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DS4AIR

DIGITAL SKILLS FOR THE AI REVOLUTION

An Erasmus+ KA2 Strategic Partnerships for Adult Education
Project Reference: 2020-1-MT01-KA204-074223

NEEDS ANALYSIS
PRESENTATION OF FINDINGS

SMART LEARNING

THE MALTA CHAMBER

B+P

SERC INTERNATIONAL

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Project Brief

The global workforce is today facing a critical period of jobs and skills instability. With a big portion of today's jobs set to disappear or become displaced by AI, robotics and automation, the world today requires a human workforce which possesses proficient digital skills. Pursuant to such predictions, the WEF has recently launched the 'Reskilling Revolution', aimed at providing better education, new skills and better work to a billion people by the year 2030. The DS4AIR project supports innovation through the design, development and evaluation of an online training course on Digital Skills in view of the Artificial Intelligence (AI) Revolution. This is aimed at improving and extending the reskilling of vulnerable adults in the workforce who possess a lower level of knowledge and digital competencies. Consequently, this will future-proof their careers vis-à-vis the anticipated shift and demands in digital skills.

In line with the WEF's initiative and as a proactive (rather than a reactive) measure, the project's objectives are:

- to establish the current state of affairs in the business industry in terms of AI readiness
- to identify the gaps between the required new digital skills and competencies and the demands of the labour market, in view of the Artificial Intelligence Revolution
- to create a learner persona defining the course's target audience
- to design and develop an online self-paced training course on digital skills for the Artificial Intelligence Revolution
- to reskill vulnerable adults whose jobs are threatened by the new technologies, hence ensuring their survival and prosperity in the job market
- to analyse the quality and impact (including the degree of satisfaction) of the course through a summative evaluation of the content and instructional design, vis-à-vis the expected learning outcomes
- to write a short recommendations document on digital skills for corporate training in the Artificial Intelligence Revolution

In terms of the project's expected impact, it is envisaged that the results will yield a high-quality digital learning environment, based on the needs and requirements of vulnerable adults in today's workforce. It is also expected that the digital competence of participating adults, will be enhanced, thus improving their careers prospects. Participating businesses will be equipped in terms of skilled labour to embrace the disruption brought about by emerging technologies and better placed to understand, assess and act upon the reskilling requirements posed by the foreseeable skills mismatch brought about by the Artificial Intelligence Revolution. In terms of the potential longer-term benefits, the online training course will become a valuable open education resource for re/upskilling for businesses and interested individuals around the world. Furthermore, the resulting recommendations document on digital skills for corporate training in the Artificial Intelligence Revolution will complement the Pan-European policy efforts in the popularisation of digital competencies, by providing evidence-based practice for future guidelines.

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1. Introduction

The review of literature underpinning this needs analysis revealed that without properly addressing the reskilling and upskilling requirements of the current workforce, the latter will be able to neither unleash its own potential nor critically determine or influence its own path and development in a 21st-century economy. Consequently, in response to the four fundamental questions emerging from the literature review, a needs analysis amongst businesses and employees (including those forming part of the target group for this project) was conducted between April and September 2021. This sought to (i) establish the current state of affairs in the business industry in terms of Artificial Intelligence (AI) readiness (ii) identify the gaps between the required new digital skills and competencies and the demands of the labour market and (iii) create a learner persona defining the course's target audience. In turn, this needs analysis will support the process of design and development of an online self-paced training course, aimed at the reskilling and upskilling of those vulnerable adults in today's workforce, in terms of digital skills for the AI revolution.

Drawing on the review of literature, the initial stages of the needs analysis comprised the identification of the target audience in line with the project objectives and the identification of their needs through surveys and interviews. The mixed methods approach allows for the conceptual and analytical integration of quantitative and qualitative data in order to better understand the underlying context being investigated. In this regard, two surveys were developed; one aimed at employees (comprising 5 digital skillsets – Information and Data Literacy, Tech Safety, Digital Content Creation, Communication and Collaboration and, Problem-solving) and one for employers (evaluating 4 strands - Transformation Readiness, Technical Readiness, Organisation Readiness, and Environmental Readiness). These were corroborated by a set of interviews with both employees and employers hailing from different industries.

2. Survey Findings

2.1 Employers

A total of 84 employers took part in the survey (Annex 1), with 52 participants working in Spain (61.9%), 29 in Malta (34.5%), 2 in Denmark (2.4%), and 1 in the United Kingdom (1.2%). The data shows that 19% of employers' companies were in the manufacturing sector, 9.5% each in the retail, technology, transportation and logistics sectors respectively, 4.8% each in healthcare and real estate, 2.4% in hospitality and 1.2% in tourism. The analysis of data focuses on the employers' perception and use of AI. The employers' readiness for the adoption and implementation of AI was examined. This included 4 different aspects; transformational, technical, organisational, and environmental readiness.

2.1.1 Transformational Readiness

Generally, the survey responses have shown that employers fully agree with the transformation capabilities of AI. The findings reveal that 78.6% of employers agree that AI will help improve the cost of operations in their companies, while 82.2% agree that AI solutions will help reduce their costs. Findings from the analysis have also shown that employers believe that the adoption of AI will open up new business opportunities (90.4%), while 79.8% of employers believe that the adoption of AI will increase their efficiency. In terms of assisting employees in their job, 91.7% of the employers taking part in the survey believe that the adoption of AI solutions will indeed help in this regard. Most of the employers (96.4%) were of the opinion and agreement that AI solutions will give their organisation a competitive advantage. To this extent, 76.2% believe that their company or organisation has a solid business case to adopt AI solutions, while 53.6% agreed that cross-functional groups are still discussing AI use cases within their organisation. Furthermore, 75% of employers agreed that possible AI solutions are in line with the organisation's overall strategy. It can therefore be concluded that employers are significantly in agreement with the transformation capabilities of AI.

