INDUSTRY 4.0 SKILLS
GAIN KNOWLEDGE

Good Practices Catalogue: Skills and Competences for Work in Industry 4.0

"Industry 4.0 Skills" is a European project, funded by ERASMUS+ Programme, funding scheme 2020 – 2022. The main goal of "Industry 4.0 Skills" project is to provide a comprehensible and useful indication of initiatives, programmes, methods and materials concerning the development and self-improvement of personal skills and competences and their evaluation and assessment. Website: https://industryfourzero-skills.eu/.

Authors:

Wolfgang Kniejski
INI-Novation GmbH

Mihail Stanev
INI-Novation GmbH

Angela Ivanova
INI-Novation GmbH

Wolfgang Eisenreich
Wissenschaftsinitiative Niederösterreich - WIN

Sonja Bercko-Eisenreich
INTEGRA INSTITUT

Alena Vajlaskova
QUALED

Co-funded by the Erasmus+ Programme of the European Union

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein. Project number: 2020-1-DE02-KA202-007473

Declaration on copyright:

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Licence.

You are free to:

- share — copy and redistribute the material in any medium or format
- adapt — remix, transform, and build upon the material

under the following terms:

- Attribution — You must give appropriate credit, provide a link to the licence, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- NonCommercial — You may not use the material for commercial purposes.
- ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same licence as the original.

Content

INTRODUCTION TO THE CATALOGUE 3
Main chapters and structure 3
Methodology and selection criteria 4
OVERVIEW 6
Industry 4.0 – the way to the future 7
Industry 4.0 - impact and benefits 9
WORK AND COMPETENCIES IN INDUSTRY 4.0 13
Transversal competencies 15
Technical skills 16
Creative skills 17
Social skills 18
Contextual skills 18
RELEVANT PRACTICES IN EUROPEAN MARKETS 20
Policies and Initiatives 22
Learning Practices 48
Stakeholders‘ viewpoints 63
COLLECTION OF TECHNOLOGY USE CASES 75
Technology area 1: Enabling Technologies 77
Technology area 2: Technologies Improving Processes 101
Technology area 3: Technologies improving organizational aspects 133
REFERENCES TO EUROPEAN POLICIES 153
CONCLUSION 154

INTRODUCTION TO THE CATALOGUE

The Fourth Industrial Revolution (or “Industry 4.0”) is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. The transformation in Industry 4.0 is producing positive effects – on the society at large and also on many individuals. Resources are becoming shifted: technologies are replacing human work, but new business and new job opportunities are created. The catalogue “Skills and Competences for Work in Industry 4.0” informs about the impact considering a wide range of skill sets needed to accomplish the transformation successfully, and also considering technology-based use cases enabling the transformation. From both points of view, many good practices and expert opinions are presented from Germany, Austria, Slovenia, Slovakia and other European countries.

Main chapters and structure

While in the first chapter a general overview on Industry 4.0 trends and especially its impacts and benefits are provided, the second chapter addresses the changes in requirements of skills as well as of learning cultures in order to promote a better understanding of and adaptation to changing demands on work forces. The emphasis is on the basic and transversal competences, but also technical, creative and social and contextual skills are addressed:

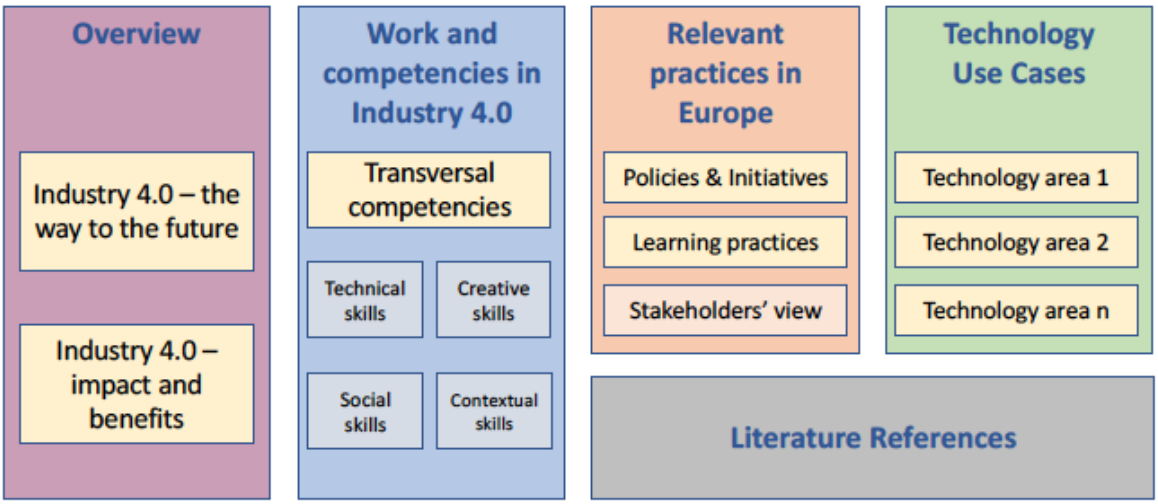


Figure 1: The structure of this good practices catalogue (© INI-Novation GmbH)

Following this general introduction into a diverse set of Industry 4.0 aspects, this catalogue provides a good practice overview in the two then following chapters: an overview of relevant practices in Europe in terms of policies, initiatives and learning practices - accompanied by

different stakeholders' opinions – and an overview of technology use cases enabling the transformation processes.

The collected good practices and technology use cases will also be published in an online interactive forum, in order to facilitate the exchange between interested stakeholder group and users from various countries.

Methodology and selection criteria

The **main objective** of this catalogue is to collect best practices that can serve as a main input for improving the vocational training policies across Europe in a way that can allow the current industrial workforce to reskill and/or upskill itself in order to meet the demands of the Fourth Industrial Revolution. Another main goal of the catalogue was to identify best practices that can facilitate the development and deployment of European policies, aimed at supporting both the industry and the industrial workforce in taking advantage of the Fourth Industrial Revolution.

Apart from the high-level objectives of the catalogue, the authors also defined three main project **priorities**, that were supposed to ensure that the collected best practices are going to contribute towards achieving the high-level objectives, and will be able to serve a variety of stakeholders along the process. More precisely, all collected best practices had to be chosen in a way that can:

- Support individuals in acquiring and developing basic skills and key competencies in order to be able to meet the new career demands, resulting from the adoption of Industry 4.0 technologies and concepts.
- Support educators, youth workers, educational leaders and support staff in acquiring new methods and best practices for upskilling and reskilling.
- Ensure the transparency and recognition of skills and qualifications in a way that benefit the workforce and the industry as a whole.

In order to achieve the above-stated objectives of identifying best practices for the catalogue, a number of different **methods** were used. The primary way of identifying best practices was an extensive literature and desk research, covering the most recent Industry 4.0-focused innovations in technology and education. For that purposes, various sources were used, such as databases, media, websites of companies, chambers, government agencies etc.

Another way of identifying novel and practice-relevant best practices was through interviews with technology experts, established companies as well as innovative start-ups. This approach seems to be particularly suitable for novel concepts because industry experts could often provide much more insights than media or the academia. Apart from the best practices that were documented as part of the interviews, they also provided us with a broader overview of the Fourth Industrial Revolution, which in turn allowed us to look for best practices in areas that we had previously missed. Having said that, the decision to supplement our research activities with interviews seemed well justified, and allowed us to create a report that is aligned with the most recent technology and vocational training innovations.

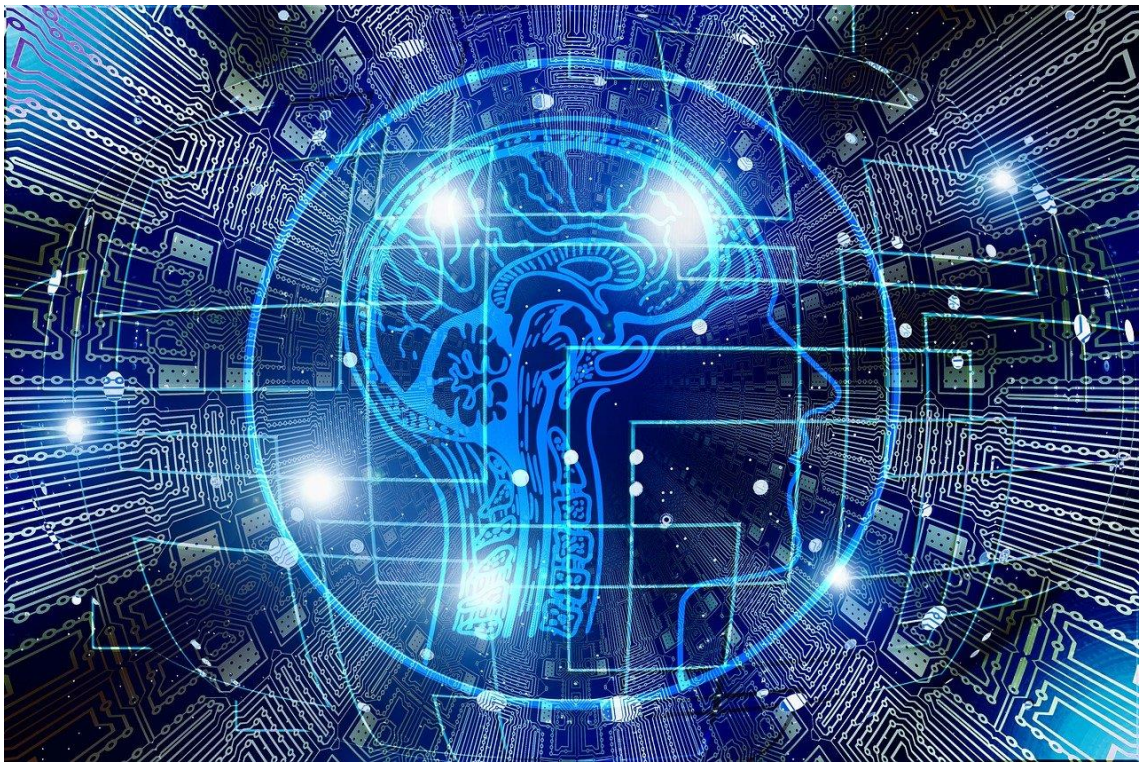
The main **criteria** for the selection of good practices were defined by the project consortium at the very beginning. The criteria are related to vocational education and training (VET) and are divided into three main groups as follows:

- Innovation – innovative nature activities and a set of necessary competencies that future employees and managers must possess in order to adopt a different approach from conventional approaches Industry 4.0 economy in order to be successful. After an in-depth study of the relevant needs and gaps, five types of competences and skills were defined: transversal competences, technical skills, creative skills, social skills, contextual skills. All good practices, related with vocational education and training, are related to the defined needed skills. They are detailed in a special chapter called Work and Competences in Industry 4.0", further down in the text;
- Efficiency - good practices should present different initiatives, programs, methods, training materials or other activity, which can produce one or more positive, tangible and/or intangible impact(s) on practice;
- Reproducibility - Local development projects, methods, actions and policies must be at least partially reproducible or transferable as knowledge and applicable by our main target audience: trainers in VET and adult education trainers, labour market policy makers and human resource managers.
- Sustainability - good practices should show how sustainable economic and human resource development can be achieved through implemented initiatives, methods, policies or other activities to increase the competences and skills provided in our first criteria. In addition, many good practices in the field of the latest and innovative technologies are described in order to increase the knowledge of the rapidly growing technological possibilities and to give clarity to the future perspective of economic and technological development.

OVERVIEW

Digital Transformation is increasingly shaping the world of work. Advanced robots, for instance, are gaining enhanced senses and dexterity, allowing them to perform a broader scope of manual tasks. Computerisation is now rapidly entering domains and machines and algorithms can readily substitute for labour in a wide range of non-routine cognitive tasks. This will change the nature of work across industries and occupations. The amount of literature on Digital Transformation keeps growing. Why, then, we come out with this catalogue brochure as just another such document?

We intend to look at the Digital Transformation from the point of view of a profound change, impacted not only in the manufacturing sector but in the entire society - a change of skills and competences made possible by technology that keeps changing due to technology evolution. Digitization is becoming increasingly pervasive and we are already starting to see a continuum leading to the transformation of humans from labour-intensive work forces to knowledge-intensive work capacities. In response to the digital economy, many new markets and jobs will be created as result of further advances in digitisation, but many existing jobs will have to be significantly re-tooled. New ways of working will become more widespread, which may demand greater flexibility for employers and employees.



Source: Pixabay (© Gerd Altmann)

A recent study (The Future of Employment: How Susceptible Are Jobs to Computerisation, Oxford 2013) estimated the probability of computerisation for 700 occupations and examined the impacts of future computerisation on the labour market. According to their estimate, 47 percent of total employment is in the high-risk category, and many occupations are potentially automatable over the next decade or two.

This means that most workers in transportation, logistics and in production are likely to be substituted by computers, as industrial robots are taking on the routine tasks of most operations. But also, many office support professions are endangered. Here, algorithms for big data are already rapidly entering domains that deal with storing or accessing information, making it probable that office and administrative support occupations will be subject to computerisation. More surprising is that also a substantial share of employment in services and sales will become the victim of computerisation in the near future. These findings are largely in line with recent documented technological developments including interactive tasks, and will concern, for example, cashiers, counter and rental clerks, or telemarketers.

By taking this development into consideration, it becomes evident that employers will put more emphasis on basic and transversal competences and on creative and social skills. Therefore, the overall objective of our project is to raise awareness about these developments, and how this will require continuous skill adaptations, especially on personal competences and soft skills. Our aim is to inform people working in the labour market service and in vocational orientation and education about successful initiatives and methods for training, developing and self-improvement of personal skills, and for evaluating and assessing personal development and competences.

Industry 4.0 – the way to the future

The Fourth Industrial Revolution (or “Industry 4.0”) is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Large-scale computerisation, machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring, and production of smart machines that can analyse and diagnose issues without the need for

human intervention[1]. It is a move toward smart technology in manufacturing and many other socio-economic sectors with a focus on connectivity.

This Fourth Industrial Revolution connects technology in organizations and in people's daily lives. It is the combination of physical and digital technologies through many components. To understand how extensive these components are, here are some contributing digital technologies as examples:

- Big Data Analytics and Advanced Processes
- The Industrial Internet of Things (iIoT) and IoT Platforms
- Horizontal and Vertical System Integration
- Robotics and Automation
- Smart Sensors
- Mixed Reality
- Simulation and Digital Twins
- Data visualization and triggered "live" training
- Additive Manufacturing (3D printing et. al.)
- Advanced human-machine interfaces
- Multilevel customer interaction and customer profiling
- Cybersecurity (Authentication and Fraud Detection).[2]

Industry 4.0 is the way of the future and is an important step in industries and manufacturing. When a company embarks on a transformation, it migrates from an analog world to a digital one, where transactions and information are digitized. A full end-to-end transformation also includes upgraded technological capabilities, such as cloud migration and re-imagined processes that allow better agility and access. The digitized data becomes an asset that allows models to be built that then predict a desired outcome. The vaster the amount of smart data a company has, the better its ability to predict an outcome. The more technological capabilities a company has, the shorter the cycle times, which enables faster learning.

[1] Mike Moore: "What is Industry 4.0? Everything you need to know"; TechRadar; November 2019, *retrieved in Wikipedia November 2020*

[2] Based on: https://www.iqsdirectory.com/resources/ultimate-guide-everything-need-to-know-about-industry-4-0/

Industry 4.0 - impact and benefits

However, there are understandable reasons for industries to hesitate before fully launching into industry 4.0. And there are reasons for companies to delay in upgrading their businesses to the new and upcoming industry models. Nevertheless, it is highly likely that the **transformation benefits** could outweigh those concerns. These benefits can be summarised as follows:

- Hesitating companies run the risk of falling short of their competition that use faster, smarter technology to meet their customer's exact needs.
- Industry 4.0 increases the efficiencies of processes and consumes less resources. Robots and automation can produce items more quickly and efficiently, especially when using smart technology.
- Information can be accessed from anyplace with a supporting broadband infrastructure.
- The digital flanking of hard products leads to the shift from products to services, thus enabling new players, new value chains and business models.
- The low transaction costs needed in the digital economy lowers the barriers of entrance for newcomers and enables the creation of new business models, which leads to new businesses.
- Using analytics and data, companies can better identify new opportunities. They could find ways to expand their business and tap into new markets.
- The lower costs lead also to increased offers and lower prices that benefit consumers, increase affordability and broaden potential markets.
- Analytics, customization and speed allow customers to get what they want sooner.
- New consumer choices steer the evolution of offers, thus shrinking the life cycle of services.
- The lower costs of products and services opens the access to a much wider market, irrespectively from the buyer's or user's physical location.
- Industry 4.0 has the potential to bring companies a great deal more revenue. This can be attributed to higher efficiency, less product waste, new opportunities, and better customer satisfaction.

The **downsides of Industry 4.0** impact can be summarised as follows:

- The increase in process efficiency, resulting from process re-engineering, decreases the need of labour with consequent loss of jobs. Jobs created by the Digital

Transformation usually requires skills and knowledge that is not available to those who lost their jobs.

- The increased market efficiency (lower price to consumers) results in a decrease of market value. This is particularly felt in mature markets where the price decrease cannot be offset by the market size increase. In those markets, the players operating in that market segments and value chains will see their revenues being squeezed.
- Increased offer, likewise, leads to more competition and price decrease, thus decreasing the overall market value.
- These two forces (market efficiency and increased offer) squeeze industry affecting both incumbents and newcomers. In the case of incumbents there is usually a greater capacity to buffer losses (but in the longer term their fall is making a bigger splash), in case of the newcomer competition is so harsh that often a zero-price based business model is pursued (giving out the product for free and capitalising on the market share).
- High competition and the low transaction cost squeezes margins and this has to be made up by increasing volumes. This tends to increase oligopolies.

The shift towards Industry 4.0 requires different processes, technologies and organisational changes. And most industries are not yet prepared to navigate this space. In November 2017, the Singapore Economic Development Board (EDB) in partnership with TÜV SÜD launched the so-called "Smart Industry Readiness Index"[3] (in the following called "SIRI") to help companies evaluate existing facilities, support companies in their transformation journey and drive the industry-wide revolution. It is a framework guiding companies across the entire Industry 4.0 lifecycle and has been built to offer a holistic and step-by-step guide to transforming business.

SIRI comprises three layers. At the top are the 3 fundamental building blocks of Industry 4.0: Process, Technology and Organization. Underpinning these building blocks are 8 pillars of focus. These pillars then map onto 16 dimensions of assessment, which represent the key components that any organisation must consider:

[3] *https://www.tuvsud.com/en/resource-centre/stories/smart-industry-readiness-index*

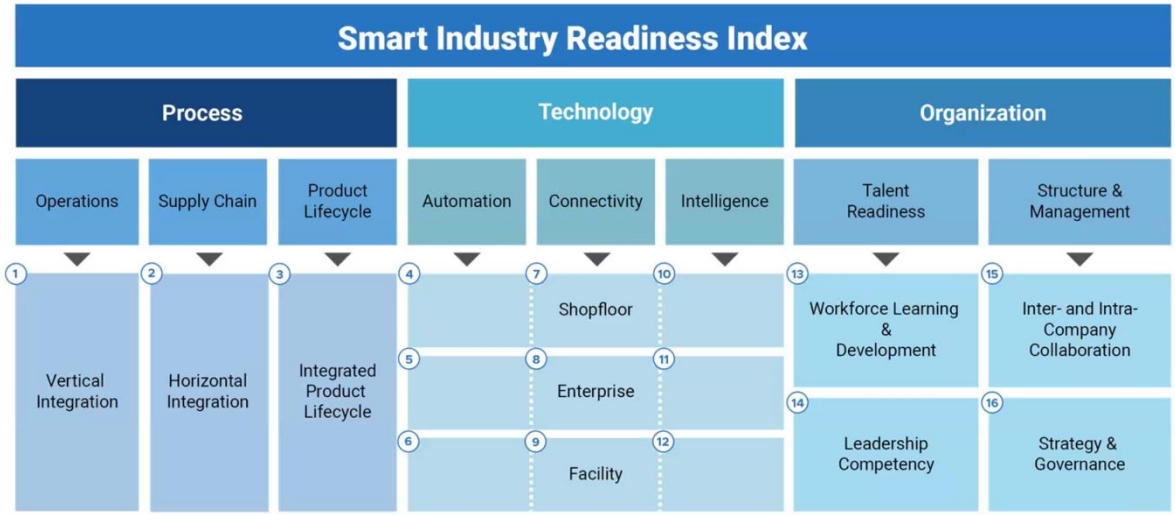


Figure 2: Elements of the Smart Industry Readiness Index (Source: TÜV SÜD)

The first building block reviews the digital transformation process roadmap. How has the business model shifted to align towards the customer, and how have the company's operations, supply-chains and product/service life cycles to be adopted, to be aligned towards data as an asset and to be integrated into the transformation achievements.

