63 responses), immature technologies (52 responses) and societal concerns (42 responses).

Risks associated with the digital revolution

Graph 9 presents the responses to the questions “How likely do you think are the following risks associated with the digital revolution?”. The survey participants evaluated each listed risk as being either high, medium or low. Privacy concerns due to availability of private data was identified to have a high risk (70.9% voted high, 28.5% voted medium risk). The second biggest risk identified were security threats due to connectivity of the global network (55.6% voted high, 38.4% voted medium). The third major risk associated with the digital revolution are disruptive waves in business models (53.6% voted high, 42.4% voted medium). The remaining two risks identified as having a medium risk are system break downs due to the complexity (20.5% voted high and 47.0% voted medium) and loss of job and social shifts due to increasing automation (37.1% voted high, 41.7% voted medium and 21.2% voted low).

Privacy concerns and security threats highly correlate with the identified barriers and limitations to digital technology adoption (graph 7). Although privacy concerns and security threats were identified as the risks with the highest impact, the survey respondents are not totally convinced that the digital revolution will threaten human lives due to system break downs. This indicates that the participants believe in the maturity and soundness of the new technologies. This highly correlates with immature technologies not being one of the main barriers towards digital technology adoption (identified by graph 7).

The risk of disruptive waves in business models gives an indication that traditional businesses will have to adapt to new waves of doing business and the use of emerging technologies and business models. And the balanced vote on the risk of job losses and social shifts due to increasing automation reflects the current popular-scientific discussion, which are far from agreeing opinions on the long-run impact of automation.

Aspects of a successful and sustainable business model

A lot of industries are being turned upside down by new entrants that are threatening ore totally driving out traditional businesses. To find answers how to cope with digital business models the respondents should respond to the following question: "How important are the following aspects of Industry 4.0 for a successful and sustainable business model?" (shown in graph 11). All listed aspects where identified as being important for a successful and sustainable business model. The individual responses on being "important" were weighted as follows: Expand digital services with additional customer benefit (78.8%). Strengthen the companies´ position towards new digital players (69.5%). Stronger digital networks with customers and partners (66.2%). Development and expansion of value-added services for example apps (63.6%). Efficient and safe cloud technologies (58.9%) and supplying solutions and systems rather than products (48.3%).

Company stakeholder actions to accelerate digital adoption

Graph 12 evaluates to what extent the survey participants agree or disagree on each listed action company stakeholders should take to spur digital technology implementation. The results are as follows: 43.0% strongly agree with increasing investments in further employee training. 35.8% strongly agree on developing better big data platforms. Over one third (34.4%) of respondents strongly agree that company stakeholders should create and collaborate on experimental platforms to test how the technologies work together. Also, over one third (33.8%) strongly agree with developing a common approach to address security issues was. Increasing investments in sensors and connectivity was as well strongly agreed upon (31.1%). To influence public policies to accelerate the adoption of digital technologies was not seen as important as the other actions. 19.2% strongly and 29.8% moderately agreed with this action.

Government actions to accelerate digital adoption

In addition to company actions, the survey identified main actions governments should take to support the acceleration of digital technologies (shown by graph 13). The survey participants rated each listed action by how strongly they agreed or disagreed. The outcome correlates with the previous responses towards security issues, education and training. 53.3% strongly agree with the provision of a regulatory framework (for example data protection laws). 45.7% strongly agree with investments in education and training programs. Further, 41.1% strongly agree on government collaborations with the private sector and other government to address issues such as trans-border data flow. The following three governmental actions had less participant agreement: Subsidize the IoT infrastructure (37.7% strongly agreed), establish and promote common standards (35.1%) and invest in long-term strategic R&D (34.4%).

Key Findings – Survey

The Work Project highlights key findings on what companies and employees should take into consideration to guarantee a successful transition from a 3.0 to a 4.0 enterprise. The conducted survey, with over 150 respondents, explores the opinions of digital natives on increasing digitization. It gives an indication on how a blueprint for digital readiness can look like. The survey responses can be pooled together and distilled into 5 key findings:

1. Constant disruption leads to change in business models

According to graph 6, 52.3% of respondents see the creation of new revenue streams through new products and services to be very important. In addition, 53.6% of respondents think that disruptive waves in business models are very likely to occur in association with the digital revolution (seen in graph 9). The fact that the survey participants are aware of disruptive waves in business models that threaten whole industries and the need for companies to create new revenue streams through new products and services implies the following: Constant disruption leads to change in business models. WhatsApp is a good example to illustrate the speed and extent of disruptive digital business models [3].

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[3] The company was founded in California in 2009 and was acquired by Facebook for 19 billion US dollars five years later. Back in 2015 more than one billion users sent about 250 million videos, 42 billion messages and 1.6 billion photos per day – with 57 engineers working for them. WhatsApp destroyed the hundred-billion-dollar Short Message Service (SMS) industry in a short period of time (Economist, 2015). According to Matzler et al. (2016) WhatsApp and other examples such as Netflix, Uber, Airbnb or Spotify show many similarities:

- Fast growth
  The market diffusion graph shows that WhatsApp only required one tenth the time the SMS needed to reach a volume of 20 billion messages per day. This phenomenon is referred to as 'big band disruption', sending shock waves towards long lasting players in different industries that have difficulties to cope with the pace of disruption (Downes & Nunes, 2013).
- Network effects that allow the winner to take it all
  A typical characteristic is the network effect. A lot of new digital business models take advantage of it to reach a monopoly position. This means the more users a service or product supplier has the more attractive the offer is for other users and creates barriers of entries for competitors (Hagiu, 2016).
- Zero marginal costs
  Digital products and services usually have marginal costs that go towards zero. Once they are produced the cost of producing any additional amount is nearly nothing. This economic principle has become the norm as the economy becomes more and more digitized. Scalability in production towards a price close to zero underlines the new digital business models.