2.1.2 Technical Readiness

Just like the transformational readiness of employers and their organisations, the technical decisions and readiness of adopting and implementing AI are key to a successful transition. Findings from the analysis have shown that 82.1% of the employers agreed that their organisations need systems similar to existing AI applications. Results reveal that 71.5% of the employers agreed that the data to be used or which is required by their organisation is already in digital form, while 46.4% agreed that they possess and have the legal framework to use the data they possess. In terms of owning data that can be processed by AI systems, 66.7% of employers agreed that their organisations already own it, while 64.3% agreed that the data belonging to their organisation can be modified in any format they require. As such, the technicalities and technical readiness involved in the adoption and implementation of AI by employers are adequate. However, the format, quality and volume of data required for the successful adoption of AI remain a key challenge for a number of survey respondents.

2.1.3 Organisational Readiness

The extent of organisational readiness toward the adoption and implementation of AI has been revealed to have a number of gaps that need to be addressed. The majority of the employers in the survey (86.9%) have revealed that top management in their organisations supports the adoption of AI solutions, while 77.1% agreed that the top management in their organisation is committed to becoming an AI-enabled organisation. Furthermore, 63.3% of the surveyed employers thought that their top management had a clear vision for an AI-enabled organisation. On the other hand, in terms of the allocation of funds and resources for AI projects, half of the employers in the survey (50%) agreed that they have allocated funds and resources to support AI projects. Findings show that a low portion of the employers in the survey (39.2%) agreed that they have the required hardware to undertake AI projects. Moreover, less than half of the total number of employers in the survey (46.4%) agreed that their organisation has the required human capital to undertake AI projects. These findings suggest that funds and resources are not effectively being allocated to promote AI-powered projects. Subsequently, organisations are less likely to possess the required hardware and

human capital to undertake the same projects. The organisational readiness of employers appears to be neither sufficient nor significant enough for the adoption, implementation, and promotion of AI. Therefore, more effort is required in preparing and making significant positive organisational decisions toward the attainment of an AI-enabled organisation.

2.1.4 Environmental Readiness

In terms of environmental readiness, findings show that there are significant inconsistencies or gaps in key decisions toward effectively implementing AI. For instance, less than half of the employers in the survey (40.5%) agreed that up till now, most of their competitors are implementing AI solutions. Thus, most of the employers (75%) agreed that if they do not implement AI solutions, they will lose their competitive advantage. However, less than half of the employers (36.9%) confirmed that their organisation has an AI strategy in place and 40.4% believed that their organisation is considering the use of AI to improve its customer experience process. Findings from the survey have also shown that 70.3% of employers are considering the use of AI to improve their decision-making process. However, the results also revealed that only 25% of the employers believed that government regulations and policies encourage the adoption of AI technologies. To this extent, only 47.7% were of the opinion that their business partners, industry experts or solution providers have been contacted to survey the AI solutions available on the market. These findings have shown that the level of environmental readiness among employers towards the adoption and implementation of AI solutions in their organisations is rather low.

2.2 Employees

A total of 234 employees took part in the survey (Annex 2), with 50.4% females, 49.1% males, and one gender non-conforming individual. In terms of age, 3.9% were between the ages of 16 to 25, 19.5% between the ages of 26 to 35 years, 30.4% between the ages of 36 to 45, 38.9% between the ages of 46 to 55, and 7.7% aged 56 and above. The respondents' educational backgrounds varied considerably; with 3.8% holding a doctorate, 36.8% holding a master's degree, 27.4% holding a post-secondary level certificate, 11.1% holding a secondary

level education, one individual holding a primary level education, and 4.7% of the employees had other forms of qualifications.

Most of the employees in the survey were from Malta (55.6%) and Spain (38.5%), while the remaining were from Denmark (4.3%) and other countries (1.7%). The results show that 10.3% of the employees worked in the healthcare sector, 4.3% in the hospitality and tourism sector, 11.1% in the manufacturing sector, 0.9% in real estate, another 0.9% in retail and tourism respectively, 4.3% in the technological sector, and 3.4% in transport and logistics. More than half of the employees in the survey (61.1%) had their company in a sector not listed in the survey. These included fields such as aviation, banking, construction and building service, customer care, education, financial services, food, public office (government), insurance, security training, research and education. Findings show that 7.3% occupied senior management positions, 17.9% were middle management, 12.8% were supervisors or team leaders, 16.7% of them occupied administration and secretarial positions, 20.5% occupied or worked as production or frontline or technical staff, 3% were self-employed, and the remaining 21.8% occupied other positions not listed in the survey.

In the coming five years, 29.9% of the surveyed employees had a target of upskilling their existing job and 47.9% were chasing a promotion within their department. Moreover, 11.2% had the intention of changing their career path and another 11.1% had other plans or goals. With regard to training, findings have shown that a little over a fifth of the employees (21.8%) have not received any training in the last 2 years. The training and continuous development of employees, in order to acquire new skills and competencies, is essential, especially in the world of AI which is continuously changing and implementing novel use-cases across different fields.