The second building block considers the underlying technologies including automation objectives, connectivity requirements, natural language processing, image recognition, speech recognition, computer vision, and other core technologies. The questions have to be answered, what are some use cases on the shopfloor, for the enterprise and for the facilities. The examples of application across verticals and functions are too numerous to list here, but this gives a flavour of what is possible.

And the third building block looks at the organisation, the human resource readiness, the structures and the management. An important aspect of the transformation process is the change of knowledge, of skills and competences. The economic value of Industry 4.0 deals also with the shift from labour-intensive work to knowledge-intensive work as well as with the shift from the ownership of knowledge to the capability to access knowledge. This is an absolute shift of paradigm.

Therefore, the organizational readiness and team capabilities have to be reviewed: "Do you have the right talent, or are you just shifting resources within a team? Are you keeping your engineers trained on the latest techniques and tools? The end-to-end processes

have to be reviewed to understand the management and workforce readiness to accompany the transformation. This will be further laid out in the following chapter.

Source: Freepik (© Creativeart)

WORK AND COMPETENCIES IN INDUSTRY 4.0

The transformation in Industry 4.0 is producing positive effects – on the society at large and also on many individuals. Resources are becoming shifted: technologies are replacing human work, but new business and new job opportunities are created. While Industry 4.0 may replace jobs with automation, it will create many new jobs through re-engineering of processes[4]. Consequently, in the coming years knowledge will be shared among humans and machines. We are just within this transition timeframe. Technology generated and owned knowledge will be flanking human knowledge. This is probably one of the major opportunities for upgrading human skills and competencies, to be derived from the Digital Transformation. And at the same time, it will be difficult to leverage, since it moves academia, VET organizations and any kind of training institutions into a new educational space:

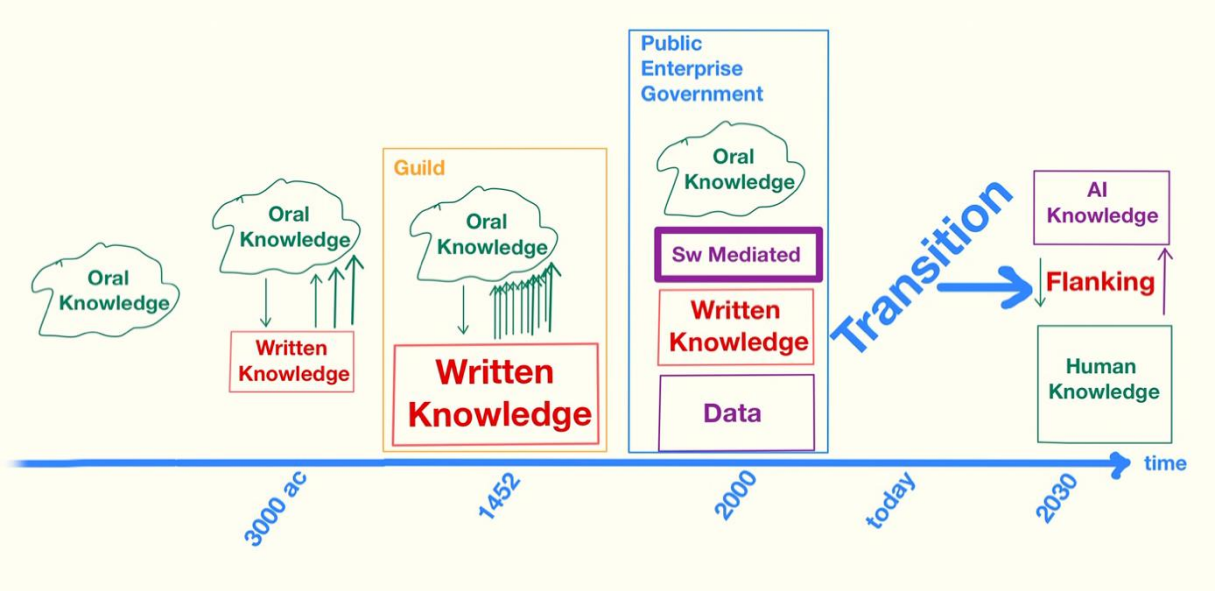


Figure 3: History of knowledge values (source: INI-Novation GmbH)

This change of knowledge – and at the same time the explosion of knowledge – is creating a gap between what a person knows and what knowledge is required. Consequently, humans in the Industry 4.0 organisation have to be able to get the needed knowledge right in time and in the most digestible form. These facts drive the need for lifelong learning towards diversification of VET, with new institutions and new stakeholders involved. This shall be accompanied by an expansion of VET to higher education areas, partly through

[4] *https://www.iqsdirectory.com/resources/ultimate-guide-everything-need-to-know-about-industry-4-0/*

reform of existing institutions, partly through the emergence of new institutions. The Industry 4.0 transformation processes indicates a clear tendency to vocational drift in engineering education. Internships in enterprises and work placements are gaining ground with a view to strengthening the relevance of higher education in a labour market context[5]. Knowledge developed in the field will be more and more relevant, not only the technical skills of internal resources or ad hoc consultants "hired". It is necessary to have a strategy for the recruiting of specialist skills capable of "mastering" the enabling technologies. “Let’s learn from each other” will be an important element of corporate strategies. The transformation in Industry 4.0 is forcing workers to leave their comfort zone, to change established habits and practices. Not an easy step, which comes along with resistance and fear. Change, which often inevitably arises from a top-down process must then be shared and accompanied step by step by robust learning and training, which targets securing availability of work forces with transversal competences as well as with technical, creative, social and contextual skills[6].

[5] *http://www.cedefop.europa.eu/en/events-and-projects/projects/changing-nature-and-role-vocational-education-and-training-vet-europe/publications*
[6] *http://www.soziales.hessen.de/arbeit/fachkraeftesicherung/betrieb-des-monats*

Transversal competencies

As it was emphasized above, the necessary shift towards 4.0 transformation means, both for manager and employees, to leave their comfort zone, to change their habits and established practices. As a result, VET should develop new didactic models and validation system, as well as implanting new training for trainers, that will take into account the so-called transversal competencies. This particular point is of importance to the 'future-assurance' of VET systems as it influences the ability of the VET system to educate and train people to actively adapt to change and efficiently face the Industry 4.0 revolution.

Transversal Competencies are competencies that are transferable between jobs. They are the ones that people used to call experience, some people have called them 'soft skills' or 'emotional intelligence'. They are not job and sector-specific skills. The acquisition and measurement of Transversal Competencies mean that one can move from a career in marketing in the building sector to a job in counselling in a different sector[7]. These non-job specific competencies as illustrated in the chart below are key competencies in this new transformation context:

Figure 4: Examples of Transversal Competencies (© INI-Novation GmbH)

[7] *http://vivagogy.com/2019/03/04/transversal-competencies-2/*

Technical skills

Companies will have to adopt Industry 4.0 technologies; consequently, it means investing in the right people and skillsets today in order to ensure a favourable position in the future. The following rundown of four major technical skill groups is far from comprehensive, but it should serve as a solid blueprint for companies that want to create new positions and invest also in human resources managing their technology portfolio:

- Networking, IT and IoT:

One can expect Industry 4.0 to dramatically impact the number of networking professionals at work in manufacturing and other critical industries. A big reason for the increase is the Industrial Internet of Things (IIoT). It would go beyond the intentions of this catalogue to list each of the established and still-emerging networking-related disciplines across world industries. Nevertheless, here's a highly relevant list:

- Smart factories and connected fabrication and material handling equipment
- Remote sensors for freight condition monitoring and inspection
- Automated infrastructure and smart metering for utility management and energy-saving efforts
- Intelligent analysis of soil and environmental conditions for agriculture
- Tracking systems for vehicles and other assets
- Monitoring for employee health and safety in dangerous and remote conditions

- Data Architects and Scientists

By 2025, nearly 30 % of that data will be gathered from customer insights or from enterprise hardware and software. Data science will become important to make predictions and reasonable decisions based on the facts.

- Developers and Software Engineers

As Industry 4.0 expands, we'll need lots of programmers and software engineers to design or write:

- Machine code for industrial control and automated systems
- Management platforms for internal industrial use and enterprise planning
- Customer-facing and mobile apps for interacting with clients on-the-go and doing business everywhere
- Data visualization tools and dashboards for surfacing industrial data, drawing conclusions from it and making business decisions based on it

- Code to give robotic systems their marching orders and better facilitate human-machine interaction

- Cybersecurity

The attack surface in Industry 4.0 is significant. From health care and retail to manufacturing and supply chain management, most industries are finding useful ways to put emerging technologies to good use. Each of these industries represents significant amounts of investments and opportunities. Unfortunately, cyberattacks committed using internet-connected devices and critical manufacturing infrastructures have exploded by more than 600 percent since 2017[8].

Creative skills

Creativity is the ability to think about a task or a problem in a new or different way, or the ability to use the imagination to generate new ideas. Creativity enables one to solve complex problems or find interesting ways to approach tasks[9]. In any kind of market segments and geographies, private and public employers are looking out for creative people or creative thinkers who have creative skills. Creative people look at things from different perspectives, which establishes a new kind of mindset in traditional organizational structures and processes. If creative skills are being applied, when it comes to implementation of innovations within the transformation to Industry 4.0, creative skills can be instrumental in solving accompanying challenges. This makes creative skills nowadays more important than ever before.

Creative skills allow Industry 4.0 stakeholders to look at processes, technologies and organisational structures from a different viewpoint. This is absolutely helpful, when it comes to supporting Industry 4.0 transformation with elements of change management. Those skill sets include entrepreneurial drive, ability of setting goals and pushing towards goals, making observations, experimenting, asking questions, curiosity, playfulness, and to be keen to understand technologies. This list is by far not exhaustive, but it can function as an eye opener to illustrate these and similar skills to be addressed, when it comes to Industry 4.0 transformation[10].

[8] *https://www.controlglobal.com/blogs/guest-blogs/must-have-skills-for-industry-4-0/*
[9] *https://www.indeed.com/career-advice/career-development/creativity-skills#:~:text=Creativity%20is%20the%20ability%20to,things%20from%20a%20unique%20perspective*
[10] *https://www.creativelive.com/blog/10-creative-skills-you-need-to-keep-creating/*

Social skills

Social skills are the skills we use to communicate and interact with each other. Social skills include both:

- verbal communication language such as tone of voice, volume of speech and the words we choose; and
- non-verbal communication methods, such as gestures, body language and personal appearance[11].

Industry 4.0 will enable machines to complete many of the tasks that once required human beings, including interaction and communication tasks. Transformation and automation will have a major effect on social skills in the coming years. Human beings are sociable creatures and we have developed many ways to communicate messages, thoughts and feelings with others. Nevertheless, manufacturing companies are reconfiguring their supply chains and their production lines. Service organizations are adapting to emphasize digital-first customer journeys and contactless operations. Those changes will have significant effects also on required social skills and capabilities, for instance, when looking at the need for shop-floor personnel to master new tools and newly urgent requirements. This will affect up-skilling workforces (gaining new skills) as well as re-skilling them (gaining new capabilities)[12].

In summary, automation and digitisation will create the needs to adopt also the social skill sets of humans to new work requirements. This is valid for the management level (where executives have to tackle new communication streams and requirements) as well as for the operational workforce level, where innovation will create a lack of communication knowledge.

Contextual skills

Especially in the Industry 4.0 transformation process the contextual skills become more and more most relevant. Contextual skills are constituted by the ability to take advantage of knowledge gained from one context and to apply it in another context. Understanding that knowledge that has been acquired within a variety of contexts and can be transformed or

[11] *https://www.skillsyouneed.com/ips/socialskills.html#:~:text=Social%20skills%20are%20the%20skills, thoughts%20and%20feelings%20with%20others*
[12] *https://www.mckinsey.com/business-functions/operations/our-insights/building-the-vital-skills-for-the-future-of-work-in-operations#*

adopted in problem solving situations, show a new demand for creative and interpersonal skills[13].

Since Industry 4.0 will transform the daily routine of many frontline roles like installation, maintenance or production into monitoring, prediction and reporting job families across all industries, a much higher level of technology literacy than in the past will be required. As automation increases in traditional fields, employees are expected to have more responsibilities related also to problem-solving skills, as well as to a broader general understanding of the work processes of their company or organization[14]. This way, employees will have to develop a knowledge framework based on previous experiences in terms of recognising occurring problems, using problem solving methodologies and generating solutions. This constitutes a huge shift on the required competences.

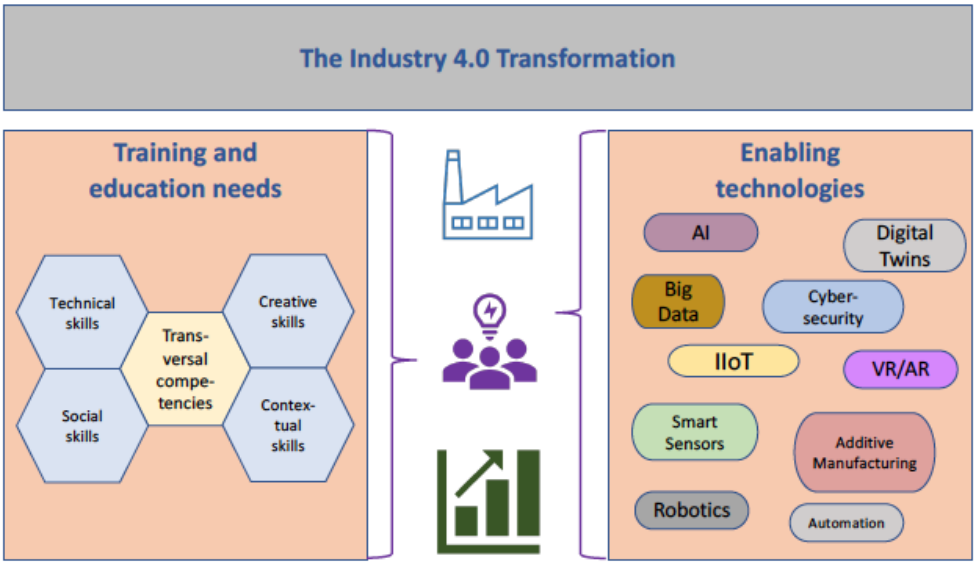


Figure 5: Technology driven transformation requiring changing skills and competencies (© INI-Novation GmbH)

In **summary** it can be stated that the transformation changes in Industry 4.0 will have a profound impact on jobs, ranging from significant job creation to job displacement, and from heightened labour productivity to widening skills gaps[15], as they were briefly described above and as it is illustrated in figure 5.

[13] *https://www.quora.com/What-are-contextual-skills-in-management*
[14] *http://reports.weforum.org/future-of-jobs-2016/skills-stability/*
[15] *http://reports.weforum.org/future-of-jobs-2016/chapter-1-the-future-of-jobs-and-skills/*

RELEVANT PRACTICES IN EUROPEAN MARKETS

The facts described in the previous chapter drive the need for adopting skills and competencies on management level and on workforce level in organisational structures in industries with a diversity of stakeholders involved. The rise of Industry 4.0 along with all innovative technologies will transform current labour-intensive workforces to knowledge-intensive workforce. Hard work and routine tasks will be executed by machines or robots, while tasks requiring experience, intuition, creativity or decisions making based on uncertainty will still reside to humans.

This process shall be accompanied by a transformation also to a different vocational education. It is obvious, because we need urgently to study the skills and competences required for manufacturing personnel of the near future[16]. In this catalogue we present therefore a collection of good practices classified as policies and initiatives as well as learning practices. Since many different stakeholders will be involved in this shift of knowledge, we will also add good practices of stakeholders' viewpoints:

Policies and Initiatives	
Name of Good Practice	*Page*
aws Connect	22
Digital Austria	23
Digital Education Action Plan (2021-2027) by the European Commission	25
DIGITAL EUROPE	27
Industry 4.0 Model Centre in Slovakia - ADV - Asociácia duálneho vzdelávania	28
Federal Institute for Vocational Education and Training in Germany	30
Industry 4.0 Austria - the platform for intelligent production	32
Industry4UM – Združenie inteligentného priemyslu	34
INNOVET	36
Peskovnik – Open Lab	38
Sova Digital	39
TECXPORT - The showcase for Austrian technology expertise	41
TestBed 4.0	43
The Arxcelerator program by Oculavis	45
University of Minho & Work 4.0 Consortium Initiatives	46

[16] *http://reports.weforum.org/future-of-jobs-2016/chapter-1-the-future-of-jobs-and-skills/*

Learning Practices	
Name of Good Practice	*Page*
EIT Manufacturing & Skills.move	48
fit4internet	50
NEMAK Slovakia	52
School Industry 4.0	53
University of Minho & Work 4.0 Consortium. Learning practice 1	55
University of Minho & Work 4.0 Consortium. Learning practice 2	58
University of Minho & Work 4.0 Consortium. Learning practice 3	60

Stakeholders‘ Viewpoints	
Name of Good Practice	*Page*
Centigrade	63
Nobilia	65
University of Minho & Work 4.0 Consortium. View point 1	67
University of Minho & Work 4.0 Consortium. View point 2	69
University of Minho & Work 4.0 Consortium. View point 3	72

Policies and Initiatives

aws Connect

Source / Link: https://www.awsconnect.at/

Thematic area:	**Type of good practice:**	**Target group:**
☐ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☒ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

Matching services for cooperation, investments, and internationalization. The platform currently has 2.505 registered startups, SMEs, corporates, investors & research institutions, and has organized 4.561 meetings on cooperation and investment.

Detailed description:

The programme offers matching services for:

1. Start-ups: As a start-up, one can use aws Connect to quickly and easily establish contacts with investors, SMEs, large companies and international partners that are willing to cooperate. Moreover, one can become a provider in AI and apply for open calls & events.
2. Corporates / SMEs: SMEs or corporates are introduced to selected innovative start-ups based on their individual search criteria. In addition, they are connected during matching events. Providers of artificial intelligence can attract potential new customers.
3. Investors have access to the most exclusive Austrian start-ups screened for investor capacity with financing needs between EUR 100k - 1 million, as well as for special investor events.
4. Research Institutions: Providers of artificial intelligence can present their relevant research areas and attract the attention of potential cooperation partners.

Access date: 14/06/2022

Provided by: WIN

Digital Austria

Bundesministerium
Digitalisierung und
Wirtschaftsstandort

Source / Link: https://www.bmdw.gv.at/Themen/Digitalisierung/Strategien/Digital-Austria.html

Thematic area:	**Type of good practice:**	**Target group:**
☒ Transversal competences ☒ Technical skills ☒ Creative skills ☒ Social skills ☒ Contextual skills	☐ Project ☐ Initiative ☒ Programme ☐ Methods ☐ Training materials ☐ Other	☒ VET and adult education trainers ☒ Labour market policy experts ☒ Human recourse management ☒ Others: Companies and Organisations

Summary:

Digital Austria is the federal government's initiative for successful digitization in Austria. The goal is to further develop Austria into a leading digital nation in order to secure and expand prosperity, jobs and quality of life in the long term. Digital Austria provides information about opportunities and successful projects, networks stakeholders and sets priorities for the future.

Detailed description

The priorities of this program are:

- Society: More quality of life for all generations.

  With information and further education, everyone in the country - regardless of education level, age or gender - should be able to benefit from digitalization. Citizens should become fit for new technologies in order to increase their quality of life.

- Economy: New opportunities for growth, jobs and prosperity.

  The course is being set to accompany our companies in the digital transformation and to strengthen Austria's competitiveness. To this end, the innovative pioneers will be networked with the established companies and the knowledge in the companies will be expanded. This will make Austrian companies fit for competition and create new jobs in Austria.

- Administration: from father state to partner state.

  Austria's administration is one of the best in Europe. In order to keep it that way in the future, the classical way of dealing with authorities is changing from electronic to mobile government. Official channels should be as simple and service-oriented as possible. Austria is thus becoming a pioneer and role model in Europe for innovative and citizen-oriented administration.