The survey identified the respondents' opinions on a successful and sustainable business model (shown in graph 11). The three most important aspects identified are the expansion of digital services with additional customer benefits, the creation of stronger digital networks with customers and partners and the strengthening of one's position towards new digital players.

78.8% consider expanding digital services with customer benefit the most important aspect for a successful and sustainable business model. Companies can either place new innovative products in their current portfolio. Or they add so called evolutionary innovations to their current product and service setting. Innovative products create either an entirely new market or transform to expensive products into affordable ones to reach a bigger customer base. Newly created markets would be the tablet or smart-watch. And products turned from unaffordable for the average consumer are for example Fords` Model T or the PC. The second way of expanding the product portfolio are the evolutionary innovations which improve and further develop existing products. In the digital era, this is done through connected devices. The expansion through digital services can nicely be illustrated by breaking down the various steps of digital value chain. An excellent example is Nest, a home automation company that was bought by Google and is known for its programmable thermostats [4].

66.2% consider stronger digital networks with customers and partners important for a successful future business model. Networks must be established and expanded to generate new

[4] According to Curtis (2014) the value chain breaks down as follows: **Step 1**: The physical product is that is the basis of the value chain are thermostats. Usually thermostats are manually adjusted through a setting wheel. The value generated for the customer is the manual regulation of the temperature. **Step 2**: The thermostat is being equipped with sensors and actuators to make an analog product into a smart appliance. Now the thermostat can learn through data generation, can be programed by its users, is connected to the internet and adjusts the temperature inside automatically to the corresponding temperature outside. **Step 3**: In this step, the smart thermostat is further developed and upgraded with IP enabled sensors. Via the internet the product can now communicate and exchange data with other devices. Also, huge amounts of data can be collected and stores. **Step 4**: This accumulated data can now be constantly analyzed to produce valuable information. Data collected can for example be consumption habits. It can be used to provide consumption forecasts and optimize domestic energy use. This information can prepare a basis for new services to generate further revenue. **Step 5**: Based on the data collected new digital services can be created or the data can be connected to other sectors to generate more value. For example, the partnership between Nest and Whirlpool, a producer of home appliances. Through the integration of the Nest thermostat with the Whirlpool mobile app it is possible to increase efficiency and customer utility. One example is the automated start of the washing machine during a period of low network utilization and lower electricity.

customers and retain the current ones. Fast growth of digital products and services can be explained by the network effects. It develops when the utilization changes because of a changing number of customers. This effect can go both ways. A positive network effect increases the utility for the user with increasing customers that use the product or service. This phenomenon is referred to as a "virtuous cycle". Examples are social media channels like Facebook, Twitter, WhatsApp and other services such as Airbnb or Uber [5]

The next most important aspect of a sustainable and successful business model is to strengthen the company's position towards new digital players with 69.5% of participants valuating this aspect as being important.

2. Performance optimization through Industry 4.0

The combination of responses from graphs 6 and 8 which evaluated the questions "How important are following the benefits for companies through Industry 4.0?" and "How high or low will the following qualitative advantages be for a company?" lead to the following assumption: The survey respondents believe that the fourth industrial revolution will lead to performance optimization. Over 80% of respondents believe the following benefits created from Industry 4.0 initiatives are extremely or very important for a company: The optimization of asset utilization, reduced operational costs and worker productivity improvement. Also, the majority of respondents consider the following qualitative advantages to have a high impact on

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[5] The virtuous cycle and positive network effect of Uber can be explained as follows:

1) A higher number of Uber drivers (partners) makes the service more attractive for the potential users (customers). More drivers, shorter waiting times, higher satisfaction for customers, growing user base and therefore increasing recommendations to other people.

2) A higher number of Uber users (customers) makes the service more attractive for potential drivers (partners). They expect higher capacity and more business.

3) Data generated and provided within the service enhances positive network effects. Algorithms can predict hot spots with a lot of users and high capacity. The more drivers provide data the more precise the hot spot prediction will get. This will lead to more Uber drivers penetrating the areas with a high number of customers. The more drivers are present the more attractive the service gets for the customers and positive feedback will increase.

the company: Better planning and controlling for example in production and logistics (74.8%) and higher flexibility in production (60.3%).

These survey results imply that top and bottom line optimization can be made through automation of processes using Big Data, algorithms, sensors and artificial intelligence. For comprehensive reasons, it is important to mention the following two areas. They will enhance performance optimization and cost reduction in the future:

Process optimization

Sensors will be able to generate, distribute and analyze data in real-time. This will allow companies, especially the manufacturing industry, to optimize the production process, error detection and debugging. The automobile industry and its supply chain management are a good example to illustrate an efficient and customer oriented production. Car producers use RFID (Radio Frequency Identification) tags. These devices contain all specification details of the respective customer. These smart manufacturing initiatives enable companies to track all parts within the value chain and control production timing. Also, the costumer benefits by exactly knowing where his order is, thus increasing customer experience.

Predictive maintenance

By uniting digital and physical assets, smart factories will become more and more important to manufacturers around the world. Through real-time data analysis maintenance procedures will change. Waiting until an error or damage occurs is part of the past. Today the key word is 'predictive maintenance', meaning forecasting and preventing damages before they occur. The workflow of machines is tracked automatedly and analyzed for patterns. This will allow predictions on when parts could fail or a damage might occur. Knowing this beforehand will allow companies to proactively exchange parts and predictively maintain the machines. Higher capacity utilization and shorter downtimes will lead inevitably to higher productivity.