The analysis of data focuses on the employees' opinion and evaluation of their perception of information and data literacy, tech safety, digital content creation, communication and collaboration, and problem-solving issues relating to the adoption of AI.

2.2.1 Information and Data Literacy

Findings on employee knowledge about information and data literacy reveal that 96.1% agreed they were able to source information and browse, while 84.2% agreed they were able to evaluate the credibility of data, such as verifying if a piece of news is true or fake. Finally, 93.6% of the respondents agreed to be capable of managing the storage and organisation of information. These findings suggest that employees have a sufficient breadth of knowledge on information and data literacy.

2.2.2 Tech Safety

Results show that knowledge of security measures, such as the protection of devices, is not a major challenge among employees, as 92.3% of the employees agreed they were capable of protecting devices through the setting up of passwords. Also, employees possess the necessary know-how regarding the protection of personal data through the setting up and installation of antivirus programs to protect important files, with 80% agreeing to their capability of protecting such data. On the other hand, surveyed employees require training on health and wellbeing-related issues in the field of tech safety, as only 75.2% of employees agreed they were aware of the health and wellbeing issues related to the use of data.

2.2.3 Digital Content Creation

The analysis of findings unveils that the use and application of programming and coding, such as for writing simple programs, is an area in which employees are lacking and generally possess limited knowledge, as only 35.9% of the employees agreed that they could carry out simple programming and coding tasks. On the other hand, the respondents were significantly more knowledgeable in the areas of modification and refining of content, as well as the development of digital content to present to an audience, with 87.1% and 90.2% of employees having agreed they were capable of carrying out these respective tasks.

2.2.4 Communication and Collaboration

The online communication and collaboration level of employees has been revealed to be significantly adequate. Nearly all respondents (96.1%) were capable of interacting online, with 92.7% capable of sharing content, and 89.3% capable of collaborating in digital environments.

2.2.5 Problem-solving

Results show that the employees' ability to solve problems creatively using technologies is an area that necessitates significant attention, with only 60.7% of the employees being capable of solving problems through digital technologies. Employees need to be equipped with the right skills and resources to have the capacity and ability to utilise and apply different forms of technologies in solving problems. Findings have also revealed that the survey respondents are capable of identifying their digital skills and competency gaps, with about 86.3% of them being experienced in this area. Furthermore, 73.1% of surveyed employees are able to troubleshoot problems and 78.7% capable of solving technical problems online.

2.2.6 Skills

Further analysis on the skills personally possessed by employees reveals that the most common skill possessed by employees is that of teamwork, with about 94.4% of the employees giving it a rating of 5 and above (out of 7). Findings have shown that teamwork is essential among workers and employees in any organisation. Thus, teamwork can be regarded as a common skill possessed by essentially all surveyed employees. Other skills commonly possessed by respondents (and consequently being rated 5 and above out of 7) include self-management capacity (91.4%), communication (90.1%), initiative capacity (89.7%), customer support (89.4%), and citizenship skills (84.7%). Digital literacy has received the lowest rating (79.1%) among employees. One notable observation made from the findings is that employees ranked information and data literacy as the most important, while problem and digital content creation were ranked least important. This clearly shows that problem and digital content creation skills are not regarded as important among employees, despite their relevance and need. Other skillsets have also been revealed to be possessed by employees, but are not being

put to use or emphasised in their day-to-day jobs. These include analytical skills, creativity, and content creation.

The use of AI by employees in their daily lives has been revealed as not significant, as only 18.4% of the employees used it every day, 17.9% used it often, 22.2% used it occasionally, 26.1% rarely made use of it, and finally, 15.4% of the employees had never used it before. These figures and the general results of the distribution from the analysis show that AI is not being fully utilised by employees and their organisations, or else employees are not aware that they are actually using AI to accomplish their tasks. This could probably be attributed to a lack of either knowledge about or skills in making use of AI. In this regard, findings have also revealed that a significant number of employees in the survey have less trust in AI, as only 53.9% trust the use of AI while 22.6% think otherwise. These findings could most probably be attributed to the lack of knowledge and use of AI among respondents. However, a significant majority of the employees showed interest in and agreed to take training on AI (77.4%).

3. Interview Findings

3.1 Employers and Employees

Interviews with 4 employers and 9 employees (from diverse sectors, such as manufacturing and education, and in different countries; Malta, Spain and Denmark) were conducted, in order to further our understanding of the aims of the needs analysis (Annex 3). A thematic analysis of the resulting interviews' data provided the basis for the identification of 17 sub-themes revolving around 5 main themes; mainly (i) knowledge; (ii) AI readiness; (iii) benefits; (iv) challenges; and (v) skills.

3.1.2 Knowledge

Although most of the interview participants seemed to understand the meaning of the term AI, a number of interviewees showed limited knowledge in this regard. Interestingly, all the employers who were interviewed could explain the term, while three employees did not seem to know what the term means or what it implies.

Sub-theme (a) Knowledge - AI is data-based

Most of the participants are of the opinion that AI involves the intensive use of data to train computers to perform actions or make decisions like humans (or even better than humans). Employee 4 noted that "*Artificial Intelligence requires intensive use of data in order to extract information*", while employer 3 further explained that the machine "*learns*" from the data and "*applies that learning to the future*".

Sub-theme (b) Knowledge - Limited knowledge of AI

Three interviewees, which happened to be all employees, showed limited knowledge of and about AI. Employee 5 stated that "*What is Artificial Intelligence in general.. what is it specifically? I don't know*". Another interviewee, employee 6 believes that "*AI is a technology that is coming*", and not one that is already being currently in use in various contexts and across different sectors.