Beneficial Results

Digitisation is not a technological end in itself, but a driver for growth and securing the future. The first Austrian Digitisation Report of the Federal Government shows flagship initiatives and projects that promote the digital transformation of the administration for society and the economy. It documents a total of 125 current projects and flagship initiatives of all ministries and thus shows how digital Austria's federal administration already is today. The measures form a strong foundation for the economic

comeback. Their joint implementation should bring Austria back to the top.
Access date: 14/06/2022
Provided by: WIN

Digital Education Action Plan (2021-2027) by the European Commission

Source / Link: https://education.ec.europa.eu/focus-topics/digital-education/digital-education-action-plan

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others:
☒ Contextual skills	☐ Training materials	
	☒ Other: Policy	

Summary:

The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age.

Detailed description:

The Digital Education Action Plan:

- offers a long-term strategic vision for high-quality, inclusive and accessible European digital education;
- addresses the challenges and opportunities of the COVID-19 pandemic, which has led to the unprecedented use of technology for education and training purposes;
- seeks stronger cooperation at the EU level on digital education and underscores the importance of working together across sectors to bring education into the digital age;
- presents opportunities, including improved quality and quantity of teaching concerning digital technologies, support for the digitalisation of teaching methods and pedagogies and the provision of infrastructure required for inclusive and resilient remote learning.

To achieve these objectives, the Action Plan sets out 2 priority areas.

1. **Fostering the development of a high-performing digital education ecosystem.**
   This includes
   a. infrastructure, connectivity and digital equipment;
   b. effective digital capacity planning and development, including up-to-date organisational capabilities;
   c. digitally competent and confident teachers and education and training staff;
   d. high-quality learning content, user-friendly tools and secure platforms which respect e-privacy rules and ethical standards.

2. **Enhancing digital skills and competences for the digital transformation.** This requires:
   a. basic digital skills and competences from an early age;
   b. digital literacy, including tackling disinformation;

c. computing education;
d. good knowledge and understanding of data-intensive technologies, such as artificial intelligence (AI);
e. advanced digital skills, which produce more digital specialists;
f. ensuring that girls and young women are equally represented in digital studies and careers.

Digital transformation has transformed society and the economy with an ever-deepening impact on everyday life. However, until the COVID-19 pandemic, its impact on education and training was much more limited. The pandemic has demonstrated that having an education and training system which is fit for the digital age is essential. While COVID-19 demonstrated the need for higher levels of digital capacity in education and training, it also led to the amplification of a number of existing challenges and inequalities between those who have access to digital technologies and those who do not, including individuals from disadvantaged backgrounds. The pandemic has also revealed a number of challenges for education and training systems related to the digital capacities of education and training institutions, teacher training and overall levels of digital skills and competences.

Beneficial Results:

The need for a new Action Plan, building on the first **Digital Education Action Plan** (2018-2020) was expressed in the **Political Guidelines** of European Commission President, President Ursula von der Leyen, in July 2019.

The renewed Digital Education Action Plan contributes to the Commission's priority '**A Europe fit for the Digital Age**' and to **Next Generation EU**. It also supports the **Recovery and Resilience Facility**, which aims to create a greener, more digital and resilient European Union.

The Digital Education Action Plan is a key enabler to realising the vision of achieving a **European Education Area** by 2025. It contributes to achieving the goals of the **European Skills Agenda**, the **European Social Pillar Action Plan** and the '**2030 Digital Compass: the European way for the Digital Decade**'.

Access date: 04/07/2022

Provided by: INI-Novation GmbH

DIGITALEUROPE

Source / Link: www.digitaleurope.org

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others: Industry
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

DIGITALEUROPE is the leading trade association representing digitally transforming industries in Europe. They stand for a regulatory environment that enables European businesses and citizens to prosper from digital technologies. They wish Europe to grow, attract and sustain the world's best digital talents and technology companies. Together with their members, they shape the industry policy positions on all relevant legislative matters and contribute to the development and implementation of relevant EU policies. The membership represents over 36,000 businesses who operate and invest in Europe.

Detailed description:

DIGITALEUROPE strives for a Europe where no one is left behind. With their members, they support public and private policies that help people develop the digital skills necessary to professionally and personally flourish. In a rapidly changing world, there is an increasing demand on people to learn how to use new technologies. Without the right skills, people fall behind. If enough of them get to the back of the line, it is the whole of society that starts to fall apart. Today, 52% of European workers are in need of reskilling. Investing in the digital skills and continuing education of Europeans is not an option. It is an imperative. DIGITALEUROPE has also taken a leadership role in driving education, training, and upskilling of European workers through numerous projects, including as the secretariat of the Skills and Jobs Coalition since 2013. On the policy front, they work aims to:

- Assist the design of EU funds and programmes enhancing digital skills;
- Promote diversity and gender equality in digital education;
- Advance the development of industry certification;
- Modernise education;
- Assist the design of reskilling & upskilling policies.

Beneficial Results:

DIGITALEUROPE ensures that digital technologies, innovation and artificial intelligence can provide Europe's citizens with competitive jobs, better health and better public services. This is being achieved by creating a strong, unfragmented digital Europe that takes leadership in creating digital inclusion, green growth, innovation, trust, and agile mission-based policymaking, driving prosperity and creating benefits for the European society, and leading globally in an open economy.

Access date: 04/07/2022

Provided by: INI-Novation GmbH

INDUSTRY 4.0 MODEL CENTRE IN SLOVAKIA

ADV - Asociácia duálneho vzdelávania

Source / Link: http://asociaciadv.sk/en/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☒ Project	☒ VET and adult education trainers
☒ Technical skills	☐ Initiative	☒ Labour market policy experts
☐ Creative skills	☐ Programme	☐ Human recourse management
☐ Social skills	☐ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☒ Other	

Summary:

The main mission of the Association of Dual Education is the realization, support and development of the system of dual education in Slovakia, with the emphasis to support the establishment of an effective and functioning system of dual education at the level of public and private education as well as individual projects carrying the elements of dual education system. That is why they support development of the Industry 4.0 model centre in Slovakia.

Detailed description:

Theoretical education and practical skills are two assets for young people that provide a perspective of adequate employment. The Association of Dual Education brings together legal entities that combine their strengths for the potential of young people. The Association of Dual Education focuses on the realization, support and development of dual education in the Slovak Republic, with aim to support the development of Industry 4.0 and with the emphasis to support the establishment of an effective and functioning system of dual education at the level of state, self-governing and private education.

Another ambition of the Association of Dual Education is to support individual projects carrying the elements of dual education and cross-border cooperation and, finally, to establish and maintain an interaction in order to exchange information, communicate, support and realize the interests of members of the association towards state authorities and organizations, bearers of education, employers, associations of profession, interest organizations, non-profit organizations and other third parties.

Beneficial Results:

The Association of Dual Education is a platform for dialogue on solutions, a platform of good practice examples and a source of motivation and inspiration for all who participate in dual education. They supported the creation of the Industry 4.0 model centre in Slovakia.

Through demonstrations and a simulation platform, they show the world of tomorrow in manufacturing to a target group of primary school pupils in 7, 8 and 9 grade. These pupils will thus get an intimate picture of the working environment and a closer look at the content of their further education, which they will be able to visualise in this way.

They present to high school students in model lessons through a simulated platform how work in production will change and what technology will make possible in manufacturing practice.

Also, they will use this model centre for education of unemployed people and for demonstration of the changes in industry for public.

They plan to equip the centre with:

ABB: Two IRB 120 industrial robots with a short conveyor for educational purposes (pictured)

FANUC: Industrial robot in Fanuc ACADEMIC PACKAGE 4 design

Didactic aid for mechatronics and automation - material handling line with material sorting

Access date 18.7.2022

Provided by: QUALED

Federal Institute for Vocational Education and Training in Germany

Source / Link: https://www.bibb.de/en/49603.php

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☐ Creative skills	☒ Programme	☒ Human recourse management
☐ Social skills	☐ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

Vocational Education and Training 4.0 has been launched. This is the joint initiative of the Federal Ministry of Education and Research (BMBF) and the Federal Institute for Vocational Education and Training (BIBB). Within the next two years, qualifications for specialist staff and competencies for the digitalised world of tomorrow will be systematically examined on an example basis.

Detailed description:

A wide range of projects have also been brought together under the umbrella of the initiative. These include projects already under way such as the preliminary examination of the potential restructuring of IT occupations, the joint VW-BIBB project on operational maintenance 4.0 and the new special programme “Digital transformation in inter-company vocational training centres (ÜBS) and competence centres”. Three additional projects are new:

- **Pillar 1: Occupation and sector screening -** in the case of occupation and sector screening, the focus is on the analysis of selected training occupations, advanced training regulations and sectors which are already partially or fully affected by digital transformation. The goal is to create recommendations for the next steps in the organisation of initial and continuing education and training and in the further development of systemic framework conditions.
- **Pillar 2: Media competency -** there is currently no single definition for media competency as an entry requirement and as a key competency across occupations in vocational training. Following on from the results of the BIBB research project “Use and production of media – development of media competences in vocational education and training” a definition is to be developed with the aim, on this basis, of continuing the dialogue with all those involved in education and training.
- **Pillar 3: Demand for skilled workers -** the plan is to establish a monitoring and forecasting system across occupations and sectors from the perspective of the labour market and the demands it places on our employees. This will enable us to deduce which qualifications are needed for Vocational Education and Training 4.0.

Beneficial Results:

The main benefit from the project is the combination of many individual results from the projects and filtering out the various needs for qualifications of specialist staff and competencies for the digitalised world of tomorrow. The findings will then serve as an input for the future design of vocational education and training systems. Additionally, the results will be disseminated by means of the involvement of social partners, public relations work, conferences and publications. The aim of Vocational Education and

Training 4.0 is to contribute to the implementation of the digital agenda by means of the ongoing exchange of information between academia, policy-making and practice.
Access date: 04/07/2022
Provided by: INI-Novation GmbH

Industry 4.0 Austria - the platform for intelligent production

INDUSTRIE 4.0 ÖSTERREICH

Source / Link: https://plattformindustrie40.at/

Thematic area:	**Type of good practice:**	**Target group:**
☐ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☐ Creative skills	☒ Programme	☒ Human recourse management
☐ Social skills	☐ Methods	☒ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The core task of the Industrie 4.0 platform is to facilitate the implementation of Industrie 4.0 and to promote cooperation between relevant actors. In this way, highly innovative and sustainable industrial production can be secured and the quality of employment can be increased.

Detailed description:

The association "Industry 4.0 Austria - the platform for intelligent production" was founded in 2015. In a broad alliance, important social, political, economic and scientific actors are actively involved in shaping the future world of production and work. The aim is to contribute to increasing future prosperity for all people in Austria. The aim is to make the best possible use of the new technological developments and innovations of digitalisation (Industry 4.0) for companies and employees and to shape the change in a socially acceptable way for society.

The association sets up activities to

- ensure a dynamic development of the Austrian production sector;
- to promote research, innovation and qualification;
- to contribute to a quality working environment; and
- to contribute to a high level of employment.

The most important drivers of Industrie 4.0 are addressed in nine defined topic areas in expert groups. These are made up of high-ranking experts from their respective fields. The strength of the platform lies in the balanced mix of experts with scientific and extensive practical and operational experience.

In addition to the expert groups, the Platform's work is complemented by national and international projects. These cover different topics:

- Trustworthy AI in standardisation: Together with the Austria Wirtschaftsservice (aws), Industry 4.0 Austria supports domestic companies in the development of trustworthy AI norms and standards;
- Digital Pioneers - Your voluntary digital year: young women between 17 and 27 can take part in the programme regardless of their prior education and experience can take part in the programme and enter a technical profession;

- GAIA-X is a European flagship project to build a high-performance and competitive, secure and trustworthy data infrastructure for Europe;
- DIVE (Digitale Industrie Verständlich Erklärt - Digital Industry Explained in an Understandable Way) is a free and open event series of the Plattform Industrie 4.0 with the aim to make Austrian Industry 4.0 expertise accessible to a broader audience and especially SMEs.

Access date: 14/06/2022

Provided by: WIN

Industry4UM – Združenie inteligentného priemyslu

Source / Link: https://industry4um.sk/en/industry-4-0-survey-in-the-slovak-republic/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The Smart Industry Association in Slovakia, also known as Idustry4UM annually provides research about current situation in Slovakia on the topic of Industry 4.0. They do that through the survey in Slovak industrial companies. Among other questions, they are targeting the need for specialised managers dealing with Industry 4.0 or how the companies work with awareness of workers about Industry 4.0 activities within the company.

Detailed description:

Industry4UM is an initiative of industry representatives under the auspices of the Ministry of Economy of the Slovak Republic whose ambition is:

- To be an independent, expert, opinion-making authority in the field of company transformations
- To bring industries together for common goals in the field of Industry 4.0
- To provide companies with more information and increased expertise on Industry 4.0, digital transformation and innovations enhancement
- To educate and raise awareness of the public on the subject of Industry 4.0
- To bring together experts and create a platform for the exchange and sharing of expert views
- To support the growth of young researchers and developers as well as start-up companies focused on digitalisation and innovation
- To provide qualified opinions on the trends in digital transformation of industry and innovations
- To cooperate with professional, scientific and academic institutions for the needs of the production industry
- To be a partner for the state institutions in guiding the development of the digitalisation of industry and innovations in Slovakia.

The purpose of the survey is to provide companies with relevant information for assessing their current situation and for using the deeper knowledge from the surrounding environment in implementing the features of Industry 4.0 for the benefit of their further development.

The survey is carried out annually, it is anonymous, and they go back to the measured parameters on a regular basis. They started to measure the level of digital transformation in the Slovak industry in 2017. The results became a unique material which identified the current state of the changes in Slovakia for the first time and provided valuable information for both the professional and the general public.

Beneficial Results: Data from the research are the unlocking key for Industry 4.0. **https://industry4um.sk/en/data-kluc-odomykajuci-industry-4-0/** (in Slovak language only) Industry4UM provides also open discussion forum whose aim is to bring answers on the topics of Industry 4.0 in the discussion with professionals and expert groups.
Access date: 20/04/2021
Provided by: QUALED

INNOVET

Source / Link: https://www.inno-vet.de/innovet/de/home/home_node.html

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☒ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

InnoVET is the innovation competition of the Federal Ministry of Education and Research (BMBF) for excellent vocational training. 17 projects were selected and will test their concepts until 2024. The BMBF is funding InnoVET with 82 million euros.

Detailed description:

Increasing the attractiveness, quality and equivalence of vocational training and initiating new learning location cooperation: these are the goals of InnoVET. The 17 funded projects develop and test attractive and high-quality qualification offers for vocational training. These create incentives for young people to start training or further education. The qualification offers are based on the needs of the companies and contribute to the training of highly qualified specialists.

The projects are broadly based and active in six thematic clusters. Each project is part of two to three theme clusters:

- **Creating equality** - Vocational and academic training on an equal footing: The projects develop high-quality further training courses that are equivalent to university degrees. Career concepts and career advice open up new perspectives.
- **Strengthening sectors** - From traditional crafts to future technology: the projects position individual sectors well for the future with new training and qualification concepts and make training more attractive.
- **Shaping digital change** Fit for 4.0: The projects develop further training courses for specialists on digitally networked thinking and acting. These enable companies to actively shape digital change and use its potential.
- **Expand learning location cooperation** Achieve more in the network: The projects create comprehensive learning location cooperation between vocational schools, training centres, companies, universities and research institutions. They intensify the cooperation between the learning locations and open up new learning opportunities.
- **Improving the quality of training and rethinking learning**: The projects are testing innovative approaches for optimally imparting knowledge and skills. Learning platforms, blended learning and digital learning content make it possible to make vocational training more flexible and individual.

- **Test hybrid education models:** The projects dovetail dual education and studies in newly designed educational courses. Practical skills from dual training and academic learning content complement each other ideally.

The funding volume for the competition is 82 million euros. The 17 joint projects started in autumn 2020 with a total of 89 joint partners have a maximum duration of 48 months. After the end of the funding, the project results should be able to be established in the vocational training system. Therefore, the transfer of knowledge and results is of particular importance.

Beneficial Results:

The main benefits from the competition are that the funded projects are ultimately increasing the attractiveness and quality of the vocational training programs, and especially the programs in the areas of Industry 4.0. By making the vocational programs more attractive and relevant for the new age, the projects also incentivize young people to consider the opportunities for further education and to take advantage of them. What is more, the vocational training programs are always developed according to the need of the companies, which also contributes to producing highly qualified specialists with skillsets that are strongly demanded by the market.

Access date: 04/07/2022

Provided by: INI-Novation GmbH

Peskovnik – Open Lab

University of Ljubljana

Source / Link: https://www.fs.uni-lj.si/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☒ Project	☐ VET and adult education trainers
☒ Technical skills	☒ Initiative	☐ Labour market policy experts
☒ Creative skills	☐ Programme	☐ Human recourse management
☒ Social skills	☒ Methods	☒ Others: Students and innovators
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The mission and vision of Peskovnik (Sandbox) is to become the central community of UL FS student engineering engagement and innovation, and for each mechanical engineer to become excellent in his field, a team player, mentor, innovator and socially responsible person who never stops learning.

Detailed description

The Faculty of Mechanical Engineering of the University of Ljubljana, in collaboration with the sponsor of the innovative technologies project, has actively entered the technologically and digitally supported society of the 21st century in the form of tools that students and other future innovators will need to develop and realize their ideas.

The open laboratory is run by students of the Faculty of Mechanical Engineering (FS) for FS students. The set consists of two four-day workshops:

1. The basics of playing in the Sandbox (Peskovnik);
2. From the Sandbox (Peskovnik) to the air.

In the first four-day workshop, students learn more about 3D printing (from idea to computer and then to printer), set up Octoprint, learn about CNC milling, CNC laser, Arduino in practice, KiCAD for mechanical engineering students. The last day of the snack section is dedicated to a fun project. In the follow-up workshop, students learn about the basics of building and manufacturing model airplanes, which is also the basis for completing the education with a built airplane, which also includes optional flying at the end.

Beneficial Results

The project itself is conceived quite innovatively and actively involves students, future engineers, in developmentally and innovatively oriented thinking models through practical engagement. You only become an engineer when theoretical knowledge is an excellent basis for even better practical implementation. New technologies, especially the needs of Industry 4.0, require a strong research and development potential and the engagement of future employees who can transform the entire society into a high-quality and competitive one with high added value.

Access date: 05/06/2022

Provided by: Integra Institute

SOVA DIGITAL

SOVA DIGITAL
Digital Transformation of Industry Companies

Solution Partner
Digital Industries Software
SIEMENS

Source / Link: https://sova.sk/riesenia/industry-4-0-poradenstvo-pre-manazment/

Thematic area:	**Type of good practice:**	**Target group:**
☒ Transversal competences	☐ Project	☐ VET and adult education trainers
☒ Technical skills	☒ Initiative	☐ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

Industry 4.0 is a natural evolution that uses current technologies to increase the competitiveness of businesses. That is a long-term and strategic corporate change that no external supplier can supply. It must be a change managed by the company's top management. However, its scope also exceeds the possibilities of ordinary business. Therefore, to achieve the expected results, the optimal solution is to combine a solid internal team with an external team of experts. SOVA Digital offers such support.

Detailed description

SOVA Digital is a member of the SOVA Group - a group of professional companies to achieve a synergistic effect created by their cooperation. SOVA Group focuses on digitising industrial enterprises and consists of SOVA Digital, CITO Digital and SIDAT Digital.

The SOVA Digital approach in management consulting is simple:

1. In the beginning, they create a team of workers who want change, are active, loyal and ready to receive new information and apply new procedures. This team should be the bearer of the initial transformations of Industry 4.0 in the company.

2. The ultimate goal is a long-term strategy, which will create the conditions for successful business development. Their goal is not to demonstrate the technology but to establish a way to bridge the gap from the current to the future expected state. For example, how to add value that the customer will appreciate, detect waste permanently, increase flexibility with decreasing repetition, and so on.

3. The intention is to gain experience and create an atmosphere of trust within the company. Thus, they start with more straightforward projects that quickly bring positive results, expertise and knowledge.

4. The implementation of the strategy should be intensive and should be extended to all company areas. It should build on the experience gained, and the procedures applied are constantly being improved.