3. Empowered customers at the center of change

The fourth industrial revolution will lead to increasing empowerment and change the relationship between companies and customers. As the new digital era fosters transparency, customers gain power and the traditional way of pushing out products to the market will decrease. Instead, customers pulling products they want and need towards them will become the norm in the future and as well as an increasing digital peer-to-peer comparison [6]. Customer experience and satisfaction will be at the core of customer service. This means that products and services will be increasingly customized towards consumer needs – whether it is on a B2C or B2B basis.

One of the main benefits for companies created through Industry 4.0 is to enhance customer experience. 50.1% of the respondents see this as an extremely important benefit the can be created through the digital revolution (shown in graph 6). In addition, 67.5% mentioned higher customer satisfaction as a main qualitative advantage of the digital revolution. This correlates with listed advantages of Industry 4.0 (shown in graph 8): First, 51.7% saying that individualized products are a high qualitative advantage for a 4.0 enterprise. And second, 54.3% of respondents stating that higher quality will be reached through digital technology initiatives.

Summarized the survey sketches out an empowered customer who wants to increase his or her experience, satisfaction and benefits through individually produced and digitally upgraded products.

[6] According to Schwab (2016) increasing peer-to-peer comparison will put companies under pressure by making them take responsibility for bad quality products or services. Also, products will go from push to pull. This peer-to-peer comparison increases customer demand, shown by a report of the Institute of Customer Service. According to them, the percentage of customers who have problems with their product or service has decreased from 17% in 2008 to 11.7% just four years later. In the same period, the customers that took active steps to make a complaint increased from 72% to 76% (Hoong, 2013).

4. Unsolved data protection concerns and security threats

The McKinsey Global Institute (2015) identified data security issues that have the potential to destroy trust towards digital initiatives and business models if not assessed appropriately [7].

The survey participants also expressed their concerns, calling for increased data protection and the mitigation of security threats. Graphs 7 and 9 prove the tendency towards increasing privacy and security concerns within the digital future. When asked what the biggest barriers are that prevent the adoption of digital technology, privacy concerns and security concerns where at the top of the scale (with 118 and 101 responses respectively). This relates to the outcomes identified in graph 9, which identified the risks associated with Industry 4.0. Privacy concerns due to the availability of vast private data and security concerns due to the connectivity of the global network were identified as being the two most likely risks connected to the fourth industrial revolution. This implies that if not assessed correctly, these issues will greatly inhibit the successful realization of digital technology initiatives.

This is where public policy must interfere to ensure the protection of privacy rights of customers as well as companies. Regulatory frameworks will have to set limits on how private data is distributed throughout the global network. In addition, security threats within a company and a society are strongly associated with the digital revolution. These security threats must be

[7] The following privacy and security issues were identified by Manyika & Chui (2015):

1) Loss of control over private data because data that has been given to companies cannot easily be detected or deleted.

2) An information imbalance is created. Companies accumulate huge amounts of data and detailed information about their customers. In contrary, the corporations themselves are not very transparent. This fact does not build trust between customer and company.

3) Data analytics can also be flawed and may create wrong data forecasts on customers which can cause discriminating acts against the user. Underwriting companies may for example raise rates on certain insurances or completely terminate insurance contracts.

4) There is also a threat of illegal use of data through criminals. Flaws in security systems or hacked gateways may allow criminals to exploit generated data illegally.

contained to establish digital trust and make everybody profit from the fourth industrial revolution. The survey identified company and government actions that should be taken to make the digital transformation work (seen in graph 12 and 13). In graph 12, survey participants call for company stakeholder to create and collaborate on experimental platforms to test how the technologies may work together. This idea of an open architecture system can help to spur innovation, identify system risks and help optimize technological systems of various companies. A mentionable example is the OpenPOWER Foundation [8]. This leads to the second important company action: creating common security approaches to address user and customer concerns. Within an open platform system, companies can also address cybersecurity issues together and accumulate a pool of ideas on how to successfully mitigate security and privacy threats. Further, the public institutions should work together with the private sector to ensure sufficient protection and gain digital trust. In graph 13, the survey participants identified three main government actions that should be considered. First the provision of a regulatory framework, mainly data protection laws. Second, the collaboration with the private sector and other governments to address such issues. And finally, the establishment of common standards to streamline regulations and provide a firm legal framework.

5. Shift of competencies in the future job market imply further education and training

The survey identified opinions towards changing job competencies and skills, newly required models of education and a possible lack of skilled workers. Also, the respondents call for corporate and governmental actions to provide further training and investment in education programs. Graph 7 identified the lack of skilled workers (111 responses) as being the second biggest barrier towards the adoption of digital technologies. This correlates with the two

[8] According to the MIT Technology Review (2015) is a technology collaboration spanning over 170 technology companies (for example Google, Mellanox Technologies and NVIDIA). This open architecture platforms enables companies to work together on solutions and products. It also helps companies to rethink their technology approach as well as enhance collaboration on security and privacy concerns.

statements in graph 10, which reached the highest approval ratings among survey participants: 76.2% highly agree (agreement options high, medium or low) that new models of education and training will be required to meet the talent demand in the future digital job market. And 65.6% highly agree with the statement that the increasing use of digital labor will transform the mix of skills that are required from the future workforce.