3.1.3 AI Readiness

The result of the analysis revealed that the majority of the interviewees or their staff/colleagues are ready to embrace AI. Employee 2 confirmed that "*we are AI-ready, I am not worried about that*". Similarly, employer 3 stated that within his organization one finds, "*a team that is … gurus and engineers, that are more than ready to adopt AI*". Employee 9's organisation is already utilising AI and is "*adapting and pushing AI*" into other business departments of the same company.

Sub-theme (a) AI Readiness - Preparing to be AI-ready

Although a number of interviewees do not consider themselves AI-ready (as yet), they are preparing to embrace AI through the provision of training and development of their staff. Employee 6 stated that "*we are more than aware and mentally prepared to know that this is what is coming, but we are certainly not prepared in terms of training. But we will train ourselves*". Similarly, employer 4 stated that "*we already are investing in training, to be more knowledgeable in this aspect, so we're taking steps towards implementing it*".

3.1.4 Benefits

The interviewees identified several benefits of AI such as automation, resource efficiency, enhancing customer support and experience, research, and product improvement.

Sub-theme (a) Benefits - Automation

Six interviewees identified automation as a key benefit of AI. Employee 7 stated that "*we're also trying to have a bot to perform customs clearance - so to input the declarations automatically, instead of a human being basically*". Similarly, employee 8 believes that AI can help in communication via a chatbot by catering "*for other languages without having to employ someone who speaks that language natively*".

Sub-theme (b) Benefits - Resource efficiency

Seven interviewees identified resource efficiency as another important benefit of AI. Employee 5 believes that AI "*helps save time*", while employee 3 is of the opinion that AI makes buildings become "*much more efficient to run*" and "*minimizes wastages*". Employee 4 stated that AI "*saves printing materials*" by detecting printing defects faster, that would have been "*otherwise gone wasted*".

Sub-theme (c) Benefits - Enhancement of customer support and experience

Seven interviewees also identified customer support and experience as a particular field in which AI has the potential to play a major role. Employee 6, who works in the education sector, believes that AI would help "*personalize the learning process*", while employer 1 maintains that AI would help in the tourism industry by improving "*the user experience and personalization*" of customers.

Sub-theme (d) Benefits - Product improvement

Improvement of existing products is also considered to be a key benefit of AI for a number of interviewees. Employee 2 argued that AI provides "*the opportunity to put some added predictive functionalities to our platform*", while employer 1 believes that AI helps improve games from being an individual/solo endeavour to "*the interaction of several users at the same time*".

Sub-theme (e) Benefits - Research

Employee 2 was of the opinion that AI helps with "*market research*". Similarly, employee 8 stated that AI can be used for the "*analysis, interpretation and representation of large data sets*" and consequently improve the research endeavours of the organisation.

Sub-theme (f) Benefits - Business growth

A number of interviewees were of the opinion that AI has already helped their business grow. To this extent, employee 1 stated that it is "*motivating to see how our business is growing*". Employee 7 argued that creating AI-based solutions lead to substantial business growth and

added that "*when you create something like this, the company grows because clients will be more satisfied*".

3.1.5 Challenges

The findings from the thematic analysis reveal a number of challenges in the business industry's quest to adopt and successfully deploy AI in its own context.

Sub-theme (a) Challenges - Human resources

Employer 4 mentioned that "*there is going to be a problem, finding people to work in AI locally in the future*". Employer 3 referred to the existence of a "*big resource gap, which is good technicians, good engineers with the hands-on experience to*" work with AI. It is important to note that a number of employers mentioned that the remuneration of the available skilled personnel is also a challenge to the business industry. Employer 1 argued that "*if the market at a given moment demands these profiles, it is more difficult for us to find them, in terms of salary*".

Sub-theme (b) Challenges - Data

The findings from the analysis revealed another major challenge; that is the quality, management, privacy, and security of the data. Employee 3 mentioned that "*Artificial Intelligence is only as intelligent as the data that it is being fed*". Also, because of the massive quantity of data required, its quality plays a critical role. Employee 3 confirmed that "*there are huge challenges when it comes to the quality of that data*". Furthermore, employee 5 argued that "*many individuals find it difficult to give out their data because of the fear of security*". Employer 3 mentioned that "*there is a huge implication, obviously on the security of this data and accessibility*". A number of interviewees also face challenges in the management of data. Employer 2 argued that "*it is one thing to obtain information and another to know how to make the most of it*".

Sub-theme (c) Challenges - Need for upskilling and reskilling

The thematic analysis reveals the need for upskilling and/or reskilling across the board. Employee 6 confirmed that "*a very obvious challenge is, on the one hand, the training of the teaching staff that we have here*". This was echoed by employee 8 who stated that the "*important thing is making that training relevant to the task of the individual*". Furthermore, since technology is gradually and consistently evolving, there is a dire need for continuous training in this regard. Employee 6 noted that "*we have to embrace AI into teaching more - these qualified people, although they all have engineering and software background since AI keeps evolving - I think we need to invest into teaching these qualified people more about AI*". Employer 3 further observed that in their organisation "*we have the knowledge of the company, what we lack is the knowledge of the software*".

Sub-theme (d) Challenges - Need for collaboration

Employee 2, who works in the media sector, mentioned that "*we need cooperation - I think we need to use each other's core competencies*" within and beyond the organisation's capabilities. Employer 3 reiterated that "*we need to enter into cooperation with AI partners*".