Beneficial Results SOVA Digital supports customers with “Blue line” - experts available 24 hours a day, seven days a week, 365 days a year. They proclaim to resolve customers issue immediately (if technically possible). Rental of licenses: SOVA Digital offers licenses that minimize the acquisition costs of information systems for an agreed period. It also offers training on delivered products, pilot projects, specialized professional training and certification courses.
Access date: 20/04/2021
Provided by: QUALED, Slovakia

TECXPORT - The showcase for Austrian technology expertise

Source / Link: https://www.tecxport.at/

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☐ Social skills	☐ Methods	☒ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

TECXPORT supports innovative Austrian technology providers with targeted funding calls, technology profiles on the TECXPORT platform in several languages, and networking opportunities during Austrian Technology Days abroad.

Detailed description

TECXPORT is an initiative of the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) implemented by the Austrian Research Promotion Agency (FFG) in cooperation with the Austrian Federal Economic Chamber (WKO). The funds are made available by the BMK and the National Foundation for Research, Technology and Development (NFTE).

The objective is to present the best of Austrian technology in a modern and easily accessible manner to:

- simplify the search for Austrian high-tech products, technological solutions and services;
- encourage international technological cooperation and technology exports; and
- enhance opportunities for commercial exploitation.

The TECXPORT platform showcases innovative technologies made by Austrian technology companies and solution providers. It is divided into nine areas with a focus on public infrastructure to present Austrian solutions which are in demand worldwide.

- Energy,
- Environment,
- Healthcare,
- Industry & Space,
- Mobility,
- Security & Defense,
- Smart Cities,
- Smart Solutions & ICT.

The platform and the individual profiles are available in six languages (German, English, French, Spanish, Russian, Chinese). The technology profiles will be presented by key figures in Austria's economy during the Austrian Technology Days both at home and abroad.
Access date: 14/06/2022
Provided by: WIN

TestBed 4.0

Source / Link: https://www.testbed.sk/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☒ Creative skills	☒ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary

TestBed 4.0 is a unique workplace focused on solving the practical needs of industry in the field of Industry 4.0 powered by SOVA Digital. (https://www.youtube.com/watch?v=uX89WdN--TI).

Detailed description

TestBed 4.0 is a specialised workplace, focused on solving the practical needs of industry in the field of Industry 4.0, creating cooperation between industry and universities, and involving young talented students in solving the practical needs of practice. The ambition of TestBed 4.0 is to provide real-world outputs, information and support for industrial enterprises, and to develop knowledge in the field of Industry 4.0. Main mission is:

- Addressing the practical needs of industry in the field of Industry 4.0,
- Educating students and involving young talented people in solving the practical needs of practice,
- Education for practice,
- Creating cooperation between industry and universities,
- Research and development of Industry 4.0 applications.

What could companies solve in cooperation with TestBed?

- design and verify the concept of the solution (workplaces, operations, halls, warehouse…),
- optimise existing production and logistics processes (from small tasks to entire operations),
- digitally verify the operation of the designed product, workplace, line before the start of its production (recommended for devices that use PLC controls),
- tune your data flows in the factory,
- design active (smart) data visualisation (state in production, in progress, workload),
- design data collection and data evaluation using IoT, and compare conventional data collection solutions with IoT solutions,
- verify the reality of the planned investment,
- development of customised digitised applications,
- be inspired by new innovations.

Beneficial Results

TestBed 4.0 provides for students:

- visits with an explanation and presentation of the principles and possibilities of Industry 4.0 for high school and university students,
- standard educational process in the form of lectures and practical exercises,
- solving the topics of year and final works brought from practice,
- participation in solving projects for practice,
- participation in solving research projects - university and practical projects.

TestBed 4.0 expects industry to be involved in listing the topics of final theses or small commercial projects that can be solved independently by students or under the guidance of TestBed specialists. Students are also considered to be doctoral students, whose expertise usually guarantees the ability to solve even more complex tasks independently.

The training package provided by TestBed 4.0 for practice covers the needs of:

- top management, aimed at managing the managed process of digital transformation of the company,
- Industry 4.0 leaders, responsible for the practical application of digital enterprise transformation,
- specialists, IT experts, industrial engineers applying elements of Industry 4.0 in the company,
- application users,
- Educational activities for practice are in most cases implemented in the form of workshops, where participants address topics close to their needs, and test and prepare applicable outputs themselves.

Access date: 20/04/2021

Provided by: QUALED, Slovakia

The Arxcelerator program by Oculavis

Source / Link: https://arxelerator.com

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences ☒ Technical skills ☒ Creative skills ☒ Social skills ☒ Contextual skills	☐ Project ☐ Initiative ☒ Programme ☐ Methods ☐ Training materials ☐ Other	☐ VET and adult education trainers ☐ Labour market policy experts ☒ Human recourse management ☒ Others: Companies and Organizations

Summary:

The Arxcelerator program offers corporates the opportunity to tackle the implementation of augmented reality into their operational processes together in a consortium with other companies. In the protected atmosphere of a professionally managed six-month program, participants can discuss technical and organizational challenges, find joint solutions, exchange experiences, and develop best practices in the design of processes and digital business models.

Detailed description

Recently, Oculavis GmbH launched the world's first reverse accelerator. The reason for this is that the corporate world needs fresh innovation formats that focus on the impact side of innovations instead of launching yet another hackathon, incubator, accelerator or digital startup lab – as innovation often already gets stuck within the boundaries of a corporate as soon as the curtain comes down on such innovation programs. The goal is to involve the right stakeholders of core business processes who directly benefit from an innovation, who themselves implement it in their processes and scale it from there – in their own organization and beyond. Oculavis wants to bring the driving forces together to enable interorganizational learning and synergetic effects.

The program will last for 6 months and the participating corporates will be able to tackle the implementation of augmented reality into their operational processes together in a consortium with other companies. In the protected atmosphere of the program, participants can discuss technical and organizational challenges, find joint solutions, exchange experiences, and develop best practices in the design of processes and digital business models.

Beneficial Results

Participation in the Arxelerator program with the opportunities for benchmarking and exchange of experience already represents a high added value. In addition, the top 5 corporates will receive packages worth more than 150,000 Euros. The results of the benchmarking form the basis for identifying the winners and are supplemented by a qualitative evaluation of the final pitches by a neutral jury.

Additionally, apart from the formal awards, a consortium of corporates working on similar issues supports each of them in pushing the implementation of augmented reality workflows and remote support, discovering new use cases and identifying measurable success factors as part of the benchmarking study.

Access date: 31/03/2021

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences	☐ Project	☐ VET and adult education trainers
☐ Technical skills	☒ Initiative	☒ Labour market policy experts
☐ Creative skills	☐ Programme	☐ Human recourse management
☒ Social skills	☐ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☒ Other: Policy	

Summary

The digital economy offers a lot of new opportunities and also important challenges that must be dealt with. One of those challenges is the need for innovative ways to ensure access to social protection for workers on atypical contracts. If we understand quality employment as a system which provides for a decent wage, occupational health and safety provision, acceptable working conditions, opportunities for training and promotion; and if a full-time and open-ended contract 'for all' is to remain the norm, then the impact of the digital revolution on labour markets triggers numerous concerns.

Detailed description

Trade Unions, especially the European Trade Union Congress (ETUC), are concerned that not enough effort is being put in to analysing the social impact of digitalization on companies and the labour market, in particular labour laws, working conditions, work-life balance, social dialogue etc., which are considered to be the key to an innovative digital labour policy. However, initiatives and resolutions are emerging, both at national and European levels. The European Commission launched in April 2017 a consultation to social partners on the access to social protection for all as well as on labour contracts rules as part of its European Pillar of Social Rights, aiming to avoid that new precariousness and inequalities will emerge.

The strategic paths for adaptation of labour market policy and institutions to provide adequate protection for workers must be based on the following aspects:

- Clear definition of the contractual partners in any employment relationship;
- Formalization of contractual clauses that protect workers from being exploited in a new employment model;
- Clarification of the concept of 'homeworker' and the duties and rights that are associated with his work model;
- Applicable law and fora to solve eventual conflicts between employer and employee;
- Terms and conditions that regulate the work performed on the web platforms (collaboration, sharing or crowdsourcing);
- Conditions for self-organisation and online entrepreneurship, including guidance on the mechanisms to establish reputation and trustworthiness;
- Innovative forms of unionization and collective bargaining for online work;

- Co-determination of work duties and rights by task owners, mediating platforms and online workers.

The policy implications of the emerging digitized economy also concern the regulatory framework of insurances. Of great importance in this context is how far self-employed workers are insured against various risks. For example, the German legislation already offers the option for independent workers to insure themselves against unemployment.

Beneficial Results

The focus of social security systems on standard employment which is understood as work that is full time, indefinite, as well as part of a subordinate relationship between an employee and an employer, and the rapid growth of non-standard employment, will become not only a problem for the unemployment insurance but also for old-age insurance. Additional incentives or even obligations to enter the old-age insurance system need to be examined in the years to come. Addressing these challenges in a timely manner will allow countries to benefit from large-scale societal benefits in the form of an improved social security system and economic stability.

Access date: 02/02/2022

Provided by: INI-Novation GmbH

Learning Practices

EIT Manufacturing & Skills.move

Source / Link: https://www.skillsmove.eu/

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences ☒ Technical skills ☐ Creative skills ☐ Social skills ☒ Contextual skills	☒ Project ☐ Initiative ☐ Programme ☐ Methods ☒ Training materials ☐ Other	☒ VET and adult education trainers ☒ Labour market policy experts ☒ Human recourse management ☒ Others: industry workers, students and job seekers

Summary:

Skills.move is EIT Manufacturing's guided learning platform. Skills.move aims to support Europe's manufacturing industry to upskill and reskill its current and future workforce by providing individuals easy access to a personalised learning experience. The curriculum has been co-created with EIT Manufacturing's partner community in line with pre-identified industry needs.

Detailed description

EIT Manufacturing was established in 2019 with a vision that global manufacturing will continue to be led by Europe, and contributing to make Europe and its manufacturing sector more competitive and sustainable. By bringing together Europe's manufacturing actors, EIT Manufacturing brings together a growing network of top-tier industrial partners, leading academic and research institutions from across the region and innovative startups, scaleups and SMEs. A key way of transforming knowledge into value is by overcoming the fragmented nature of many innovation networks. In order to ensure that innovations reach the market, industry has the right talent and entrepreneurs can thrive; EIT Manufacturing connects and integrates the areas of education, innovation and business creation.

Skills.move is EIT Manufacturing's guided learning platform, and is the main project of the education division of the organisation. Skills.move aims to support Europe's manufacturing industry to upskill and reskill its current and future workforce by providing individuals easy access to a personalised learning experience. The curriculum has been co-created with EIT Manufacturing's partner community in line with pre-identified industry needs. Currently, the platform covers topics, such as additive manufacturing, artificial intelligence, augmented reality, automated guided vehicle, big data, binder jetting, cloud computing, cobots, cybersecurity, data, data analytics, digital transformation, digital twins, direct energy deposition, disposal, and 25 other topics.

Ultimately, the platform could be considered a high-value adding tool for reskilling and upskilling industrial workers, students and professionals with various backgrounds, by also taking into account the needs of industrial companies.

Beneficial Results

The availability of such digital learning resources undoubtedly brings many benefits for the industry and the people, and some of them are:

- Skills for the future - The skills people need to perform and grow in their career, and stay on top of new technologies and trends could be acquired by taking courses in the platform.
- Recognised certificates – after the completion of a course, a certificate is issued, which is recognised by prestigious industry partners.
- Hands-on experience – the platform offers theoretical study that is complemented with practical learning experiences, co-created with industry and academia. Learning Factories and real working environments through Teaching Factory training projects. Access to different types of didactic resources, like e-learning units, practical task lessons, Augmented Reality (AR) and Virtual Reality (VR), along with learning assessments to achieve and verify your desired competencies.
- A tailored learning journey, which combines the right learning units and learning paths, to meet learners' individual needs.

Access date: 07/02/2022

Provided by: INI-Novation GmbH

fit4internet

Source / Link: https://www.fit4internet.at/page/home/&lang=EN

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☐ Initiative	☒ Labour market policy experts
☒ Creative skills	☒ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others
☒ Contextual skills	☒ Training materials	
	☐ Other	

Summary:

fit4internet is committed to raising digital skills. On this platform, people can gain an understanding of the Austrian competence framework, determine their own level of knowledge, learn new things in a playful way, find suitable learning offers and stay well informed. Course providers can assign and advertise their offers. One can also find information on members or partners who support activities to increase digital literacy in Austria.

Detailed description:

The programme consists of four steps:

1. **Understanding the Digital Competence Framework**

Information on what "being digitally competent" means. Austria has developed its own competence model for digital skills. It is called "Digital Competence Framework for Austria - DigComp 2.2 AT" and is based on the European Reference Framework for Digital Competences (DigComp 2.1). The Competence Framework serves to classify and compare digital skills and thereby makes a contribution to facilitate the exchange on desirable knowledge and competences in the digital world of life and work.

2. **Checking**

fit4internet gives offers the opportunity to evaluate one's digital skills. For this purpose, the fit4internet tools CHECK and QUIZ were developed. A CHECK contains self-assessment questions and a QUIZ, on the other hand, employs knowledge-based questions. There is no time limit for answering the questions. Moreover, a registration is not required. The f4i-tools can be used as often as desired.

3. **Learning**

The fit4internet catalogue provides a choice of courses and certificates of competence that are designed to develop, enhance or confirm digital skills. They are categorised according to the six competence areas and eight competence levels defined by the Digital Competence Framework for Austria. The offers come from different providers. The offer descriptions are outlined in the language that is used by the respective course provider (German/English).

4. **Keep going**

Users can find brief articles on how to be digitally competent in everyday life, how to navigate one's way around the overload of digital information, why it is worthwhile to continue training digital skills, what to expect in the digital future, and where the limits of digitalisation are.

Access date: 14/06/2022
Provided by: WIN

NEMAK Slovakia

Source / Link: https://www.nemak.com/

https://industry4um.sk/en/nemak-slovakia-pokial-nam-zalezi-na-kvalite-vzdelavania-spolupraca-firiem-a-skol-je-klucova/

Thematic area:	**Type of good practice:**	**Target group:**
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☐ Initiative	☐ Labour market policy experts
☐ Creative skills	☐ Programme	☒ Human recourse management
☐ Social skills	☐ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☒ Other (School with dual education)	

Summary:

Nemak Slovakia within the InTech association in town Žiar and Hronom, Slovakia, established Private Secondary Technical Vocational School, using dual education.

Detailed description

Nemak is a leading provider of innovative lightweight solutions for the global automotive industry, specialising in the development and manufacturing of aluminum components for powertrain and body structure applications. It has been operating in Slovakia since 2005, when the then owner of Rautenbach AG was taken over by the Teodora Nemak group. Nemak builds its future on automation, digitisation, the concept and technologies of Industry 4.0. Nemak vision is to become the leader of Industry 4.0 in Slovakia. This brings demands not only to increase the number of employees, but also to qualify them. And it is in accordance with this vision that they have been preparing a qualified staff base in a vocational school involved in the dual education system for years.

The lack of qualified high school graduates for the needs of practice is a notorious problem in Slovak industry. As not much has changed in the education system, even after years of urging employers after a major reform, a group of companies, led by the largest employer in the Žiar region, Nemak Slovakia, established the InTech association and took the training of future employees into their own hands. In 2008, they established a Private Secondary Technical Vocational School in Žiar nad Hronom. Today, it is involved in the system of dual education, and creates profiles of graduates according to the requirements of companies. Thus, qualified and enthusiastic students with their first practical experience come from the school to Nemak.

Beneficial Results

Except Nemak Slovakia, the school is working with other companies from the region, which participated on the dual education (Fagor Ederlan Slovensko,a.s., Remeslo strojal,s.r.o, Sapa Profily a.s, Slovalco, a.s., TUBAPACK, a.s., Zámočníctvo Ruckschloss Banská Štiavnica, ELBA, a.s. Kremnica, GAMAalumínium s.r.o, Continental Automotive Systems Slovakia s.r.o. Zvolen, BURGMAIER, Precision Slovakia, s.r.o.).

Access date: 20/04/2021

Provided by: QUALED

School Industry 4.0.

Source / Link: https://www.siq.si

Thematic area:	**Type of good practice:**	**Target group:**
☒ Transversal competences ☒ Technical skills ☒ Creative skills ☒ Social skills ☒ Contextual skills	☐ Project ☐ Initiative ☐ Programme ☒ Methods ☒ Training materials ☐ Other	☐ VET and adult education trainers ☐ Labour market policy experts ☒ Human recourse management ☒ Others: Companies and Organisations

Summary:

Organizations are increasingly aware that only through continuous development and improvement of processes will they be able to compete in changed market conditions (changed global circumstances, emergence of new technologies and materials, changed consumer and user habits, labour shortages...) and successfully integrate into global chains values. The key challenge currently faced by manufacturing companies in particular is the agile management of the aforementioned changed circumstances in the business environment.

Detailed description

The adaptability of the organization, which in some way resembles an autopoietic (self-controlled) organism, is not possible without interconnected and information-supported processes and their control based on objective facts. This is where the digitization and automation of processes prove to be key complements to management decision-making in real time, as irreplaceable support for employees in the effective realization of processes and business ideas, and increasingly even as a feasible answer to the lack of human resources. This is what the Industry 4.0 School is for.

The school, that is, the education, takes place in a hybrid format, which means a combination of online and classroom training as well as individual and interactive work and includes several sets of educational training, over five (5) educational days, with contents such as:

1. Foundations of Industry 4.0 and digital competences
2. Phases of transformation of Industry 4.0
3. Methods and tools Industry 4.0
4. Technologies of Industry 4.0 and calculating the cost-effectiveness of investments in digital transformation.
5. Visit the Laboratory for Factories of the Future (LABTOP), which is an educational industrial laboratory for motivation, teaching, applied research and testing. The laboratory presents the most modern technologies, concepts and solutions for smart factories with the integration of the business system as a link in the entire production process. At nine demonstration sites, it provides insight into the business system (ERP), production management system (MES), manipulative and collaborative robots, autonomous vehicle (AGV), augmented reality (AR) and smart sensors (RFID technology).

The training ends with the creation and presentation of project tasks. By successfully presenting the project task at the end of the program, the participant obtained the title of Digital Transformation Project Manager.

Beneficial Results

Participants gain out of the programme a more comprehensive understanding of the concept of Industry 4.0 and Society 5.0, necessary knowledge of approaches and technologies and presentation of examples of good practices, knowledge to identify the existing and desired state of industrialization of the company, guidelines for the preparation of an action plan for the transformation to the level of Industry 4.0 with the support of a mentor, with an emphasis on acquired practical knowledge for independent management of internal projects of digital transformation of production processes.

Organizations thereby gain:

- an understanding of the effects of the transition to the level of Industry 4.0, such as an increase in the organization's supply capacity, vertical integration of processes from sales to delivery, increased resistance to disturbances in the external and internal business environment, control of operations in real time and the possibility of using artificial intelligence in decision making,
- self-assessment of the current level,
- knowledge of business and technological trends in the digitization of business,
- a broader insight into the economic feasibility of investments,
- qualified colleagues who can creatively co-create the transition to the level of Industry 4.0,
- qualified colleagues for the internal management of process digitization projects, the use of modern approaches in product planning and production automation.

Access date: 05/05/2021

Provided by: Integra Institute

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☐ Technical skills	☐ Initiative	☐ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☒ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

While it is difficult to accurately predict the occupations that will emerge in the near future, the key competencies for the digital economy are easy to identify. In an increasingly globalized and technological world, in urban contexts of high population density, where virtual life experience competes with the physical one, creativity, resilience and social intelligence are skills as important as skills in science, technology, engineering and mathematics (STEM).