Corporations and governmental institutions must respond immediately to approach the worries towards mismatching job competencies and possible technological unemployment. Graph 12 and 13 recommend the following measures to mitigate such risks: Companies must increase investments in further employee training and governments must invest in education (starting from formal school education) and training programs. The World Economic Forums ‘Future of Jobs Report’ should be mentioned, which evaluates the dynamics of the fourth digital revolution on the workforce, the skills demand and future job competencies [9]. It is important to mention that training activities should not only be borne by businesses. Governments have the obligation to help finance such programs and must help reform the school agendas to prepare the future employees and the domestic economy for the future digital job environment.

[9] The WEF Report states that about 35% of very important skills for the workforce in 2015 will have changed by 2020. The current digital revolution will have introduced advanced robotics, artificial intelligence (AI), autonomous driving, machine learning and advanced materials. Businesses should make sure that the workforce is able to adapt to the new emerging technologies that will be integrated into the business environment. And provide support to the workforce. They must learn the new skills that are needed to complementary the new technologies and avoid lay-offs. We must keep in mind that this process of adaptation will be different between the different employee groups. Studies suggest that the pressure of adjustment will be higher for low-paid and low-skilled workers (Bonin, et al., 2015). Specific training and qualification measures should be introduced to support the workforce that has the highest potential of being substituted by automated machines and processes.

Conclusion

The conducted survey indicates that we face many difficult challenges towards the digital future. When overcome and assessed correctly, the fourth digital revolution provides fundamental advantages contributing towards economic growth and prosperity. The Work Project has the task to increase the awareness of the current technological revolution we are in and trigger discussions on potential economic, societal and political impact. The following identified key findings create a list of indications and reference points to consider when tackling the corporate digital transformations:

1. Constant disruption leads to change in business models
2. Performance optimization through Industry 4.0
3. Empowered customers at the center of change
4. Unsolved data protection concerns and security threats
5. Shift of competencies in the future job market imply further education and training

The digital transformation of companies triggered by the fourth industrial revolution is a continuous process based on new and emerging technologies. Organizational structures, processes and employees will be heavily affected by these changes. Starting from threats from disruptive products or services, the way their production process is managed, the way they interact with customers, extend employee training and skill development, countermeasures towards technological unemployment and the way companies handle private and public data (which will be their most precious resource in the future).

Not only can we shape powerful minds, but also ask them to actively shape the future we will live in. A future of clear conscience and equal opportunities for all.

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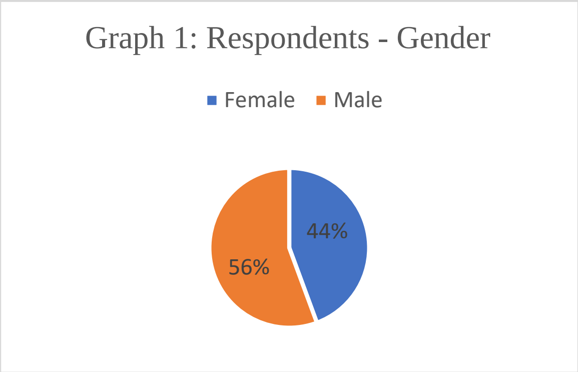
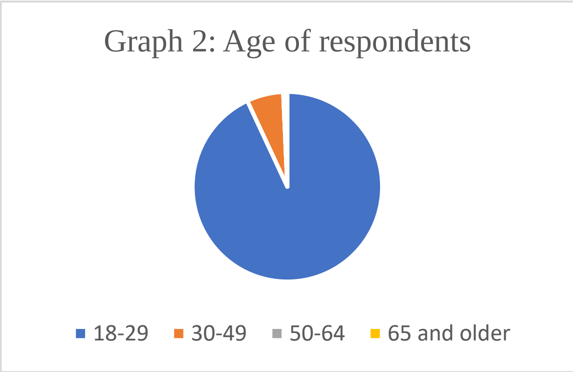
Appendix – Survey graphs