3.1.6 Skills

The need for upskilling and/or reskilling was a common concern for most interviewees. They argued that a number of novel skillsets across fields will be required in the near future; including in areas such as data analytics, visualisation, programming and mathematics.

Sub-theme (a) Skills - Data analytics

Six interview participants believed that data analytics is a core skill crucial to the successful adoption and implementation of AI. Employer 5 argued that, "*if you're looking at what skills you need from the future labour market, you need people that are conversant with data*". Also, Employee 4 mentioned that "*for me in particular, I still have a lot of training to do, especially in advanced big data*". This was echoed by employee 1 who argued that "*we need to work a lot on analytical skills, on knowing how to interpret data; and this is more complex*".

Sub-theme (b) Skills - Visualisation

A number of interviewees were of the opinion that there is a need for employees to learn data visualization skills. Employer 1 argued that "*I would like to get tools like Power BI, I would like to get to know them more*". Employee 8 believes that being conversant with spreadsheet software is a necessary prerequisite for understanding AI. In this regard, employee 8 confirmed that "*you need to make sure that you can use MS Excel to facilitate the task that you are responsible for; so for me, that is the most important thing*".

Sub- theme (c) Skills - Programming

Interview participants also identified programming as a required skill that is key to the AI revolution. Employee 7 argued that "*learning hard skills, like programming*" is crucial. Employer 3 confirmed that "*I guess it would mean programming skills and finding people conversant enough on programming*". However, employer 4 mentioned the "*a growing demand, a very large demand for digital profiles, which is not going to be able to absorb the current supply, not by a long shot*".

Sub-theme (d) Skills - Mathematical skills

Few interviewees acknowledged that mathematical skills are one of the key skillsets that are required in view of the adoption of AI. In this regard, employer 3 said that "*you need people that are conversant with data, that have the mathematical skills*".

4. Learner Persona

4.1 Introduction

The learner persona gives indications and determines in which area of skills and competencies a particular demographic (classified according to occupation, education level and age) needs training. Here, the focus is given to those skills and competencies which are significantly different among the employees. This has been thematised based on the demographic information of the employees.

4.1 Occupation

A one-way ANOVA was conducted in order to examine and compare the differences in skills and competencies among employees of different occupations (Table 1).

Table 1 - ANOVA result for differences attributed to the occupation of employees

		Sum of Squares	df	Mean Square	F	Sig.
Information and data literacy	Between Groups	3.414	6	0.569	1.743	0.112
	Within Groups	74.128	227	0.327		
	Total	77.543	233			
Tech safety	Between Groups	2.634	6	0.439	0.854	0.530
	Within Groups	116.707	227	0.514		
	Total	119.341	233			
Digital content creation	Between Groups	2.046	6	0.341	0.517	0.795
	Within Groups	149.687	227	0.659		
	Total	151.733	233			
Communication and collaboration	Between Groups	2.464	6	0.411	1.381	0.223
	Within Groups	67.513	227	0.297		
	Total	69.976	233			
Problem-solving	Between Groups	5.523	6	0.921	1.063	0.385
	Within Groups	196.487	227	0.866		
	Total	202.010	233			

Results from the ANOVA analysis conducted above have revealed that there is no significant difference in skills and competencies among employees of different occupations, ($p < 0.05$). This implies that one cannot determine which particular occupation group needs training or the specific area of training required.

4.2 Education level

Another ANOVA analysis was conducted to examine the differences in skills and competencies among employees with different educational backgrounds. Findings (Table 2) have revealed that there is a significant difference in digital content creation skills among employees with different educational backgrounds, $F(6, 227) = 3.463$, $p < 0.05$.

Table 2 - ANOVA result for differences attributed to the educational level of employees

		Sum of Squares	df	Mean Square	F	Sig.
Information and data literacy	Between Groups	3.917	6	0.653	2.013	0.065
	Within Groups	73.626	227	0.324		
	Total	77.543	233			
Tech safety	Between Groups	5.647	6	0.941	1.879	0.085
	Within Groups	113.695	227	0.501		
	Total	119.341	233			
Digital content creation	Between Groups	12.723	6	2.120	3.463	0.003
	Within Groups	139.010	227	0.612		
	Total	151.733	233			
Communication and collaboration	Between Groups	3.634	6	0.606	2.072	0.057
	Within Groups	66.343	227	0.292		
	Total	69.976	233			
Problem-solving	Between Groups	9.396	6	1.566	1.845	0.091
	Within Groups	192.614	227	0.849		
	Total	202.010	233			

The descriptive summary statistics (Table 3) shows the mean or average level of digital content creation among employees with different educational backgrounds. Data shows that employees with post-secondary level have the least level of skills with regard to digital content creation.