Detailed description

The transformations expected by automation of the industrial processes, services and channels of human interaction emphasize the importance of strictly human skills and which are very difficult to automate. The experts have been highlighting several of these skills namely:

- **Sense-making skills**, which translate into the human capacity to co-create meaning and construct social realities that enhance collective well-being. Knowledge entrepreneurship and leadership are examples of skills that fall into this category. Moreover, the digital economy demands motivated, self-reliant individuals who are capable of setting up their own goals, schedules, workloads and education in a way that shortens the skill gaps in the organization and empowers the worker to define meaningful careers.
- **Social intelligence skills** correspond to the human capacity to empathically connect with other people, in order to produce effective interactions and to motivate positive reactions. These competencies are particularly relevant in services where effective response depends on the quality of communication. Socially intelligent workers are able to quickly assess the emotions of those around them and adapt their words, tone and gestures accordingly. Social intelligence skills are of central importance to collaboration aiming at solving complex problems that require multidisciplinary knowledge. They are also important for global businesses and teams.
- **Cognitive load management** focuses on the ability to filter information by importance and also understand how to maximize cognitive functioning using a variety of tools and techniques. The next generation of workers will develop their own techniques to manage problems of cognitive overload such as social filtering - ranking, tagging, etc. or add information as a way to project their own image or the image of the organization.
- **Novel and adaptive thinking** that translates into the ability to adjust thinking to the specific circumstances of the moment and find quick solutions that go beyond what is obvious, possibly transformational enhancers that take the best advantage of windows of opportunity. The

professions linked to technological innovation and customer service will greatly benefit from this type of skills. This category of skills includes those related to organizational and work engineering that give the worker the ability to make adjustments to her/his work environment in order to enhance performance. The learning of strategies for adjustment and adaptation are becoming increasingly important to help navigating a complex world undergoing constant change.

- **Cross-cultural skills** integrate multi-cultural communication skills. In a global world, work will no longer depend on the geographical proximity between the employer and the employee, nor between the company and its customers. For these relationships to be efficient, the worker will need to master multiple languages and a wide range of cultural meanings. Workers will need to be able to identify and communicate common insights such as shared goals, priorities and values to build strong professional/commercial relationships and work effectively together. These skills are also important for teams in the same geographic space. The growing migratory movements and international businesses give rise to work teams of great cultural, religious, gender and linguistic diversity. Being able to cooperate in this context of great diversity will add value to the worker of the future.
- **Transdisciplinary skills** allow to understand the complex situations from multiple scientific perspectives. Certain professions linked to innovation and complex problem solving (global warming, terrorism, aging populations) will require experts in a number of multidisciplinary fields as well as interdisciplinary communication skills. Workers will have to develop deep understanding of at least one field, while having the capacity to comprehend a broad range of disciplines. Furthermore, the multi–disciplinary mix of science, engineering and arts is of utmost importance for creative businesses that the digital economy requires.
- **Design mindset** is the ability to define and develop tasks and work processes for desired outcomes. Workers will be able to shape their working environments in order to leverage cognition. Work environments have an impact on the brain so next generation of workers must be able to recognize those impacts and to make adjustments that favour the accomplishment of their tasks. The design mindset includes considering the arts as a valuable component of education.
- **Computational thinking skills** that include statistical and programming skills required to develop analytical and visualization technologies for a vast amount of structured and unstructured data. Workers will increasingly need to be able to turn data into relevant and useful insights that can increase productivity and lead to further innovation. They need to understand the strengths and limitations of models used to identify patterns in the available data and how well those models support business goals and strategies. Workers must also be able to effectively react in the absence of data and recognize what that absence is indicating. Furthermore, simulations will be used to support negotiations and decision-making in organizations. The ability to create/identify useful simulation tools and to interpret results of simulations will be very important skills.
- **New-media literacy** which refers to the ability to critically evaluate new communication technologies and apply them in a way that makes communication with co-workers, customers, service users and others, more effective. More than recognizing the risks of a hyper-connected society, it is important to be able to adopt and develop more effective strategies to strengthen the security online presence. Improving online reputation, implementing trust mechanisms and distinguishing credible information from rumors will be increasingly sought after skills. Furthermore, the ability to produce content to leverage these new media for persuasive communication will be highly valued.
- **Virtual collaboration skills** are important to work in groups through virtual platforms that enable collaboration between geographically dispersed workers. Virtual collaboration requires specific communication skills such as the ability to interpret emotion in texts, effective articulation of thoughts, and minimization of uncertainty associated with waiting for an important feedback. In virtual environments, access to facial expressions and information about the activity of the interlocutor outside the moments of interaction may be minimal. This limitation can cause communication problems with negative impact on the motivation to collaborate. Moreover, future

workers should be comfortable with the use of game strategies to motivate online work as well as the use of avatars in virtual work environments**.**

Beneficial Results

Digitisation and the fourth industrial revolution require the successful acquisition of appropriate skills. This can only be achieved by restructuring and modernizing school curricula, especially in the fields of informatics, logic, creative thinking, problem solving, project work and team work. This requires a change at all levels of education, including formal and non-formal forms of learning, of education models for work, and the integration with the economy and government.

Overcoming the traditional silos of the scientific disciplines that characterize most of today's education is a huge challenge that must be tackled quickly. Innovative initiatives in this field are increasingly urgent, particularly if we take into account that the education sector will soon undergo a major transformation due to the introduction of robots. These robots will allow aggregating high-quality content according to the student's specific needs in a one-to-one learning approach.

Access date: 01/02/2022

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☐ Initiative	☐ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☒ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The coming decades will witness to profound social, cultural and economic changes enhanced by rapid scientific and technological advances. New businesses, forms of social organization and work models will bring numerous opportunities for personal and collective development as well as complex challenges of individual well-being and social progress. Professional success will depend on individuals' ability to maintain skills tailored to the needs of a continuously shrinking labour market. Robots and intelligent systems will be increasingly used to perform repetitive and well-defined tasks, which not only include simple tasks but also very complex ones that require high levels of precision. In this context, the scientific and technological skills as well as those that are still specifically human will be fundamental for the future worker.

Detailed description

Skills can be developed in the classroom and outside classroom guided by formal activities designed to lead and assess the student learning. The skills are developed using curricula, programs, workshops, laboratory work, training sessions, projects, company visits and study journey, in individual or group learning approaches.

Learning methodologies can be divided into three categories: expository, guided, and active strategies (Cinque, 2016). The expository strategy includes (1) the lecture where the specialists explore a topic in depth; (2) the seminar that brings together a small group of participants that explore a topic in a participative way; (3) the conference where a set of innovative topics are presented by different speakers and discussed by a large number of participants; and (4) the demonstration where the application of concepts in experiments is used to make their learning easier.

The guided strategy includes the (1) debate that presupposes that topics are discussed from the different experiences of the discussants and the discussion is informed by the scientific knowledge about those topics; (2) workshop adds to the debate the possibility to experiment with the discussed concepts using adequate tools; (3) case study allows for the in depth study of a phenomenon within the context it is unfolding; (4) project work usually allows for the development of a proof of concept (methodological or technological tools that implement a conceptual perspective) or towards the experimentally learning about complex topics; (5) simulation supports the testing of complex decisions, allowing the developing

an in depth understanding of their impacts in specific contexts; (6) mentoring allows to facilitate the learning of a student by closely following his/her performance and helping to acquire the knowledge that will allow to overcome faced challenges.

Finally, the active strategy is implemented in (1) brainstorming is a group creativity discussion aimed at raising as many ideas as possible on how to address problems, avoiding pre-judgements about the quality or feasibility of those ideas; (2) role play allows for the embodied knowledge of situations by developing actual experience about challenges and problems; (3) business game is a technique aimed at engaging students in close to reality business situations; (4) visits and journeys are aimed at observing organizational and social contexts where the phenomena are unfolding. This strategy differs from the case study as the student assumes the passive role of an observer instead of the active role of a researcher; (5) outdoor training takes the students outside the classroom to more relaxing environments that may be more stimulant of creativity; (6) coaching is the strategy aimed at defining clear learning steps that the student must follow to achieve the goals jointly defined by the coacher and the student.

Although an initial presentation of concepts and practices may benefit from expository strategies, they induce a passive attitude that is not appropriate with current knowledge that effective learning requires practical experience with these concepts and practices. Learning alters the brain to the extent that it involves integrative cognition: mind and body. Therefore, guided and active strategies have been increasingly applied by trainers and educators. However, the learning of the skills required by the digital and global economy may face various challenges even when using these strategies.

Many processes are being virtualized and the worker must have an effective action both on virtual and physical work environments. The likelihood is that workers will spend more and more time in the virtual work environments where he/she must collaborate and communicate effectively, co-creating solutions, implementing innovative processes and leading teams. This requires that active learning happens mostly in the mind and little is required from body learning. Moreover, the interaction of co-workers is still limited in terms of the emotional and behavioural clues that the worker can access. New technologies are being developed to reduce those limitations by permitting to share sensorial information on the internet, including sound, touch, smell (Aijaz, Dohler, Hamid Aghvami, Friderikos, & Frodigh, 2017; Fettweis, 2014). These are still experimental technologies but once they become commercially available in a large scale, guided and active strategies will be applied for innovative learning processes to develop skills for virtual work contexts.

In particular, strategies such as case study, project work, mentoring, role play, visits and journeys, outdoor training, coaching will benefit from augmented reality and sensorial technologies to create learning environments where teams geographically distributed can experiment with concepts is a quasi-physically way, enjoying the relaxation and induction of creativity that outdoor environments bring to learning.

Beneficial Results

Specially designed learning environments have the potential to revolutionize education and vocational training by customizing learning and freeing the teacher/trainer from gathering and structuring content and context. It will promote technology-enhanced learning in which learners are guided in their real/virtual-world learning by autonomous and intelligent systems that give access to the most adequate digital resources.

Access date: 02/02/2022

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☐ Initiative	☐ Labour market policy experts
☒ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☒ Methods	☐ Others
☒ Contextual skills	☒ Training materials	
	☐ Other	

Summary:

This best practice outlines some concrete recommendations for developing certain future-proof skills. Since the focus is on the digital economy and the labour market transformations it entails, the recommendations address effective strategy for the development of these skills for working in virtual and smart work environments.

Detailed description

Sense-making, Social Intelligence and Cross-Cultural Skills

The growth of information available on the web is huge and grows very fast with each passing day. This information is often created and shared by credible entities genuinely interested in sharing important information for understanding the world around us and to make decisions; however, individuals and organizations have the same ability to share false information and spread rumours. The workers of the future will increasingly use digital information to learn, perform their tasks and innovate. Thus, it will be necessary to train these workers in the best strategies to distinguish credible information from false information to address this theme the following learning outcomes are recommended:

- Explain the concepts of fake/biased information and rumours together with the reasons that may lead to their creation and spread,
- Analyse problems and potential consequences associated with the spread of fake and biased information,
- Explore real cases in which fake/biased information led to serious consequences for organizations and the society in general,
- Apply strategies to assess the credibility of information sources,
- Apply strategies to avoid unintended spread of rumours online,
- Evaluate software that automatically detects fake information.

Increasingly, workers will find themselves interacting online with clients and suppliers, co-workers, individuals in knowledge communities external to their organizations among many other individuals reachable over the internet. The success of these interactions depends on their ability to understand the interlocutor and making others to understand them. Below it is a list of recommended learning outcomes:

- Apply social listening by using effective software tools to monitor social media. In this way, workers can anticipate expectations and dissatisfactions as well as develop a prior knowledge of the interlocutors.
- Evaluate different strategies to writing text to communicate reasoning and emotion. Assess the effectiveness of tools to share visual, sound, touch and smell information in an online communication.
- Apply strategies for online conflict resolution to deal with situations such as cyberbullying, fast response to a negatively-charged interaction in a productive manner, reduce the impact of a misunderstood message.
- Apply one-to-one listening during online interactions, namely by maintaining a stable focus on the exchange of information, ask for clarifications that may be useful to a complete interpretation of received information, relating to prior online interactions to contextualize received information.
- Create effective strategies for online self-advocacy that adequately transmit one's needs without compromising the dignity of oneself or others.
- Develop online coherent identity by ensuring consistent communication, managing online reputation, and provide information on life experiences (personal, social, professional).

In the global economy, to make sense of situations and to relate harmoniously with whom she/he interacts, the worker must be able to understand different cultures and learn how cultures express online. For effective cross-cultural communication and collaboration, the learning outcomes listed for online sensemaking and social intelligence are also important. The list of additional recommended learning outcomes includes:

- Recognize cultural diversity and online cultural expressions;
- Explains strategies that promote mutual acceptance and understanding;
- Recognize online best communication practices;
- Describe how to prepare for a multi-cultural online assignment.

Cognitive Load Management skills

The numerous devices that surround us offer many opportunities for accessing information, making contacts with acquaintances and strangers, and acting locally or at a distance. The price of this empowerment of decision and action is an overload of information that requires a very high cognitive effort, producing anxiety, attention difficulties and inability to build consistent understandings about events. In order to deal with the incoming information and other stimuli, workers will have to learn how to manage their cognitive load. Below it is a list of recommended learning outcomes:

- Apply effective techniques to focus own attention towards the issues relevant to perform the tasks at hand;
- Understand the concept of collective intelligence to apply it to interlink the cognitive capabilities of a group of people using adequate technology;
- Apply techniques and software tools to effectively manage time;
- Recognize and assess software tools that integrate information into insightful visualizations.

Adaptive Thinking and Transdisciplinary skills

These skills support the worker's ability to innovate by adjusting perspectives and connecting insights from different scientific fields. Smart work environments will be created to take advantage of these skills. The list of learning outcomes below are useful guides to develop them:

- Explain how to apply technology to analyse and integrate structured or unstructured data from different sources to produce insightful visualizations;
- Explain how to use intelligent systems to guide decision and expand action capabilities;

- Design work environments where technology (IoT, cloud computing, big data) interconnect and expand human intelligence, defining an open ecology of interconnected smart spaces and services;
- Recognize the potential of smartphones to act as human sensors for a wide range of solutions that require human judgement in the selection of the information to transmit.

Design Mindset and Computational Thinking skills

As the digital economy grows, the demand for innovative supply solutions, dynamic integration of multi-national teams and development of new digital products will increase. Courses to develop the design mindset and computational skills should include the following learning outcomes:

- Identify the digital marks of activities and transactions;
- Explain the role of digital currency and how it is created;
- Design self-organization strategies and mechanisms for digital organizations;
- Assess the performance of machine learning algorithms and their usefulness in specific work contexts;
- Select appropriate programming languages for different development objectives;
- Design and build robots.

Beneficial Results

The learning outcomes that have been recommended for the definition of training that allows the development of skills considered key to the digital age reflect the specific needs of digital work or work that heavily relies in present and emerging technologies. The above listed recommendations represent a reasonable blueprint, which can be used by human resource departments and VET trainers to design training programs, which are aimed at building future-proof skills among workers.

Access date: 03/03/2022

Provided by: INI-Novation GmbH

Stakeholders‘ viewpoints

Centigrade

°CENTIGRADE

Source: EIT Manufacturing

Thematic area:	**Type of good practice:**	**Target group:**
☐ Transversal competences	☐ Project	☐ VET and adult education trainers
☒ Technical skills	☐ Initiative	☐ Labour market policy experts
☐ Creative skills	☐ Programme	☒ Human recourse management
☐ Social skills	☒ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

Transforming industry into a ‘smart factory’ is a major challenge for companies in many ways. As well as developing and implementing new processes and IoT-capable production facilities, one of the most important aspects is the human factor. There are numerous further training and professional education courses designed to get employees ready for new machines. Centigrade offers an alternative by developing interfaces that get new machines ready for employees. Thomas Immich, CEO of Centigrade, explains why Industry 4.0 means more than just new machinery, and why the human-machine interface needs rethinking.

Detailed description

Centigrade views UX design and engineering as strategic aspects of developing new machinery, applications and processes. In other words, according to Thomas Immich, the often rather vague concept of 'strategy’ primarily means: ‘Rather than remaining in a state of implementation, let’s take a few smart steps towards significant change.’ This motto continually guides Centigrade in the development of user interfaces for machinery and systems. A good strategy is doubly vital in the UX sector: most users are overwhelmed by the quantity of features with which they are saddled on a daily basis. Targeted countermeasures are therefore needed to provide users with significantly fewer functions. This results in more satisfied users with greater skills experience, as well as in lower implementation costs, as many functions can be removed as early as the concept phase, or at least moved down the priority list.

Industry 4.0 is increasing the level of automation, networking machines and processes, and enabling machines and parts to communicate with each other. In those developments, the human interface plays a very important role. It is clear that machines – and robots in particular – are doing an increasing number of simple tasks but the complexity of the goods being produced and customer demand for personalisation are also increasing to at least the same extent. The flexible production dreamt of under Industry 4.0 is only possible if people continue to play a major role, although with different tasks to perform. Thomas Immich also explains that, according to one of the company’s long-term clients, despite a very high level of innovation, the top management are absolutely clear that humans are the ‘drivers of added value’. Industry 4.0 therefore naturally involves future topics such as Artificial Intelligence, cobotics and autonomous vehicles. However, all of this must be understood, calibrated, controlled and taken responsibility for by humans! A self-explanatory and intuitive user interface is key to this.

Beneficial Results • Users enjoy operations more than before; • Improved or redesigned UX support the employees in achieving their goals without the need of a handbook or expert training; • Lower implementation costs for new technologies.
Access date: 31/03/2021
Provided by: INI-Novation GmbH

Nobilia

Source: EIT Manufacturing

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences	☐ Project	☐ VET and adult education trainers
☒ Technical skills	☐ Initiative	☐ Labour market policy experts
☐ Creative skills	☐ Programme	☒ Human recourse management
☐ Social skills	☒ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

Nobilia is Europe's largest kitchen manufacturer and it builds on state-of-the-art production processes and the work of its staff. The company is currently building a new factory in Germany's Saarland and Dr. Lars M. Bopf, CEO of Nobilia-Werke, explains the importance of automation in the furniture industry, international markets and the role of employees. Since Nobilia is a traditional family company, where it is believed that success comes from people, Dr. Bopf explains that targeted training is a way to overcome the challenges for the employees that come as a result of the automation of various production processes.

Detailed description

As explained by Dr. Bopf, despite the size of the company, Nobilia's corporate culture is a family one with a strong sense of togetherness. This is a good foundation for promoting and systematically implementing innovations. The company naturally always tries to continuously improve its products, processes, technologies and services and this is part of the company's DNA. This ongoing progress is not something that happens by chance – it is addressed strategically. Every goal that the company achieves gives it a boost for the next step forward.

Every Nobilia kitchen is unique, and customer demand for customised products is also constantly growing. Increasing variance and consequently greater complexity in production and processing is not something that could be handled without networked systems and exchange of data between production facilities. Whether order forwarding via EDI, electronic recording and order processing in internal sales, production, or shipping by their modern delivery fleet with its new telematics system, digital processes have ensured complete transparency regarding individual customer orders at Nobilia. In other words, this makes Industry 4.0 technologies crucial for the company's success.

However, new production processes always represent a new challenge for employees. The knowledge required to operate the systems does not come from training alone. Cutting-edge technologies are becoming increasingly intuitive, but still require new elements such as a deeper understanding of production processes. Dr. Bopf explains that Nobilia provides its employees with targeted training in this area. Technical interests and the motivation to constantly learn new things are indispensable in the modern world. In addition, social skills – such as professional interactions with team colleagues or problem-solving skills – are increasingly important.

Beneficial Results

Apart from enabling Nobilia to better meet their customers' demands, Industry 4.0 technologies also reinforce the company's competitive advantages. One such advantage is Nobilia's production facilities in Germany. As it is known, production in Germany is considered expensive in comparison to other cheap-labour countries. However, German production for Nobilia's high-quality furniture has proven its worth, so the company kept to this approach when deciding on the new location. This is down to various factors. Proximity to France, their primary export country, is important and they are therefore geographically well placed to serve customers in France as well as other southern European countries. This saves transport costs and makes logistics easier. In addition, Saarland offers a well-structured pool of skilled personnel. When it comes to the technological aspect, Industry 4.0 technologies have the potential to reduce costs even further and to make the production in Germany even more profitable for Nobilia.

Access date: 31/03/2021

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☐ Technical skills	☒ Initiative	☒ Labour market policy experts
☐ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☒ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The continuous digitalization of our world will lead to a number of changes in the labour models and in the way jobs are performed. In 2015 the European Foundation for the Improvement of Living and Working Conditions (Eurofound) defined and described 9 new and innovative forms of employment models and the respective emerging skills and competences that they will most likely require. The impact of these new models is presented below and additionally, measures regarding the regulation and measurement of these new models are discussed.