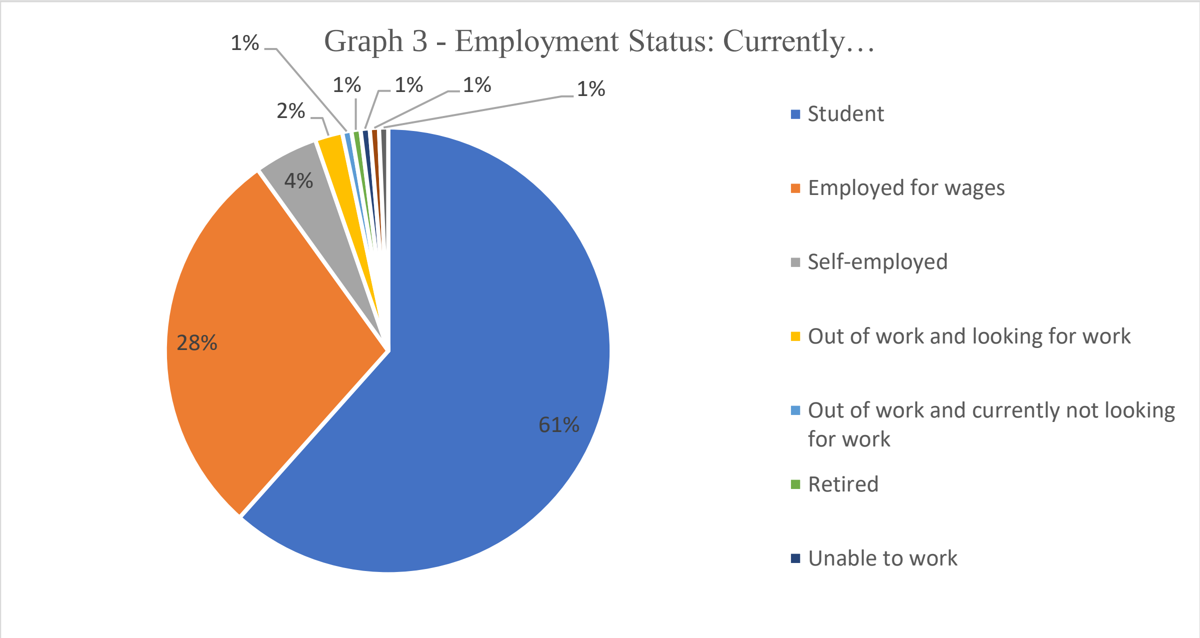
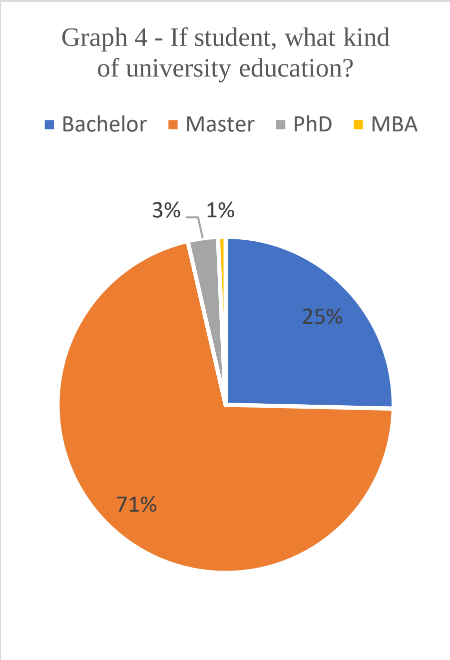
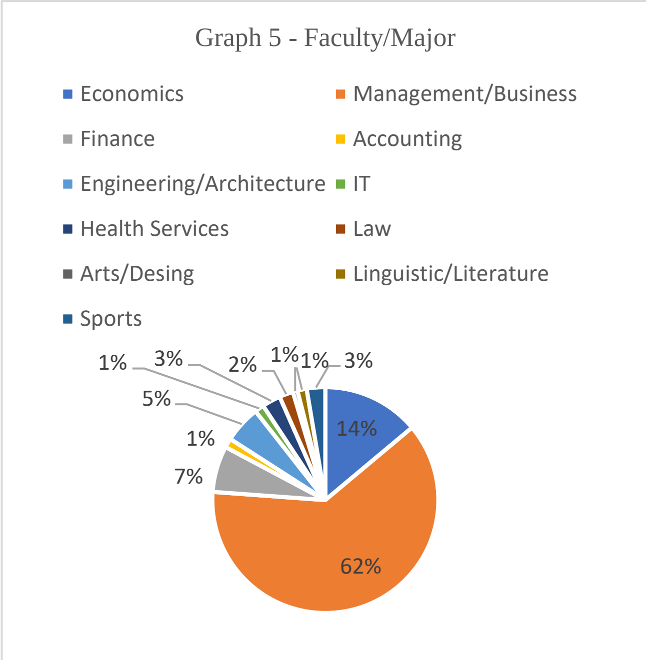
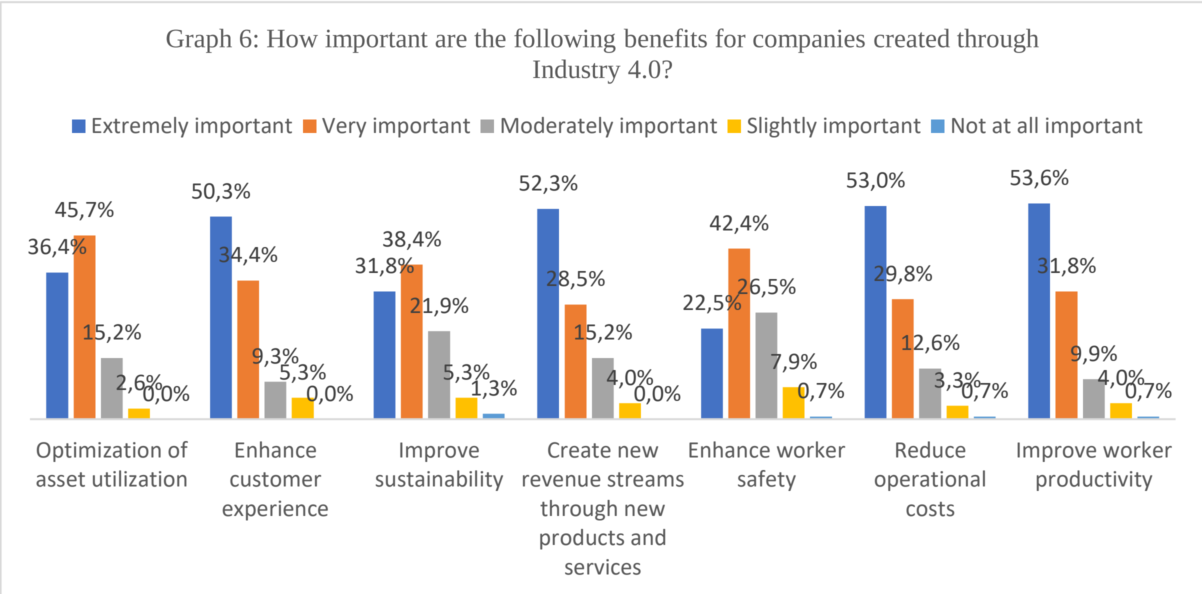