Table 3 - Descriptive statistics for the distribution of skills and competencies according to the educational level of employees

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Digital content creation	Doctorate	9	4.1481	0.66898	0.22299	3.6339	4.6624	3.33	5.00
	Master's degree	86	4.1202	0.67816	0.07313	3.9748	4.2656	2.00	5.00
	Undergraduate degree	37	4.0360	0.81945	0.13472	3.7628	4.3093	2.33	5.00
	Post-secondary level	64	3.5859	0.90120	0.11265	3.3608	3.8111	1.67	5.00
	Secondary level	26	3.9744	0.74787	0.14667	3.6723	4.2764	2.00	5.00
	Primary level	1	5.0000	.	.	.	.	5.00	5.00
	Other	11	3.8939	0.83757	0.25254	3.3313	4.4566	2.33	5.00
	Total	234	3.9387	0.80698	0.05275	3.8348	4.0427	1.67	5.00

4.3 Age

To examine the differences in skills and competencies among the employees, another ANOVA analysis was further conducted to investigate which particular skills and competencies need improvement and among which demographic group of employees (categorised by age). Findings from the analysis (Table 4) have shown that there is a significant difference in digital content creation and problem-solving among employees of different age groups, ($p < 0.05$). This means that the levels of digital content creation and problem-solving skills are significantly different among different age groups.

Table 4 - ANOVA result for differences attributed to the age of employees

		Sum of Squares	df	Mean Square	F	Sig.
Information and data literacy	Between Groups	2.620	4	0.655	2.002	0.095
	Within Groups	74.922	229	0.327		
	Total	77.543	233			
Tech safety	Between Groups	2.592	4	0.648	1.271	0.282
	Within Groups	116.749	229	0.510		
	Total	119.341	233			
Digital content creation	Between Groups	6.561	4	1.640	2.587	0.038
	Within Groups	145.172	229	0.634		
	Total	151.733	233			
Communication and collaboration	Between Groups	1.003	4	0.251	0.833	0.506
	Within Groups	68.973	229	0.301		
	Total	69.976	233			
Problem-solving	Between Groups	25.848	4	6.462	8.400	0.000
	Within Groups	176.162	229	0.769		
	Total	202.010	233			

Descriptive statistics show the average and mean levels of these two skillsets among the different age groups (Table 5). It can be observed that the digital content creation skill is higher among employees of age 16 to 26 and lower among employees of age 56 and above. However, problem-solving skills are significantly higher among employees who are16 to 25 years old, but low among employees of age 56 and above.

Table 5 - Descriptive statistics for the distribution of skills and competencies according to the age of employees

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Digital content creation	16-25	9	4.3333	0.66667	0.22222	3.8209	4.8458	3.33	5.00
	26-35	45	4.1667	0.60511	0.09020	3.9849	4.3485	3.00	5.00
	36-45	71	3.9531	0.86059	0.10213	3.7494	4.1568	1.67	5.00
	46-55	91	3.8407	0.80312	0.08419	3.6734	4.0079	2.00	5.00
	56+	18	3.6111	0.95828	0.22587	3.1346	4.0877	1.67	5.00
	Total	234	3.9387	0.80698	0.05275	3.8348	4.0427	1.67	5.00
Problem-solving	16-25	9	4.5833	0.43301	0.14434	4.2505	4.9162	3.75	5.00
	26-35	45	4.4315	0.62923	0.09380	4.2424	4.6205	2.50	5.00
	36-45	71	4.0751	0.88474	0.10500	3.8657	4.2845	1.00	5.00
	46-55	91	3.9057	0.98132	0.10287	3.7013	4.1100	1.00	5.00
	56+	18	3.1389	0.96338	0.22707	2.6598	3.6180	1.00	4.25
	Total	234	4.0253	0.93113	0.06087	3.9054	4.1452	1.00	5.00

5. Conclusion

The survey results suggest that the overall transformational and technical readiness involved in the adoption and implementation of AI by employers is adequate. However, the format, quality and volume of data required for the successful adoption of AI remain a key challenge for a number of survey respondents. Furthermore, it appears that funds and resources are not effectively being allocated to promote AI-powered projects. Subsequently, organisations are less likely to possess the required hardware and human capital to undertake the same projects. In this regard, the organisational readiness of employers appears to be neither sufficient nor significant enough for the adoption, implementation, and promotion of AI. Furthermore, the level of environmental readiness among employers towards the adoption and implementation of AI solutions in their organisations appears to be rather low.

Survey responses amongst employees reveal that 27.35% of employees with a post-secondary level education possess limited skillsets and competencies in digital content creation (with a total mean or average level of skill of 3.59) vis-à-vis the other employees. The results also show that digital content creation and problem-solving skills are significantly lower or lesser among employees of age 56 years and above (7.69%), and significantly higher among young employees of age 16 to 25 years (3.85%). Consequently, digital content creation and problem-solving skills have been generally observed as the two skillsets and competencies which significantly differ among employees, both in terms of educational background and age. Both problem-solving and digital content creation were rated 4th and 5th respectively (out of five skills and competencies) when employees were asked to rate and rank them based on the perceived order of importance. Therefore, it is evident that problem-solving and digital content creation require particular attention as they significantly differ among the demographic characteristics of employees and at the same time are perceived to be less important by the same employees, when compared to other skills and competencies.

Furthermore, the thematic analysis of the interview responses shows that most of the interviewees knew the meaning and implications of the term AI. The findings reveal that employers were more knowledgeable about AI when compared to employees. Most of the

interview participants were able to identify ways in which AI is or could be beneficial to their sector; including automation, resource efficiency, enhancing customer support and experience, research, and product improvement. On the other hand; scarcity of talent, high remuneration packages, data challenges, the need for upskilling and reskilling and collaboration are considered to be the major challenges to the successful adoption and implementation of AI. Furthermore, findings suggest that there is a need for specialised skillsets; such as data analytics, visualisation, programming and mathematical skills.