Detailed description

In 2015 the European Foundation for the Improvement of Living and Working Conditions (Eurofound) defined and described the following 9 new and innovative forms of employment models:

- The **employee sharing** model implies that the worker is employed by various employers and, on a rotational basis, works within different organizations. In this way organizations fulfil their need for a highly skilled professional and the worker gets permanent full-time employment.
- In **job sharing**, the employer hires two or more part-time workers to jointly perform the activities of a full-time position. In this way the employer reduces the dependency from one single worker and the worker is allowed a part-time job.
- **Interim management** refers to the temporary hiring of highly skilled experts that will manage a project team or solve a specific problem. In this way, the organization accesses external management skills highly paid for a limited period of time.
- The **causal work** is a form of employment in which the worker is called on demand by the employer.
- More and more organizations require to ICT-based **mobile work**, where workers can do their job from any place at any time, as long as he/she has the requited technologies to perform the tasks.
- **Voucher-based work** refers a form of employment in which the services are paid with a voucher purchased from an authorised organisation that covers both pay and social security contributions.

- When a self-employed individual works for a large number of clients in small scale jobs for each of them, the individual is doing portfolio work according to the Eurofound classification.
- **Crowd employment** refers work done in response to open calls to perform specific tasks (innovation, creativity tasks, micro tasks) placed on an online platform that matches skill seekers with contributors. These platforms form “virtual clouds” of workers motivated to answer the open calls that fit their perceived skills.
- **Collaborative employment** is a form of employment in which freelancers, self-employed or micro enterprises, cooperate in some way to overcome limitations of size and professional isolation.

Beneficial Results

Some of these forms of employment have only become possible because of the digitization of the economy, others are developments of more traditional forms of employment made possible by sophisticated technology available at low cost.

Using innovative models of employment or more traditional formats, it seems certain that in the decades to come new occupations will emerge as a response to the challenges faced by mankind and the technologies that have transformed the world into a global village.

Access date: 01/02/2022

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☐ Transversal competences	☒ Project	☐ VET and adult education trainers
☐ Technical skills	☐ Initiative	☐ Labour market policy experts
☐ Creative skills	☐ Programme	☐ Human recourse management
☐ Social skills	☐ Methods	☐ Others
☐ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

With the social, economic and technological transformations associated to the gradual implementation of the digital economy, new families of occupations are emerging and will continue to emerge. The best practice describes the new emerging occupations among several sectors, such as health, agriculture, economy, education, engineering and environment.

Detailed description

Below the new emerging occupations in several sectors are described briefly:

Agriculture:

- **Urban farmers:** This profession will emerge as a way to reduce costs with the shipping and transport of food. Integrated gardens are already emerging in the city as well as specially built buildings for this purpose.
- **Plant- and tree-jackers:** specialists in the manipulation of trees and plants, including genetic, growth, texture and other kinds of manipulations. This kind of manipulations may be useful to meet consumer preferences and to develop more resilient plants to climate changes.
- **Crop robots technicians:** robots will monitor water levels and soil types; they will collect data that can be stored and analysed to help farmers making decisions about harvesting, replanting and pesticide use. Maintaining these robots and adjusting them to the different needs of crops will require specialized technicians.

Economy:

- **Alternative money bankers**: the growth of online transactions will increase the demand for virtual money (Bitcoin, Etherium) and for banks to set up such money.
- **Future currency speculators**: buy and sell virtual currencies to profit from fluctuations in the value of those currencies.
- Jobs of the **future specialist/recruiter**: due to the fast change in the labour market and emerging advanced technologies, experts in anticipating changes in the professions / emergence of new professions and in identifying individuals with the appropriate profile for positions that are not yet being offered may become important labour market players.

Education:

- **Dismantlers of professions**: will be specialized in deep transformations, or even the elimination of industries, in the less disruptive form possible. One of the areas of activity will be in higher education. With the increase of knowledge sharing and the increase of online courses, the trend will be to migrate from conventional education to a more dynamic model. Infrastructure for teaching content will no longer be needed and its use will have to be rethought. Online learning will also need to be structured in a way that allows for virtual forms of socialization and mobility.
- **One-to-one learning specialists**: artificial intelligence and unlimited access to powerful cloud computing resources will support the emergence of devices able to create learning materials that are tailored to the needs, aspirations and learning styles of each individual student. Device-embedded cameras and machine vision systems will analyze learners' facial expressions and body language to determine how engaged and invested they are in the learning process, how difficult they are finding a particular topic, and to detect early signs of learning disabilities. One-to-one learning specialists will be needed to guide the meta-learning process that allows for the student to define learning needs and aspirations; to overcome learning difficulties the intervention of specialists in different areas such as psychology, neurosciences, pedagogy and son on will be required.

Engineering/Technology:

- **3D/4D printing engineers**: A profession specializing in the handling of 3D/4D printing technologies for service delivery and the creation of innovative artefacts.
- **Global systems designers**: in present globalized information systems, designers will be needed to build and manage these systems; their expertise will greatly influence global policies (security, work design and safety, HR management).
- **Drone operators**: drones will be used to deliver multiple products and for community functions such as garbage collection or traffic monitoring. Skilled traders will be highly sought after to meet these needs.
- **Space-based energy systems designers and engineers**: the time will come when Earth's natural resources will no longer be explored so deeply. New ways of capturing and producing energy will emerge, namely by exploiting resources available outside the planet.
- **Microbial balance experts**: concerns with dangerous bacterial agents have been increasing because of new forms of bacteria and the trend for parents to avoid vaccination. Specialists in the evaluation of the health impact of bacteria and ways pandemics will evolve are increasingly needed (“10 New Jobs People Will Have by the Year 2030,” n.d., “8 New Jobs People Will Have In 2025,” n.d.).
- **Privacy consultant**: the increase in personal information sharing in a progressively more virtualized world will bring about the need for specialists in personal data protection and online reputation development.

Environment:

- **Specialists in reversing extinctions**: people capable of making extinct species reappear from genetic material.
- **Experts in environmental recovery**: professionals able to apply innovative technology for, for example, clean the atmosphere of human pollution and reduce the temperature of the earth.
- **Climate change specialists**: experts in developing and applying techniques and technologies to monitor and control climate change, thus ensuring the future of the human species.

Health:

- **Nano-doctors**: physicians specializing in disease detection, drug development and monitoring the body from the inside.
- **Service providers for octogenarians**: the growing of the average life expectancy will increase the number of people more than 80 years old. This group of people will create demand for goods and services that currently do not exist in the market. These goods and services will not all be in the healthcare sector since people will reach that age still active.
- **Amnesia surgeons**: doctors able to remove bad memories or alter rooted behaviours.
- **Organ / body parts manufacturers**: experts in using innovative technology to manufacture healthy organs from scratch that can be used in humans.

- **Big data doctor**: health care will be offered based on the patient's health record as well as lifestyle information collected automatically. Doctors will need skills to effectively use big data systems and advanced information visualization tools.

Beneficial Results

The emergence of so many new opportunities will to a large extent compensate for the automation and extinction of other professions. In such scenarios, transversal, social, creative, technological and contextual skills will be of an ever-increasing importance because it will enable people to better meet the requirements of new occupations and to leverage their experience.

Access date: 02/02/2022

Provided by: INI-Novation GmbH

University of Minho & Work 4.0 Consortium

Source / Link: http://work4-0.eu/

Thematic area:	Type of good practice:	Target group:
☒ Transversal competences	☐ Project	☒ VET and adult education trainers
☒ Technical skills	☒ Initiative	☒ Labour market policy experts
☐ Creative skills	☐ Programme	☒ Human recourse management
☒ Social skills	☐ Methods	☐ Others
☒ Contextual skills	☐ Training materials	
	☐ Other	

Summary:

The technical developments are radically changing not only the prospects of which work will remain to be carried out by people, but also the working conditions that will apply for them. This means by whom, where, when and how the work will be carried out. This flexibilization in working conditions is very beneficial for Work 4.0. Nevertheless, we need to bear in mind that the positive role of the innovation driven by technology will not arise automatically. The amount of flexibilization of working conditions needs to be balanced by the same amount of security for the workers.

Flexibility in working conditions includes the agreement between the worker and the employer about the adaptation to the market demands with respect to who will do the work (the function), when (the time), where (place) and how (approach) the work will be performed. The working conditions thus become individualised, bringing the opportunity for collective intelligence where workers are empowered to collaborate in the execution of sophisticated tasks; it also can materialize into powerlessness and isolation.

Detailed description

Digitisation overlaps temporal limitations of production. Work becomes more mobile and more independent. New forms of employment emerge, which reflect these changes.

Firstly, the flexibilisation of time includes jobs with fewer working hours than full time:

- **Part time job**, which represents a shift from a 40-hours week to a shorter week, on a regular basis;
- **Temporary work** employs workers for a limited time – for a season or for a project;
- **On call work** (or on-demand work) employs workers at the exact time when there is actual need for them. Many agencies contract on-call workers in order to supply enterprises with quick replacements for employees who become ill during the course of the day;
- **Key-time staffing** allows enterprises to make hourly adjustments in staffing according to fluctuating levels of customer service or production demand. This type of work has been implemented in service industries such as fast-food restaurants, supermarkets or banks.

Secondly, the time flexibilization is reflected also in jobs with different organisation of the working time, such as:

- **Compressed workweeks** means that the employee works the traditional 40-hours week, but in fewer days. For example, instead of five 8-hours days, he/she works four 10-hours days. This arrangement is suitable for workers who need to commute to work;
- **Performance related pay** refers the payment of a salary that does not depend on the time spent at work but on how well the employee performed the job. This can be used for professions such as cars salespeople or production line workers.

Some studies are showing that these forms of employment can eventually lead to a higher employment rate, as they offer opportunities for entering the labour market for the people that would not be able gain a full-time employment. This is also the reason that these types of jobs with time flexibility are getting bigger support in the national policies with varying degrees of monitoring, regulation and social security.

The flexibilization of space is highly influenced by the organization and management of the work among companies and also within companies. Production can be networked, even beyond company boundaries. The companies may outsource the needed job to a person, who is on the other side of the globe. The routines are less centralized, with higher levels of local self-regulation. The most common forms of spatial flexibilisation include teleworking where workers do not physically commute to work but use telecommunication technologies (WiFi, tablets, smartphones) to work from a different place. It may be from home, from a coffee place or from a specialised place, like neighbourhood work centres, where workers from different companies can work side by side. Another example would be a virtual office, where people armed with high-tech tools work anywhere, anytime and even cooperate with colleagues

Flexibilization of space covers not only the topic where the workers are, but also the topic of how the workplace is organised. Restructuring offices organized around individualized cubicles into more communal and shared spaces may facilitate teamwork and problem solving, and save costs on physical infrastructure. Management costs may be reduced as more centralized workspaces shift the focus from “management by oversight” to “management for results”. Increased opportunity for communication among workers tends to increase levels of support, lower employee stress and increased productivity. Flexible office spaces are particularly common in the “creative” professions including marketing, software development or research.

Within the company, there is also a bigger need for the functional flexibility, which means the extent to which workers can be transferred from one activity or task to another one. One way to reach the functional flexibility would be outsourcing.

Outsourcing firms are independent firms that supply services to a variety of enterprises. The most common outsourcing companies offer clerical, cafeteria, security and janitorial services, accounting, (insurance) claims processing, printing, computer systems management, sales and product marketing.

However, it is also possible to reach the functional flexibility within the company, by encouraging job rotation (shift of workers between two or more assignments or jobs), training of employees in different tasks and changing the management structure.

The internet has served the employers in finding their workforce in the global labour market, but it also offers many possibilities for workers to enjoy the flexibility and benefits of part-time jobs. The internet of things (IoT) offers big opportunities for flexible work conditions. There is a strong call for individualisation of product, which gives space to new types of economies.

For example, the Peer-to-Peer, or P2P, economy is a new decentralized type of economy, where the buyer and the seller are directly connected, without any third party serving as a mediator. All the production process is owned and performed by the individual, who also owns the final product. Nonetheless, questions regarding the quality, safety and transparency of the offered goods and services are arising which have led to the emergence of the Platform Economy. The platforms have different means to ensure the lacking qualities of P2P economy, which include mechanisms for identity validation and assessment of participant trustworthiness. The platform economy providers are creating online structures that enable a wide range of human activities and interconnections. Some examples include open-source software development (platforms supporting the participation of any programmer in the development of a usually complex software that can be used by anyone accessing the Internet),

TaskRabbits (which is an online and mobile marketplace that matches freelance labour with local demand, allowing consumers to find immediate help with everyday tasks, including cleaning, moving, delivery and handyman work), AirBnB (alternative to hotels, where individuals accommodate other people in their homes), Uber (alternative to TAXI service, where passengers are looking for a free car via an app) or Etsy (for selling handmade products).

Individual specialists can also work in global teams to fulfil given tasks. Collaborative platforms offer opportunities to share information, perform activities online by geographically distributed teams and communicate in real time.

Beneficial Results

Enterprises and workers can both benefit from flexibility and individualization in work, e.g., from better work organisation, from the upward mobility resulting from increased skills, from investment in training that pay off for enterprises while helping workers adapt to and accept change. Ultimately, by ensuring a great flexibility in the professional world, companies will be able to significantly increase their competitiveness, while at the same time workers will have numerous opportunities to grow professionally along with the success of their company or industry.

Access date: 02/02/2022

Provided by: INI-Novation GmbH

COLLECTION OF TECHNOLOGY USE CASES

The previous chapters have so far described the growing need for appropriate skills and competences that will empower workers and organizations to take advantage of Industry 4.0. Additionally, best practices regarding the transformation to different vocational educational systems were presented in order to demonstrate possibilities for acquiring those skills. While in the previous sections the focus was more on people and their skills, in this chapter we will now present technology use cases that illustrate the changes that occur on a company level and the resulting benefits for both organizations and employees.

As mentioned earlier, the shift towards Industry 4.0 requires different enabling technologies, processes and organisational changes. This framework serves to a large extent as a guideline for companies in their journey to becoming a part of Industry 4.0. This is why, the technology use cases will be divided into 3 groups, that follow the logical elements of this framework, namely, enabling technologies, technologies improving processes and technologies improving organizational structures. The goal of this division is to put the fundamental skills and competences, described in the previous chapters, in perspective and to practically illustrate the implications that the shift from labour-intensive work to knowledge-intensive work has on organizations and people.

Technology Area 1: Enabling Technologies	
Name of Good Practice	*Page*
ASSECO CEIT	77
Dairy.com & Orbis	79
LexaTexer	81
Navanita	83
NSE Group	85
Ondosense	87
R3 Communications	89
Radicos	91
Roboception, QRS & Danfloss	93
SECOP	95
SMARTFACTORY	97
Vodafone Spain & Bodegas Familiares Matarromera	99

Technology Area 2: Technologies Improving Organizational Processes	
Name of Good Practice	*Page*
ABB & Apotea	101
AccessHub	103
DTE	106
D-Cube & Stone Group International	108
Expivi	110
Foxconn Slovakia	112
IDEA & ECA Group	113
innoSEP	115
LACROIX Electronics	117
RZ INM Mekaniska	119
SFM Systems and VOITH	121
SKODA AUTO	123
Synsor.ai	125
Tatravagónka Poprad – Case study	127
TVARIT	129
Visometry	131

Technology Area 3: Technologies Improving Organizational Aspects	
Name of Good Practice	*Page*
5th Industry	133
AR-Experts	135
Arla Foods & Au2mate	137
Aucobo & Wieland	139
Awesome Technologies	141
KROMBERG & Schubert s.r.o. + CEIT	143
Nightingale HQ & FLS Logistics	145
PIA Automation & DUALIS IT Solution	147
Probility	149
WearHealth & E.ON	151

Technology area 1: Enabling Technologies

ASSECO CEIT

Source / Link: https://www.asseco-ceit.com/en/

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☒ Big Data	☐ Project	☒ Automotive
☒ Digital Twins	☐ Initiative	☐ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☒ VR/AR		☐ Pharmaceuticals and chemistry
☒ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☒ System Integration		☐ Textiles
☒ Smart Sensors		☒ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

The Asseco CEIT provide customers with increased productivity in the field of logistics and production automation, planning or optimisation in many industries.

The Asseco CEIT is leader in the field of industrial digitisation in Slovakia and is a strong partner of manufacturing and logistics companies using Industry 4.0 tools. They provide support and open the door to the digital and virtual worlds and turn production plants into smart factories.

Detailed description

The Asseco CEIT is an innovative technology company with its own Research and Development Centre, which brings complex industrial solutions to the market. The foundations for the establishment of CEIT were laid at the Žilina University in Žilina, where intensive research and development focused on unique solutions in logistics and robotics had been done even before 2007. The ideas and results of the research had a strong potential. Favourable market situation has allowed for a later commercial use and intense transfer of these unique solutions and ideas into practice. This was the biggest impetus to establish CEIT. The company has evolved rapidly, and today it is an innovative partner of renowned factories.

Beneficial Results

2018 - Winning the European Automotive Logistics Awards Competition

In 2019 they established Asseco CEIT Partnership Program with benefits included:

- Authorisation to resell pre-defined Asseco CEIT solutions range,
- Use of Asseco CEIT solutions for marketing and sales support purposes,
- Access to new Asseco CEIT products for internal and customer trials,
- A state-of-the-art Training Program and platform,
- Joint demand generation campaigns,

• Access to Market Development Funds, • Access to Asseco CEIT support incidents for pre- and post-sales inquiries, • Asseco CEIT sales support and an assigned Business Development Manager, • Access to sales promotions, spiffs, and special rebates.
Access date: 12/05/2021
Provided by: QUALED

Dairy.com & Orbis

Source / Link: Personal interview & https://orbismes.com/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☒ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☒ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Dairy.com is a supply chain software company, which has developed and currently distributes software solutions for milk farms that monitors farm inputs and outputs quantities, fat and protein levels, quality of milk etc. Last year, Dairy.com announced the acquisition of Orbis, a Dublin, Ireland based leader in manufacturing execution systems (MES) for the food and beverage industry.

Orbis does end-to-end traceability within the plant and monitors key parameters, quality parameters, OEE, mass balance and looks for losses within the plans itself. As the milk or raw materials go through the different production stages, the software looks for losses and ensures that operators are looking at the right parameters – protein level, cycle times, cycle of the drier (used to produce milk powder), temperature etc.

In process and packaging, Orbis' solutions measure the performance of manufacturing equipment and promotes zero loss operations, helping the company limit down-time and optimize the performance of their systems.

Detailed description

Orbis has a history of engagement and extensive experience not only with the dairy industry but also with the beverage industry. Orbis has implemented their software solutions for operation and performance analytics in breweries, distilleries and drinks companies across Ireland and Europe. Some of the company's clients include Guinness, Baileys, Captain Morgan Distillery, New Belgium Brewery and Britvic. Orbis' solutions help breweries and distilleries to combine operational excellence with quality and sustainability by enabling the end-to-end tracking of the product flow through the brewing process from grain to bottle and enables batch quality track and trace. The software also tracks and accounts for energy and extract losses in the production line.

Recently, a major Irish brewery implemented Orbis's software that tracks material losses from raw materials through all the brewing processes, and as a result the company was able to decrease their waste by a number of percentage points, which significantly benefited their bottom line.

Beneficial Results

Implementing Orbis' solutions turned out to be very successful and beneficial for many milk-processing plants and breweries, and some of the achievements that were accomplished are:

- Digitizing production plants lowered operational risk and made the plant staff more effective with access to the best resources, no matter the location;
- Digitization empowered Business Intelligence, which provided operators with critical insights into what could happen two days from now, two weeks from now, even two years from now;
- Track and trace solutions helped production plants track raw ingredients to finished product and give them the ability to trace quality parameters within each batch;
- Improved product quality and enhanced compliance;
- Visualization and sharing of critical data and reports that could be used for informing the decision makers in the organization;
- Created efficiencies - the data logs that Orbis' solutions produce eliminated the requirement for keeping multiple and disparate spreadsheets and enabled the company to set up a paperless office, where operators can log key production attributes and visualize the process in real-time;
- Orbis' solutions helped companies identify downtime and under-performance in their production line, misconfiguration of utilities, and wastage in their supply chain.

Access date: 16/07/2021

Provided by: INI-Novation GmbH

LexaTexer

Source / Link: https://www.lexatexer.com/index.html

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others: Heavy machinery, finance and retail
☐ Additive Manufacturing		
☐ Other		

Summary:

LexaTexer offers predictive analytics automation, to support corporations' direct decision making, by integrating and analyzing unstructured-, structured- and alternative data with machine learning technology. The LexaTexer platform reduces the complexity of building, deploying and integrating AI solutions in smart manufacturing, finance and retail. Companies can build, integrate and operate AI driven solutions in days, not months.