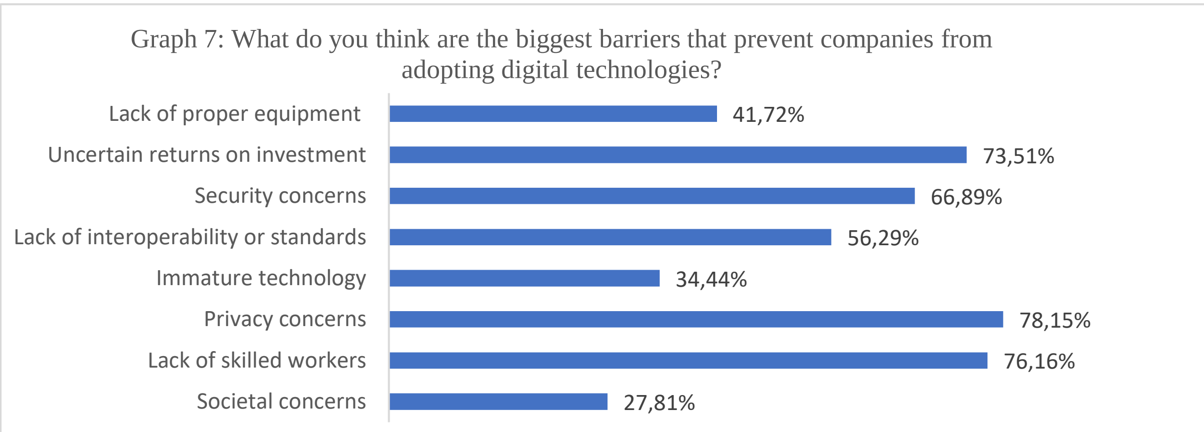
TABLE 1: COUNTRY OF ORIGIN OF SURVEY RESPONDENTS

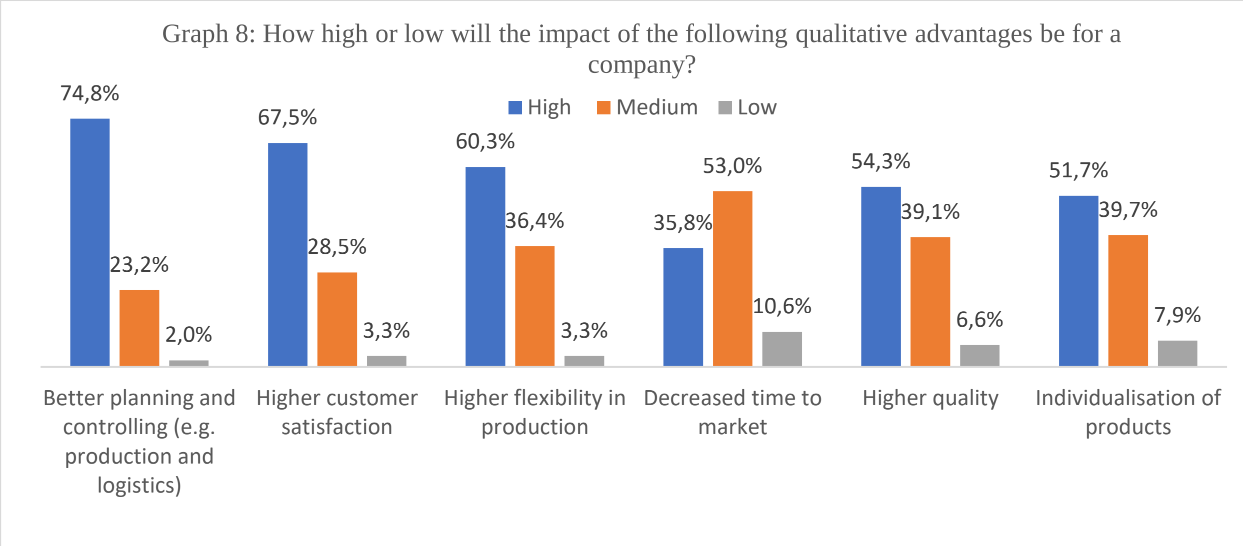
COUNTRY OF ORIGIN	Number of respondents
GERMANY	70
PORTUGAL	27
ITALY	24
FRANCE	11
SPAIN	4
RUSSIA	2
AUSTRALIA	1
AUSTRIA	1
BELARUS	1
BELGIUM	1
BULGARIA	1
BOLIVIA	1
FINLAND	1
IRAN	1
IRELAND	1
NAMIBIA	1
NORWAY	1
PAKISTAN	1
POLAND	1