6. Annex 1 – Employer Survey

DS4AIR Employer Survey

This survey is part of the Erasmus+ KA2 project, entitled 'Digital Skills for the Artificial Intelligence Revolution' (DS4AIR), which is co-funded by the European Union (Reference Number: 2020-1-MT01-KA204-074223). The DS4AIR project aims at creating a high-quality digital learning environment, for adults in today's workforce vis-à-vis the disruption brought about by emerging technologies, in particular the Artificial Intelligence Revolution. More information can be found at http://www.ds4air.com

The purpose of this survey is to establish the current state of affairs in the business industry in terms of AI Readiness, while identifying the gaps between the required new digital skills and competencies and the demands of the labour market, in view of the Artificial Intelligence Revolution.

The survey should not take more than 15 minutes to complete. Your responses will always remain confidential and anonymous and we will not be able to identify individuals from their responses. We will not be collecting personal data from this form and your responses will only be used for the expressed purpose of the project. Your participation is extremely valuable to us, and your time is greatly appreciated.

Profile	
Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals (European Commission 2018) Today, AI is used in most of the things around us, like air conditioners, ovens, fridges and coffee machines. Video games also use AI when you play against the computer! Other forms of entertainment such as streaming services, like Netflix, use AI to display a selection of movies which you will enjoy.	
1.	**Select your Country of Employment**
	Denmark
	Malta
	Spain
	United Kingdom
	Other (go to Q2)
2.	**If your answer to Q1 is 'Other', please specify your answer here**
	Enter your answer
3.	**Select the primary sector of your business**
	Healthcare
	Hospitality / Tourism
	Manufacturing

	Maritime
	Real Estate
	Retail
	Tech Companies
	Tourism
	Transport / Logistics
	Other (go to Q4)
4.	**If your answer to Q3 is 'Other', please specify your answer here**
	Enter your answer

Transformational Readiness

5. Do you agree or disagree with the follow statements

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	When compared to other technologies, AI is the one that will help me improve my operations						
	AI solutions will help me reduce costs.						
	AI solutions will open up new business opportunities for me.						
	AI solutions will help me increase my income.						
	AI solutions will help me increase efficiency.						
	AI solutions will assist my employees in their job.						
	AI solutions will give my organization a competitive advantage.						
	The organization has a solid business case to adopt AI solutions.						
	Cross-functional groups have been discussing AI use cases within my organization.						
	Possible AI solutions are in line with the organization's overall strategy.						

Technical Readiness

6. Do you agree or disagree with the follow statements*

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	The organization needs systems similar to existing AI applications.						
	The organization already owns a lot of data that can be processed by AI systems.						
	The data belonging to the organization can be modified in any format we require.						

	The data we're going to use is already in digital form.						
	From a legal perspective, we have all the rights to use the data.						

Organisation Readiness

7. Do you agree or disagree with the follow statements*

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Top management supports the adoption of AI solutions.						
	Top management is committed to becoming an AI-enabled organization.						
	Top management has a clear vision for the AI-enabled organization.						
	Top management allocated funds and resources for AI projects.						
	The organization has the required hardware to undertake AI projects.						
	The organization has the required human capital to undertake AI projects.						

Environmental Readiness

8. Do you agree or disagree with the follow statements

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Most of our competitors are implementing AI solutions.						
	If we don’t implement AI solutions, we will lose our competitive advantage.						
	The organization has an AI strategy in place.						
	The organization is considering the use of AI to improve its customer experience process.						
	The organization is considering the use of AI to improve its decision-making process.						
	Government regulations and policies encourage the adoption of AI technologies.						
	Business partners, industry experts or solution providers have been contacted to survey the AI solutions available on the market.						

7. Annex 2 – Employee Survey

DS4AIR Employee Survey

This survey is part of the Erasmus+ KA2 project, entitled 'Digital Skills for the Artificial Intelligence Revolution' (DS4AIR), which is co-funded by the European Union (Reference Number: 2020-1-MT01-KA204-074223). The DS4AIR project aims at creating a high-quality digital learning environment, for adults in today's workforce vis-à-vis the disruption brought about by emerging technologies, in particular the Artificial Intelligence Revolution. More information can be found at http://www.ds4air.com

The purpose of this survey is to establish the current state of affairs in the business industry in terms of AI Readiness, while identifying the gaps between the required new digital skills and competencies and the demands of the labour market, in view of the Artificial Intelligence Revolution.

The survey should not take more than 15 minutes to complete. Your responses will always remain confidential and anonymous and we will not be able to identify individuals from their responses. We will not be collecting personal data from this form and your responses will only be used for the expressed purpose of the project. Your participation is extremely valuable to us, and your time is greatly appreciated.

Profile	
Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals (European Commission 2018) Today, AI is used in most of the things around us, like air conditioners, ovens, fridges and coffee machines. Video games also use AI when you play against the computer! Other forms of entertainment such as streaming services, like Netflix, use AI to display a selection of movies which you will enjoy.	
1.	**Select your Country of Employment**
	Malta
	Spain
	United Kingdom
	Other (go to Q2)
2.	**If answer to Q1 is 'Other', Please specify your answer below**
	Enter your answer
3.	**Select the primary sector of your business**
	Healthcare
	Hospitality / Tourism
	Manufacturing
	Maritime