Detailed description

Digitizing heavy industries with AI driven real time analytics (AI-IoT) promises a substantial increase in efficiency (OEE) for operators while increasing quality of service (QoS) for users at the same time. However, to actually generate value from data driven solutions, a number of issues need to be addressed and solved, such as high complexity, lack of data, long tail data, poor solution integration, limited scaling etc.

To address this challenge, LXTXR provides software and IoT devices to build enterprise-scale AI applications more efficiently and cost-effectively than alternative approaches. LXTXR highly automates the building, testing, integration, operation, securing and scaling of AI and data driven solutions across industries. One of LexaTexer's solutions – LXTXR Production - is a predictive analytics platform, which reduces the complexity of building, deploying and integrating AI driven solutions in smart manufacturing, operations, finance and retail. LXTXR Production is the workbench for predictive optimization and automation covering automotive and Tier1 suppliers. The LXTXR production suit supports use cases like predictive production, predictive maintenance, predictive scheduling and OEE optimization. Integrate and analyze manufacturing data, inspection and maintenance data. LXTXR Production reads, understands and integrates structured measurements and also unstructured data like maintenance reports. Out-of-the

box LXTXR understands more than one million language items, language models for multiple verticals are available, LXTXR production is looking beyond individual words to understand the context and to provide optimal results even with mixed type and mixed quality data sets.

Beneficial Results

LexaTexer clients have seen a number of benefits as a result of using the platform, some of which are:

- OEE increase of up to 17%;
- 10x lower error margins in sales and demand predictions;
- Reductions in root cause failure analysis from month to days;
- Real time monitoring of operational parameters, e.g., idle times, consumed resources, scrap rates, electrical and mechanical failure codes;
- Optimize scheduling on the fly for contradictory objectives, e.g., time, scrap, costs;
- The platform can be used to run multiple use cases.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Navantia

Source / Link: https://www.larazon.es

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☒ Digital Twins	☒ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☒ Others: Shipbuilding
☒ Additive Manufacturing		
☐ Other		

Summary:

Navantia has a digital transformation plan underway to modernize the shipyards and the way they work. The project is committed not only to modernize and automate work processes in the shipyards, but also aims to make the leap to digital platforms to manage all phases of shipbuilding, from design, to manufacturing, and even maintenance during its service at the customer. In order to make this possible, Navantia has commissioned a private cloud from Telefónica with high security standards where all the program management information will be housed. The company also selected Siemens Digital Industries Software as its technological partner to digitalize the company's shipbuilding process.

Detailed description

Navantia is a Spanish state-owned shipbuilding company, which operates in both the military and the civil sector. Recently, Navantia has launched its digital transformation plan which aims to modernize and automate work processes in shipyards, and to make the leap to digital platforms in order to be able to manage all phases of construction of a ship, from design, to manufacturing, and even to maintenance during its service. Central to this initiative, are digital twins. Navantia's digital twin will incorporate modeling, simulation and artificial intelligence techniques that will provide a virtual representation capable of reproducing the behavior of the ship in all types of missions and permanently monitoring the operation of its equipment and systems. Apart from these advantages, it will also provide more information to the commander for decision-making and will be able to detect breakdowns before they occur, making maintenance more efficient and reducing costs. This will also lead to the fact that Navantia will be able to improve design quality and to optimize production processes. What is more, the company is also working at its Additive Manufacturing Center (Cefan), located in the Puerto Real shipyard, on initiatives to mass-produce certain ship components using 3D printing, which will save money and costs.

People are the last part of Navantia's digital transformation plan and also the most important one. All advances will revolve around them. The company is clear that the profound transformations envisioned will not be possible without adequate staff training and a true change of mindset. The processes, although

they will be more automatic, will continue to need workers to control them and make decisions and many of them will continue to be manual. In the end, technology and people, no matter the order, will be the key to a process with which Navantia aims to be at the forefront of shipbuilding.

Beneficial Results

The digital transformation initiative is expected to bring numerous benefits to Navantia, some of which are:

- Navantia's digital twins will incorporate modelling, simulation and artificial intelligence techniques that will provide a virtual representation capable of reproducing the behaviour of the ships in all types of missions and to permanently monitor the operation of their equipment and systems;
- The digital twins will also provide more information to the operators for decision making and will be able to detect breakdowns before they occur, making maintenance more efficient and reducing costs;
- The digital transformation program will improve design quality and will optimize production in the shipyard;

Access date: 30/03/2021

Provided by: INI-Novation GmbH

NSE Group

Source / Link: http://www.electronique-mag.com/article17568.html

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☒ System Integration		☐ Textiles
☐ Smart Sensors		☒ Others: Engineering & Manufacturing
☐ Additive Manufacturing		
☐ Other		

Summary:

NSE Group, specialized in the design, manufacturing and maintenance of high-tech electronic equipment, selects the ERP Infor SyteLine as part of a project to rationalize and perpetuate its activities. This is done in order to quickly respond to the diversification of NSE Group's business sectors: defense, MRO, consumer electronics; to rationalize its business processes and to deploy even more internationally. In addition to Infor SyteLine, the NSE Group has also opted for the Infor Factory Track solution, a complete production automation solution that promotes warehouse mobility and traceability, the Infor CPQ (Configure Price Quote) pricing and quotation software, and the Infor OS (Operating Service) platform.

Detailed description

The deployment of the ERP Infor SyteLine solution is part of an ambitious project to redesign and develop NSE's services activities in France and internationally, driven by a standard, agile and scalable solutions. The objective of the project was set at the beginning of 2021 and Infor and its partner G4 have to replace the ERP set up in 2007 within the Business Unit "Services" of the NSE Group, an entity that coordinates and supports the interface with user customers, supply chain operations, as well as repairs of consumer electronic equipment, aeronautics and defense. As the system no longer meets changing expectations and regulations in targeted markets, NSE has turned to a modern, agile and scalable solution capable of adapting to its activities and constraints. Sylvain Séramy, a project manager within the NSE Group, also explained that the goal for NSE with this migration to Infor SyteLine was to quickly be able to respond to the diversification of the business sectors that the group addresses (defence, MCO, MRO, consumer electronics), to streamline their business processes and to deploy even more internationally. Sylvain Séramy also explained that the project will modernize the equipment and software of the Business Unit

in order to maintain the competitiveness expected by NSE Group's customers in France and internationally.

Additionally, apart from just optimizing their business processes, productivity and quality of their services, NSE Group also wants to keep up with the new digitalisation standards, to lay the foundations for Industry 4.0 and also to avoid relocations of activities to countries with low labour costs.

Beneficial Results

The adoption of the new ERP system and the other solution is expected to result in many benefits for NSE Group, some of which are:

- NSE Group will modernize the business unit's equipment and software in order to maintain the competitiveness expected by its customers in France and internationally;
- The new technologies will help optimize business processes, boost productivity and the quality of service;
- NSE Group will be able to embrace new digitalization standards and lay the foundations for Industry 4.0, whilst avoiding relocating activities to low-labour-cost countries.

Access date: 30/03/2021

Provided by: INI-Novation GmbH

Ondosense

Source / Link: https://ondosense.com/

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

OndoSense realizes innovative radar sensor technology for a digitized industrial world. With IOT sensor solutions based on high-precision, robust radar technology and smart sensor software, OndoSense ensures customers get relevant data for the intelligent control and monitoring of production plants and machines. Whatever challenge their radar sensors are confronted with – be it dimension measurement, wear measurement or process automation: OndoSense sensor technology always stands for highest measuring precision and a wide application range. Even in cases where classic sensors and measuring methods are too inaccurate or fail. Their robust and compact OndoSense radar sensors are reliable even in the harshest environments.

One major application of their sensors is in logistics, and more precisely for avoiding collision between automated guided vehicle (AGVs). With the OndoSense sensor solution for reliable 3D collision avoidance, AGVs can operate with maximum reliability even in demanding environments or outdoors. The radar sensor also detects objects that protrude into the agv's driveway from above or below and uses special radar algorithms to detect people in the safety area. The OndoSense sensor technology records the AGV with high precision, which enables a flexible adjustment of the safety zone. This reduces the travel distance and increases productivity.

Detailed description

As mobile robots, Automatic Guided Vehicles (AGV) make a major contribution to automation and increased efficiency - for example in warehousing and logistics, in production but also in the health sector. High-performance sensors are required that deliver reliable results at all times in complex and difficult conditions. Otherwise, there is a risk of collisions with objects and people leading to unplanned downtime with costs of over USD 350 per second. With classic sensor technologies, collision-free navigation is only possible to a limited extent: Laser scanners usually only capture the environment horizontally and thus do not recognize potential obstacles that are below or above the scan plane. Inclined positions of the AGV and bumps on the road also limit the performance of the LiDAR sensors and represent further

accident risks. Most laser, vision and ultrasonic sensors also struggle in harsh environments with dust, dirt, fog, smoke, heavy rain, extreme temperatures, flashes of light or strong vibrations.

With OndoSense IoT radar sensors, AGVs can detect objects with extreme reliability, even in the most demanding situations or outdoors. This even applies to environments with dirt, rain, fire, steam, very high or low temperatures, poor lighting conditions or strong vibrations. In addition, people can also be detected using special radar algorithms. Since the radar sensors, unlike image processing sensors, do not recognize individual persons, there are no data protection risks. Thanks to the large vertical opening angle of 110 degrees (elevation), the radar sensor also prevents collisions with objects that protrude into the route from below or above. This means that the safety zone can be adjusted e. g. to the height of the AGV. The OndoSense AGV radar also records the speed of the mobile transport robot with high precision without additional sensors. The advantage: The safety zone can be adapted directly and continuously to the driving speed and the calculated braking distance. This reduces the travel distance and increases productivity. The OndoSense radar sensor system also offers a high ease of maintenance: In contrast to LiDAR or vision sensors, there are no moving parts that are susceptible to repair or sensitive optics that need to be cleansed. The result: a long product service life and reliability.

Beneficial Results

Using OndoSense's 3D radar sensor for collision avoidance leads to a number of benefits, ranging from less collisions and machine downtime to more opportunities for automation, and to an overall improved working environment for people. The main benefits could be summarized as follows:

- Full 3D collision avoidance – detects very high and low objects in the safety area (110° elevation);
- Reliable in adverse environments – also suitable for the most difficult conditions (outdoor, etc.);
- Detection of human beings without recognizing individual persons: no data protection risks;
- Precise speed measurement – for an adaptive configuration of security zones.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

R3 Communications

Source / Link: https://www.r3.group

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☒ Robotics		☒ Food and agriculture
☐ Automation		☒ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☒ Other: Connectivity		

Summary:

R3 develops WiFi-based ultra-reliable low latency communications (URLLC) technology to meet the highest industrial requirements. Their patented solution EchoRing is a deterministic and decentralized wireless network that delivers cable-like reliability and performance. The result of extensive research and development, EchoRing is plug and play (PnP), 100% software-based, and compatible with standard industrial interfaces and commercial off-the-shelf (COTS) hardware. Representing a keystone technology for IoT and Industry 4.0, EchoRing enables fast and easy deployment and system changeovers while greatly reducing the errors and maintenance downtimes that currently result from wear and tear on fragile components. R3's solution opens the door for highly optimized production layouts as well as innovative new business models and product concepts.

Detailed description

In manufacturing and industrial environments ensuring that all machines and equipment are operational, and working is of the highest importance since downtime usually leads to significant financial losses. Therefore, due to the high demands of real-time capability, reliability and availability, cable technologies continue to dominate automation technology primarily due to their robustness and reliability. However, both internal and external cables, trailing cables and tool connections wear out due to the constant movements of robots and other types of machinery, resulting in wear, malfunctions and defects. This in turn interrupts the communication, which then leading to the industrial processes stopping and most often this affects the company financially in a negative way. R3's EchoRing solution could address this challenge by acting as an emergency kit. In other words, when the wired connection fails, EchoRing and the Robot Emergency Kit come into play as an easy-to-install emergency kit until the next scheduled maintenance takes place. Ultimately, this significantly reduces machine downtime, with undoubtedly improves the financial performance of the company. The R3 Robot Emergency Kit can be used for all common robots such as ABB, FANUC and KUKA.

Beneficial Results

Using R3's EchoRing and Robot Emergency Kit can benefit the companies using the solution in a few ways. Firstly, in case of downtime due to a worn-out cable or other connectivity component, the industrial processes can be restored almost instantly by switching the connectivity method to R3's EchoRing. The solution can be used as long as needed and until the defective cables can be replaced, which ultimately also allows the company to be flexible when it comes to scheduling the maintenance.

Secondly, in large industrial and manufacturing areas, finding the faulty cables or components could be extremely time and resource consuming. EchoRing can be used to narrow down and localise the faulty connection or cable, which again has the potential to save a lot of time during maintenance.

Last but not least, EchoRing can also be used on-demand, which significantly facilitates the plannability of repairs and maintenance. In other words, in some cases, a planned maintenance could be conducted without the need to stop operations, simply by choosing EchoRing as a communication route instead of the cables.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Radicos

Source / Link: https://www.radicos.com/ and a personal interview

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☐ System Integration		☒ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Radicos is an OEM company founded in 2011 to develop, market and globalize the TWIN technology. TWIN stands for the Two Wire Integrated Network. It is the world's first integrated digital asset monitoring system. The TWIN System is a powerful and fault-tolerant sensor-actuator-network optimized for Industrial IoT applications in harsh environments. It is especially designed for monitoring assets of up to 10km^2. TWIN is able to collect data from thousands of sensors over kilometre distances, process them locally or in the cloud, and reversely drive actuators at the site of the sensors. At its core is the patented Computer-In-Cable-Technology™.

TWIN is a major building block for the Industrial IoT. Consequently, it may be used across a wide range of industry sectors, one of which is agriculture and horticulture. Population growth and urbanization drive a permanent increase in global food production. As a consequence, the size of production facilities such as greenhouses are significantly growing. The average surface of a vegetable greenhouse in The Netherlands is currently more than 5 soccer fields. Smart and Digital Farming enables the operation of such massive production plants. TWIN provides a unique solution to monitor the climates in greenhouses and livestock housing. Additionally, there are many more agricultural potential monitoring applications in Agriculture, such as temperature and gas monitoring in silos or temperature monitoring in warehouses and cold storage.

Detailed description

Deploying the TWIN Greenhouse & Livestock Housing Monitoring System leads to creating the perfect climate for the welfare, health and quality of plants and livestock. Radicos' tailor-made climate monitoring solution for greenhouses and livestock housing boosts smart farming to a new level and enables farms and greenhouse operators to use hundreds of sensors instead of just a few at an affordable price. By using those sensors, organizations benefit from a range of key features that the system offers. On the one hand, by using the TWIN system and the data from the sensors, the operators receive complete

information, which can then use to create the perfect climate for the crops and the livestock. Mastering the climate is a complex task and absolutely decisive for the welfare, health and quality of plants and livestock.

On the other hand, the data that stems from the system allows farms and greenhouses to save money by empowering them to make more educated and accurate control measures, which lead to significant savings in energy and materials, and to ultimately increased production yields.

Currently the TWIN Greenhouse & Livestock Housing Monitoring Solution covers the measurement of: Temperature Humidity CO_2 (carbon dioxide) NH_3 (ammonia) H_2S (hydrogen sulphide). In addition, Radicos has existing concepts for the integration of further sensors like airflow and light sensors.

Beneficial Results

Implementing Radicos' solution could be very successful and beneficial not only for farms and greenhouses but also for other organizations from a number of different industries, such as maritime, mining, minerals & cement, transportation, oil & gas, energy & utilities etc. Some of the benefits that are usually achieved are:

- Easy and cheap installation of the sensors in comparison to other alternatives
- TWIN works completely reliable even in the dustiest atmosphere or at relative humidity levels above 90%, which makes it perfect for challenging environments
- Visualization: The TWIN Dashboard comes with high resolution heat- and humidity maps. The value of each single sensor is easily accessible. Furthermore, the dashboard provides many kinds of configurable graphs and diagrams, including alarms and SMS alarm notifications to the operator's mobile phone
- Ultra-low power consumption of the TWIN system
- The system is deployed via a single, fault tolerant continuous cable (no star wiring required)
- Data can be collected from any digital source, typically via a sensor or interface to an existing but not yet connected component or machine
- Connect thousands of digital sensors with multi-sensor support and high-speed polling (3rd Party Support, 1000 sensors/s with 12 bits resolution)
- Each sensor node can be used as an actuator via e.g., a photocoupler
- Lightweight twisted pair cable (20-60g/m)

Access date: 15/07/2021

Provided by: INI-Novation GmbH

Roboception, QRS & Danfloss

Source / Link: https://roboception.com/en/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☒ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Roboception offers innovative navigation, real-time perception and manipulation solutions for robotic systems. Customer-specific software products for a variety of hardware platforms are developed in compliance with the customer's individual plug-and-produce requirements. Roboception's innovative sensor solutions enable customers across all robotic domains to generate real-time, time and location-dependent 3D data products and to equip robotic systems with robust and seamless infrastructure-free navigation. Following the concept of "Sense. Reason. Act.", 3D technologies such as object localization, recognition and scene analysis, robotic manipulation and application development complete the portfolio. The solutions include highly intuitive, user-friendly interfaces, parametrization and programming; hence a detailed robotic knowledge is not required for their setup and operation. Munich-based Roboception GmbH was founded in March 2015 as a spin-off of the Institute of Robotics and Mechatronics of the German Aerospace Center (DLR).

In a recent project by QRS and Danfoss the challenges of object recognition was slowing down and threatening the implementation of a major automation project in Danfloss. In order to solve this challenge, QRS decided to implement the solution of Roboception - rc_visard 3D stereo sensor – in order to empower the robots to recognise more than 100 different components.

Detailed description

At Danfoss, a Danish manufacturer of mobile hydraulics as well as electronic and electrical components, robotic systems equipped with 3D sensors now reliably and precisely recognize and move a large number of different components. In the new production line implemented by Danish integrator Quality Robot Systems (QRS), a total of six KUKA robots, takes over work steps that were previously performed manually. For this, the robotic cells must recognize and move up to 100 different components without manual intervention.

The requirement for the robotic cells at Danfoss was fully automatic feeding of the components – a task that can only be solved with a camera system, given the large number of variations. The alternative, namely feeding the blanks meticulously ordered and aligned, was simply not economically feasible. Instead, the objects arrive at the first robot station in standard roll boxes, sorted by box, but with the boxes stacked on top of each other more or less indiscriminately, and with the layers of objects separated by paper sheets.

To meet the challenges of object recognition, QRS was able to benefit from its close partnership with KUKA. For when it comes to camera systems and object recognition, KUKA turns to Munich-based partner Roboception and their rc_visard 3D stereo sensor.

At Danfoss, the rc_visard (using the SilhouetteMatch software), reliably detects the position and orientation of the flat, unordered objects on the flat paper surface and also provides the robot with the gripping points at the same time.

A 2D solution was quickly ruled out for this project, as the paper slipsheets are not always completely flat, or may be oily due to the components. In tests with other systems, the camera had sometimes misinterpreted impressions as workpieces. SilhouetteMatch, on the other hand, recognizes exactly which components are supplied to the robotic cell and reliably transmits the appropriate gripping points for a KR CYBERTECH from KUKA.

Beneficial Results

The effort was worth it in many respects. In this way, not only was the client satisfied, but the successful integration of the camera system from Roboception also ensured follow-up orders at QRS. Danfoss, too, is pleased with the solution from KUKA, Roboception and QRS. The automation not only accelerates and stabilizes the hydraulics expert's production processes, but simultaneously ensures greater safety at work for its employees.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

SECOP

Source / Link:

https://industry4um.sk/secop-digitalne-dvojca-nam-pomaha-odstranit-uzke-miesta-na-montaznej-linke/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☐ Automotive
☒ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other:		

Summary

Secop s.r.o. completed the implementation of the digital twin on the assembly line of refrigeration compressors. The purpose of implementing one of the industry 4.0 megatrend - the digital twin's key technologies was to help identify the emergence of problems that reduce the productivity of the production line. It is one of the few solutions implemented to implement a digital twin in the Slovak engineering environment. The solution fulfilled the task of evaluating the production process on the line and identifying the sources causing decreased productivity.

Detailed description

SECOP digital twin - Secop is the expert for advanced hermetic compressor technologies and cooling solutions in commercial refrigeration. They develop high performance static and mobile cooling solutions for leading international retail refrigeration businesses.