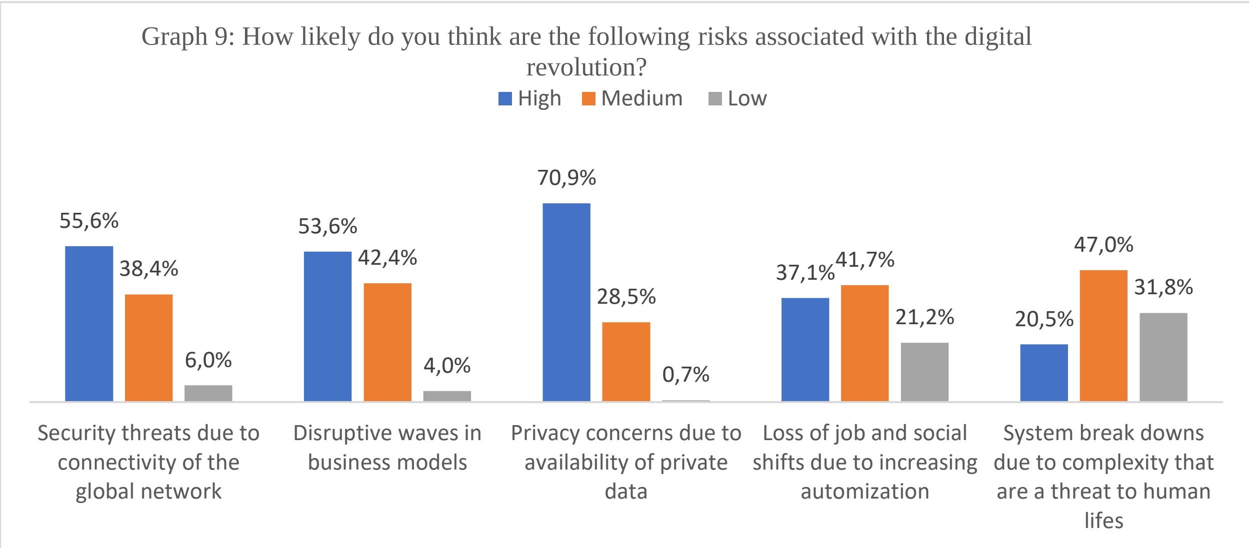

Graph 4 - If student, what kind of university education?
Bachelor
Master
PhD
MBA
3%
1%
25%
71%

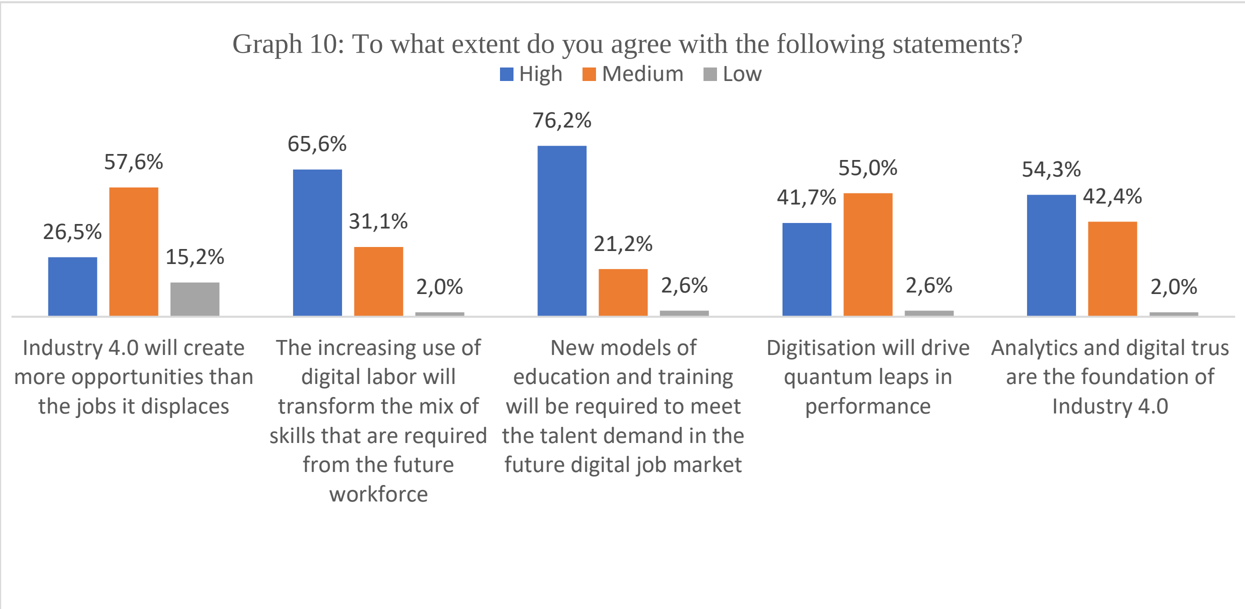

Graph 5 - Faculty/Major
Economics
Management/Business
Finance
Accounting
Engineering/Architecture
IT
Health Services
Law
Arts/Desing
Linguistic/Literature
Sports
1%
3%
2%
1%
1%
3%
5%
1%
7%
14%
62%


Graph 6: How important are the following benefits for companies created through Industry 4.0?
Extremely important
Very important
Moderately important
Slightly important
Not at all important
36,4%
45,7%
15,2%
2,6%
0,0%
50,3%
34,4%
9,3%
5,3%
0,0%
31,8%
38,4%
21,9%
5,3%
1,3%
52,3%
28,5%
15,2%
4,0%
0,0%
22,5%
42,4%
26,5%
7,9%
0,7%
53,0%
29,8%
12,6%
3,3%
0,7%
53,6%
31,8%
9,9%
4,0%
0,7%
Optimization of asset utilization
Enhance customer experience
Improve sustainability
Create new revenue streams through new products and services
Enhance worker safety
Reduce operational costs
Improve worker productivity