	Real Estate
	Retail
	Tech Companies
	Tourism
	Transport / Logistics
	Other (go to Q4)
4.	**If answer to Q3 is 'Other', Please specify your answer below**
	Enter your answer
5.	**Select your role within the organisation**
	Senior Management
	Middle Management
	Supervisor / Team Leader
	Administration / Secretarial
	Production / Front Line / Technical
	Self Employed
	Other (go to Q6)
6.	**If answer to Q5 is 'Other', Please specify your answer below**
	Enter your answer
7.	**What gender do you identify as?**
	Female
	Male
	I don't want to mention
	Other (go to Q8)
8.	**If answer to Q7 is 'Other', Please specify your answer below**
	Enter your answer
9.	**Age Range**
	16-25
	26-35
	36-45
	46-55
	56+
10.	**What is the highest level of education that you have completed?**
	Primary Level
	Secondary Level
	Post-Secondary Level
	Undergraduate Degree (Tertiary)
	Masters Degree (Tertiary)
	Doctorate
	Other (go to Q11)
11.	**If answer to Q10 is 'Other', Please specify your answer below**
	Enter your answer

12.	What are your goals for the next five years?
	Upskill existing job
	Promotion within department
	Promotion within another department
	Change career path
	Other (go to Q13)
13.	**If answer to Q12 is 'Other', Please specify your answer below**
	Enter your answer
14.	**Have you participated in training in the past 2 years?**
	Yes
	No

Skills and Competencies

15. How comfortable do you feel around the topic of 'Information and Data Literacy'?*

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Browsing Example: I can look for information on Google						
	Evaluating credibility of data Example: I can verify if a news is true or false						
	Managing the storage and organisation of information Example: I can store my photos online						

16. How comfortable do you feel around the topic of 'Tech Safety'?*

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Protecting Devices Example: I can set up a password to protect my mobile device						
	Protecting Personal Data Example: I can set up an antivirus program to protect my files						
	Health and Wellbeing Example: I can limit the screen time for myself and those around me						

17. How comfortable do you feel around the topic of 'Digital Content Creation'?*

		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Developing digital content to present for an audience Example: I can prepare a presentation using PowerPoint						
	Modifying and refine digital content for presenting to an audience Example: I can edit/add to a document						

	Programming and Coding Example: I can write simple programs						

18.	How comfortable do you feel around the topic of 'Communication and Collaboration'?*						
		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Interacting online Example: I can chat with my friends online						
	Sharing content online Example: I can share photos online						
	Collaborating on content online Example: I can work with my colleagues online						

19.	How comfortable do you feel around the topic of 'Problem Solving'?*						
		Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree	Don't understand the question
	Solving Technical Problems Online Example: I can solve issues related to my social media account						
	Troubleshooting Problems Example: I can solve issues related to my webcam						
	Solve problems creatively using technologies Example: I can draw using my computer						
	Identifying Digital Skills and Competency Gaps Example: I can identify areas in which I need to improve						

Miscellaneous

20.	Rate the level of skills you personally possess (1 being do not possess to 7 highly proficient)*							
		1	2	3	4	5	6	7
	Communication Skills							
	Customer Services							
	Using Initiative							
	Team Working							
	Citizenship							
	Digital Literacy							
	Self Management							

21.	Rank the following skills in order of importance to you*
	1 Digital Content Creation
	2 Problem Solving

	3 Information and Data Literacy						
	4 Communication and Collaboration						
	5 Safety						
22.	**Are there any areas / skills you feel have not been included? (Please do not provide any personal details)***						
	Enter your answer						
23.	**What skills do you have which you feel are not being used to their full extent in your employment? (Please do not provide any personal details)***						
	Enter your answer						
24.	**Select the most appropriate answer from the list***						
		Everyday	**Often**	**Occasionally**	**Rarely**	**Never**	**I cannot answer this question**
	How often do you use Artificial Intelligence in your life? Examples: Siri, Alexa, Google Assistant						
25.	**Select the most appropriate answer from the list***						
		Strongly Agree	**Somewhat Agree**	**Neither Agree or Disagree**	**Somewhat Disagree**	**Strongly Disagree**	**I cannot answer this question**
	I trust Artificial Intelligence						
	I would like to take training about Artificial Intelligence						

8. Annex 3 – Interview Questions

A. EMPLOYERS

(i) Initial Questions

1. What is the business sector that your organisation currently operates in?
2. What is your role within your organisation?
3. How old are you? (or How long have you been working in this role?)

(ii) Core Questions

1. What do you understand by the term 'Artificial Intelligence' (AI)? Can you give examples?
2. Is your organisation currently utilising AI? If yes, how? If not, in which ways could it possibly utilise such technology?
3. What are the challenges and opportunities that AI has brought/can bring to your organisation?
4. Do you feel that your staff is ready to adopt AI? Why? Or if already working with AI, is your staff maximising the adoption of AI? How?
5. What are the gaps in the existing workforce's digital skills and competencies, in view of the demands of the future labour market (especially when it comes to AI)?

B. EMPLOYEES

(i) Initial Questions

1. What is the sector that you are currently working in?
2. What is your role within the organisation that you work for?
3. How old are you? (or How long have you been working in this role?)

(ii) Core Questions

1. What do you understand by the term 'Artificial Intelligence' (AI)? Can you give examples?
2. Do you utilise AI in your work? If yes, how? If no, in which ways could you possibly utilise such technology?
3. What are the challenges and opportunities that AI has brought/can bring to your work?
4. Do you feel that you are ready to adopt AI? Why? Or if already working with AI, are you maximising on the adoption of AI? How?
5. Which are the digital skills and competences that you need to be trained in, in order to be better equipped for the future labour market (especially when it comes to AI)?