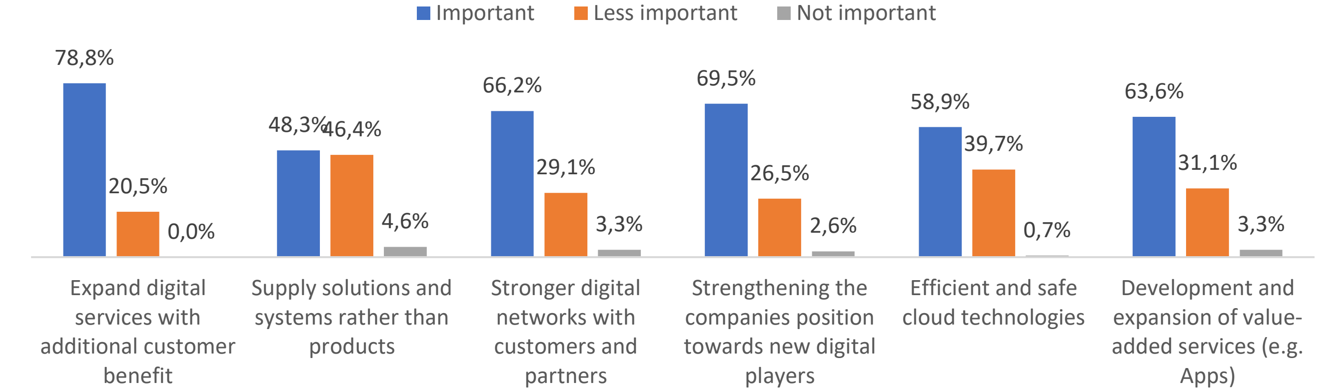

Graph 7: What do you think are the biggest barriers that prevent companies from adopting digital technologies?
Lack of proper equipment
41,72%
Uncertain returns on investment
73,51%
Security concerns
66,89%
Lack of interoperability or standards
56,29%
Immature technology
34,44%
Privacy concerns
78,15%
Lack of skilled workers
76,16%
Societal concerns
27,81%


Graph 8: How high or low will the impact of the following qualitative advantages be for a company?
High
Medium
Low
74,8%
23,2%
2,0%
67,5%
28,5%
3,3%
60,3%
36,4%
3,3%
35,8%
53,0%
10,6%
54,3%
39,1%
6,6%
51,7%
39,7%
7,9%
Better planning and controlling (e.g. production and logistics)
Higher customer satisfaction
Higher flexibility in production
Decreased time to market
Higher quality
Individualisation of products

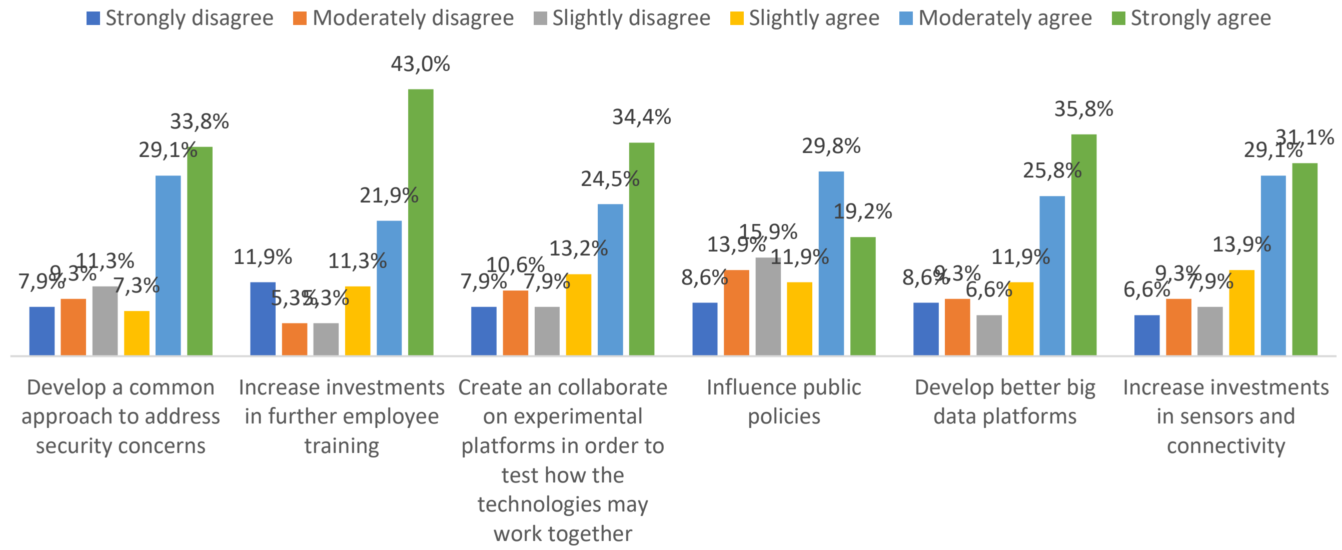

Graph 9: How likely do you think are the following risks associated with the digital revolution?
High
Medium
Low
55,6%
38,4%
6,0%
53,6%
42,4%
4,0%
70,9%
28,5%
0,7%
37,1%
41,7%
21,2%
20,5%
47,0%
31,8%
Security threats due to connectivity of the global network
Disruptive waves in business models
Privacy concerns due to availability of private data
Loss of job and social shifts due to increasing automization
System break downs due to complexity that are a threat to human lifes


Graph 10: To what extent do you agree with the following statements?
High
Medium
Low
26,5%
57,6%
15,2%
65,6%
31,1%
2,0%
76,2%
21,2%
2,6%
41,7%
55,0%
2,6%
54,3%
42,4%
2,0%
Industry 4.0 will create more opportunities than the jobs it displaces
The increasing use of digital labor will transform the mix of skills that are required from the future workforce
New models of education and training will be required to meet the talent demand in the future digital job market
Digitisation will drive quantum leaps in performance
Analytics and digital trus are the foundation of Industry 4.0

Graph 11: How important are the following aspects of Industry 4.0 for a successful and sustainable business model?



Graph 12: To what extent do you agree/disagree with the actions company stakeholders should take in order to accelerate the adoption of digital technolgy?



Graph 13: How strongly do you agree/disagree with tha actions governments should take to accelerate the adoption of digital technology?