The digital twin solution for Secop was created by SOVA Digital and SIDAT Digital in the Plant Simulation software environment from Siemens. The digital twin project was complex and included a whole chain of measures. It includes sensors, data collection, PLC control units, simultaneously digitization of production data, the position of the digital twin itself and the subsequent generation of intelligent outputs, which fall into the Industry 4.0 Strategy for algorithmic identification of problem areas in production.

Beneficial Results

Standard reports were used as outputs and visualization, which algorithmically evaluates data in real-time and brings them into graphical processing. In this way, they can be used for various professions such as master, production manager, quality and the like. By implementing a digital twin, Secop has transformed the collected data into meaningful and standardised information. As a result, the company has the potential to invest its money best so that the production line is more efficient. At the same time, the decision to continue the digitization and implementation of the digital twin on other lines as well.

Access date: 20/04/2021
Provided by: QUALED

SMARTFACTORY

Source / Link: https://smartfactory.ie/ & a personal interview

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☒ System Integration		☒ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

SmartFactory helps accelerate smart manufacturing initiatives to drive continuous improvement, knowledge transfer and data-based decision making. The company assists organizations move away from paper and spreadsheets – and guides them digitally through their work processes. SmartFactory uses wireless sensors and cutting-edge IIoT technology to capture, analyse and visualise KPIs in real-time, so that manufacturing companies can spend more time fixing losses than finding them. Using digital workflows, pick-to-light solutions, video downtime analysis and digital daily management systems, SmartFactory improves organizations' efficiency through innovation and helps bridge the IT/OT convergence in manufacturing.

Detailed description

SmartFactory's smart solutions reduce the amount of time and resources required to capture and communicate critical information across organisations and dynamically translate this data into actionable intelligence. The company empowers employees to take the appropriate corrective action to help eliminate losses and promotes a sense of ownership and collaboration. Their secure OPC architecture can communicate to virtually every type or brand of PLC. Smart wireless sensors facilitate the capturing of data from non-networked machines or semi-manual/manual processes. Intuitive mobile touch screen devices convert manual paperwork into lean digital workflows. Interactive smart digital displays eliminate the wasteful effort of preparing and printing paper reports and help to digitise the daily management process. Continuous product and process improvement and the elimination of waste is a fundamental principle of lean manufacturing. Capturing and visualising data to highlight losses in real-time has been proven to change behaviour, improve throughput and quality and has been shown to improve overall productivity by 5-10%.

Recently**,** SmartFactory implemented their solutions in a manufacturing company, which initially wanted to build a new production line in order to expand their current capacity (already around 35 machines). By implementing their solution, SmartFactory was able to increase the company's output by 40% and this

ultimately eliminated the need for buying new machinery and building a new production line. The main operator of the machines has been working with the company for the past 12 years and although he knew everything like the palm of his hand, he could not have increased the capacity on his own because he lacked the necessary data. SmartFactory put sensors on all machines and connected them to a dashboard that was shown every morning on a 75″ TV to the whole team. By having this data, the operator and his team were then able step by step to increase the production of the machines.

Ultimately, by implementing their solution, SmartFactory saved the company more than a million euros by not having to buy additional machines and the manufacturing company actually discovered that they had plenty of capacity that they did not know they have.

Beneficial Results

The project turned out to be very successful and beneficial for the manufacturing company and some of the achievements that were accomplished along the way are:

- Increased productivity and OEE (overall equipment effectiveness),
- Enabled automatic gathering of critical data from the manufacturer's equipment,
- Significant cost savings,
- Shift to a paperless office.

Access date: 15/07/2021

Provided by: INI-Novation GmbH

Vodafone Spain & Bodegas Familiares Matarromera

Source / Link:

http://www.castillayleoneconomica.es/noticia/matarromera-finalista-de-los-premios-nacionales-industria-conectada-40

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☒ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☒ Initiative	☐ Aerospace
☒ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Vodafone Spain has started the implementation of a technological initiative based on IoT technology to manage the production activities of the winery Bodegas Familiares Matarromera, located in Valbuena de Duero (Valladolid), with the aim of improving energy efficiency, cost control and risk prevention. Vodafone provides a single data management platform, in which all the information from the connected devices is integrated and allows the winery to have greater control of all its production processes, such as the collection of grapes or bottling, and avoid both cost overruns and impacts on the environment.

Detailed description

This Internet of Things technology consists of installing sensors connected to a network in all those elements that the operators want to control and then taking advantage of all the information and data that is collected. In this sense, Vodafone has deployed different IoT solutions in the facilities in some of the most critical areas of Bodegas Familiares Matarromera that, through sensors, offer very accurate and real-time information of the entire production process of wine. Thus, all the data that is being collected allows the winery to act quickly and effectively in the event of detecting any setbacks or production related problems.

In addition to using an energy self-management system with solar panels, biomass boiler and water treatment planting, since its inception, Bodegas Familiares Matarromera has also been constantly adopting the necessary technologies that make the wine production process more efficient and sustainable. Thanks to those efficiencies obtained in the production processes, the company's spherical business model is driven based on the value it brings to society, and it further reinforces the company's commitment to sustainability.

Beneficial Results

This initiative has led to many beneficial results for Bodegas Familiares Matarromera, some of which are:

- Improved energy management in order to control costs and performance in water, gases, electricity, and thermal heating and cooling systems;
- Better maintenance control of the different sites, especially in the cellars, as well as control of the barrel room, where humidity and temperature can be modified remotely without the need to be in the room;
- Possibility to monitor the grape in the winery, from the moment it enters the facilities until the end of the process, which allows predictive maintenance on all the machines that treat the grape in order to avoid equipment breakage;
- The collected data helps the company reconsider how it can improve processes in the future;
- Preventive control of possible occupational hazards;
- The operators can supervise all processes from one location and have total control over the machines and possible incidents.

Access date: 26/03/2021

Provided by: INI-Novation GmbH

Technology area 2: Technologies Improving Processes

ABB & Apotea

Source / Link: https://new.abb.com/news/detail/60640/online-pharmacy-achieves-30-per-cent-higher-productivity-helped-by-abb-robots

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☒ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Three ABB robots in the logistics centre of Sweden's largest online pharmacy, Apotea, enable the automation of the company's logistics. ABB's IRB 4600 industrial robots sort the parcels directly into the designated transport trolleys and thus significantly support the shipping process. As a result, productivity has increased by 30% and 2 million more parcels were delivered in 2019 than in 2018. Additionally, the robots improve the work of employees as they perform more varied and skilled tasks.

Detailed description

Seven years ago, online pharmacy Apotea in Sweden delivered only a handful of packages per day. Since 2019, it has been the largest online pharmacy in the country, delivering more than 170,000 packages every week. This rapid growth is largely based on efficient Logistics. "Our customers value fast and inexpensive deliveries. Ensuring this is a challenge that we face every day," explains Maria Alriksson, Business Development Manager at Apotea.

Processes should be as efficient as possible at Apotea's new logistics centre in Morgongva. At peak times, around 35,000 parcels leave the logistics centre every day. Three ABB IRB 4600 industrial robots from ABB have increased productivity by 30 percent. The robots sort the parcels directly into the designated transport wagons and thus significantly support the shipment. In order to make this happen, ABB collaborated with Löfqvist Engineering to program the robots. "The highly productive INDUSTRIEROBOTER IRB 4600 fits perfectly with the short cycle times required in Apotea's Fulfillment Center," says Peter Öhrn, Sales Manager at ABB Robotics Sweden.

To ensure safety, the robots are equipped with ABB's safety-certified Safemove software. At Apotea, all robot movements are stopped as soon as an employee enters the cell via arc sensors integrated into the robots. This is particularly important in the case of Apotea, as employees have to change the transport trolleys in the cells at regular intervals. As soon as the employee leaves the cell, the robots starts the automated sorting again at the push of a button.

Beneficial Results

The ABB Robots also improve the work of the employees. "The working day of our employees has changed a lot for the better. They carry out more varied and qualified activities. Our employees have developed from pure package lifters to machine operators," explains Pär Svärdson, CEO of Apotea.

The increase in efficiency is also reflected in the company's growth. Two million more parcels were delivered in 2019 than in 2018. "I think that in the future we will have twice as many robots in use as we do today. We are already seeing the great contribution of robots in increasing capacity," Svärdson concludes.

Access date: 26/03/2021

Provided by: INI-Novation GmbH

AccessHub

AccessHub

Source / Link: https://access-hub.com/ & a personal interview

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☒ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☒ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

AccessHub is a Dutch scaleup with a focus on different innovations in the privacy and data management domains. It is widely known that there are a lot of different risks for our data, so this ultimately raises the question, whether we really are masters of our data. There are many third parties, both known and unknown, that are involved in people' and organizations' communication with the internet and this leads to various security and privacy issues, especially when using unprotected networks (public WIFI), cloud-based services, social networks etc. Since we rarely know who is behind these services (e.g., hackers, governments etc.) we cannot be sure whether we are communicating and transmitting data in a safe and protected way.

AccessHub develops solutions that help their customers become real masters of their own data – something that is especially important for organizations dealing with sensitive information, such as personal data, legal or financial information, intellectual property, smart equipment etc. The main product of AccessHub is called "SecureZone" and this is a very well protected environment with dedicated applications servers inside, which can be deployed on top of every existing network infrastructure, in order to ensure the safe and protected transmission of critical data and information.

Detailed description

AccessHub's products and services can be applied to a variety of industries, but they are especially suitable for manufacturing settings. Recently, AccessHub took part in a pilot installation of shared production lines (a manufacturing concept that is expected to become even more popular in the future), where multiple companies were sharing access to a few production lines, consisting of 3D printers.

The owner of the production line had to provide information about how long the line was occupied by a specific customer, how many final components were produced etc. This information was then stored in blockchain and subsequently used for automatically determining how much to charge the customer for the components he produced. Such systems can be connected with a quality control system, so that it

rejects components that don't meet adequate quality standards. Respectively for any such poor-quality components, the manufacturer covers their price and does not charge the customer, thus ensuring a better transparency of the processes.

AccessHub's role in the project was to provide the connectivity and implement appropriate security measures in order to ensure the seamless execution of the manufacturing activities. The role of AccessHub and other providers of cybersecurity solutions is of crucial importance to the manufacturing sector since most classical manufacturers and manufacturing devices do not have the right cybersecurity measures in place and they often lack the skills to implement them.

Additionally, with the growing importance of integrated supply chains and with more and more companies committing to them, the role of cybersecurity will continue to play a critical role. Such integrated supply chains will enable consumers to check and follow the story of specific products and they will be able to obtain more information regarding the plant, where the product was produced, who produced it, what its package is made of, where it was shipped from and many other product-specific information. Such level of granularity of the information will undoubtedly necessitate superior cybersecurity standards and solutions, which will ensure the data integrity and its safe transmission.

Beneficial Results

The project turned out to be very successful and beneficial for AccessHub and practically illustrates the central role cybersecurity solutions play in a manufacturing environment. Some of the achievements that were accomplished within the project are:

- Greater visibility and traceability of manufacturing processes;
- Improved reliability and security of manufacturing data;
- Visualization of an integrated supply chain in a secure way.

Access date: 13/07/2021

Provided by: INI-Novation GmbH

DTE

Source / Link: https://dte.ai/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others:
☐ Additive Manufacturing		
☐ Other		

Summary:

DTE, a global company, based in Reykjavik, Iceland, is the leading innovator in the field of real-time intelligence from liquid metals by combining connected, real-time, chemical composition analysis from molten metals - based on DTE's unique technology Liquid-Phase, Laser-Induced Breakdown Spectroscopy (LP-LIBS™) - with an artificial intelligence-based cloud platform, the engine of DTE's metals production ecosystem. DTE's vision is to transform the metals industry, contributing to the 1.5-degree challenge while driving its digital transformation towards Industry 4.0 with the next generation of elemental analysis technology and metals intelligence.

Detailed description

Process control of metals manufacturing has historically been limited by the need to cast a solid sample for analysis from the melt. Samples are collected, prepared and analysed in a laboratory, delaying vital data that are necessary to actively and predictively control the process. This also introduces many sources of potential error and safety risks to human operators.

DTE's industry-leading LP-LIBS™ sensor technology is uniquely able to deliver instant, reference quality and high-frequency elemental analysis direct from both high temperature liquid, as well as solid, metals. Our solution offers the seamless IT/OT integration of this proprietary elemental analysis technology with a powerful AI-based analytics platform, enabling unprecedented real-time and predictive process control insights.

Our breakthrough LP-LIBS™ sensor technology is uniquely able to deliver reference grade elemental analysis direct from high temperature liquid metals in less than 60 seconds from sampling, for enhanced process control and decision support.

Beneficial Results DTE's mission and purpose is the digital transformation of the metals industry, contributing to the 1.5-degree challenge for humanity through our next generation IIoT analysis technology. Their breakthrough "real-time intelligence from liquid metals" innovation contributes to maximizing value, sustainability, safety, and efficiency for all the metals industry stakeholders through.
Access date: 07/07/2022
Provided by: INI-Novation GmbH

D-Cube & Stone Group International

Source / Link: Personal interview & https://www.d-cube.eu/success-story/sgi/

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☒ Others: Stone and tiles production
☐ Additive Manufacturing		
☐ Other:		

Summary:

Stone Group International (SGI) is one of the largest groups of marble companies in Europe, active in quarrying, processing and trading marble all over the world with a dynamic presence in more than 80 countries. With the technologies, developed by D-Cube, SGI has managed to fully adopt Stone 4.0 in the entire tile production, enabling unquestionable marble tile sorting through novel machine learning algorithms. Smart tile sorting proved to be far more accurate and stable compared to manual sorting. Instant and automated marble tile rejection and classification led to yield optimization, claim reduction and real-time production insights.

Detailed description

Before the implementation of the technology, developed by D-Cube, SGI, just like other stone and tile producing companies, was facing challenges specific to the industy. Some of them were:

- Manual tile sorting, which often had high rate of human error;
- Tile misclassification resulting in faulty palletization;
- Lack of traceability across the plants;
- No real-time production monitoring;
- Accumulated operational and production costs.

Those main issues, in turn, were leading to delays in order delivery, customer claims due to tile misclassification, suboptimal production and lack of insights and production-related data – all of which ultimately was reducing the profitability of the company.

To address this challenge, D-Cube developed an industrial IoT ecosystem, which delivers quality assurance to tile production, palletization and end-to-end tracking. The system uses AI-based machine vision to enable smart tile sorting and defect detection. Augmented reality interfaces are used to support

the precise pickup and palletization, and intranet and extranet cloud interfaces enable the real-time production monitoring and feed the business intelligence.

The different activities performed by the system can be summarized into 7 steps:

1. Marble tiles or slabs exit processing machine on a conveyor belt and continue towards packaging.
2. Marble tiles/slabs enter the Machine Vision smart cage, where a laser sensor identifies each tile/slab separately and the tracking process begins.
3. Neural Networks process realistic captures of each tile/slab resulting in autonomous sorting and surficial defect detection (holes, scratches, spots, crystals, etc.) in less than 2 seconds.
4. A virtual mirror imprints sorting information on physical tiles/slabs through augmented reality, allowing for fast and human-error-free packaging.
5. Data are shipped from the industrial floor to a private cloud, providing near-real time production insights (ad-hoc statistics, virtual dry lay).
6. Customers logon to a dedicated extranet, where they can track their orders, explore stock pallets and even browse tiles in a pallet or a box.
7. Retail customers have the opportunity to actually see what is in a box before buying it, through a smartphone app.

As a result, D-Cube's IoT solution blends sensors, people, processes, cyber-physical systems and apps into one whole ecosystem that benefits the industrial processes of Stone Group International and ultimately improves their profitability.

Beneficial Results

The project turned out to be very successful and beneficial for Stone Group International and some of the achievements that were accomplished as a result of D-Cube's technology are:

- The Smart tile sorting became 2x more accurate than human sorting;
- 100% sorting repeatability;
- Easy generalization to new tile types;
- Faster Quality Control;
- Reduced number of customer claims;
- Availability of real-time production insights;
- Online added value to customer services.

Access date: 27/07/2021

Provided by: INI-Novation GmbH

Expivi

Source / Link: https://www.expivi.com/en

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☒ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Expivi's platform uses a 3D configurator and Augmented Reality to help brands give their consumers an immersive shopping experience. With our technology, consumers can individualize products and feel empowered in their purchasing decisions. We make it possible for consumers to get a digital look and feel of products, pick colors and textures, engrave or include text, and really make the product their very own. The options are endless for retailers, but they don't have to produce anything before the orders have actually been placed — more choices for shoppers, fewer products in inventory. With this easy and intuitive user interface, consumers get an accurate representation of products, can see the items in their own environment, and get real-time pricing — before making the purchase. That's the Expivi solution. The platform is integrated with SAP, Salesforce, SAP Hybris, Magento, WooCommerce, Shopify and many more.

Detailed description

The Expivi platform empowers companies to increase online sales by implementing AR technologies. The platform is much more than a 3D product configurator, it is a service dedicated to helping businesses grow. As a cloud-based SaaS solution, customers only need to setup their products once and they can use the same data across all of their channels. Expivi provides an extensive API and plug & play extensions for easy integration into their existing e-commmerce and ERP solutions. Integrating augmented reality enriches customers online experience and shortens the path to purchase. As a result, clients often see a higher conversion rate and happier customers. The solution gives them the power to personalize products on desktop and mobile and their customers can view the results instantly from anywhere in the world.

One company that decided to adopt the Expivi was Stemeseder. Stemeseder is an Austrian company specialised in premium aluminium systems for decades and offers multiple lines of products. For their

doors line, they have chosen to use Expivi's 3D configurator as this product line has a lot of different options. Their customers are able to customize the doors to their liking and see it from the outdoor angle but also from the indoor angle. They also wanted to give a more unique user experience to their customers, so they've decided to use Expivi's Augmented Reality feature as well. Thanks to the AR functionality, customers are able to view the configured doors in their own setting, so they can make much better buying decisions.

Beneficial Results

Some of the benefits that the Expivi platform brings to its users are:

- Opportunity to take the in-store shopping experience online. Expivi allows its users to meet the growing expectations of their online customers;
- Customers of online shops are able to see exactly what they are buying, which means more confidence, less returns and less inventory for the online shop or for the producer;
- Opportunity to increase online sales.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Foxconn Slovakia

Source / Link: https://www.foxconn.sk/; https://industry4um.sk/en/foxconn-slovakia-digitalny-model-interneho-logistickeho-systemu/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence ☐ Big Data ☒ Digital Twins ☒ IoT and IIoT ☐ Cybersecurity ☐ VR/AR ☒ Robotics ☒ Automation ☒ System Integration ☐ Smart Sensors ☐ Additive Manufacturing ☒ Other (SMT technology)	☒ Company ☐ Project ☐ Initiative ☐ Programme ☐ Other	☒ Discrete (smart) manufacturing ☐ Automotive ☐ Aerospace ☐ Metal processing ☐ Consumer goods ☐ Pharmaceuticals and chemistry ☐ Food and agriculture ☐ Health ☐ Textiles ☒ Others (Electro-technical products)

Summary:

Foxconn company is one of the leading manufacturers of electro-technical products for various global brands. Currently, they focus mainly on the production of LCD and OLED TVs and PCBs using the SMT technology. In the field of electro-technical production and engineering, they provide complex solutions, from software development, production process designing through to the final production as such. They also specialise in automation, robotisation and IoT.

Detailed description

Foxconn Slovakia, a subsidiary of the world electrical engineering giant Foxconn, is currently the second largest electrical engineering company in Slovakia, the eighth largest Slovak exporter and the tenth largest manufacturer. It is also the largest company in the Nitra region. As part of global changes, it took over production from Sony in 2010. It currently employs almost 2,000 workers and, in addition to production, relies on sophisticated logistics and executive engineering. In cooperation with Industry4UM the company needed to check the real utilisation of internal logistics. It faced the challenge of reducing the number of forklifts while maintaining the required productivity. Part of the assignment was the creation of an application for operational planning of the number of resources for individual days according to the production plan.

Based on the assessment of all input data and with the help of Plant Simulation technology, they created a digital model of the client's internal logistics system, copying the actual situation at the plants.

Beneficial Results

The added value of the solution is also other important functionalities of the planning system, which were gradually added to the system during its processing.

Access date: 26/04/2021

Provided by: QUALED

IDEA & ECA Group

Source / Link: http://www.boursica.com

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☒ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☒ Others: Logistics
☐ Additive Manufacturing		
☐ Other		

Summary:

French logistics supplier IDEA, which operates on large industrial sites like shipyards, aeronautical production units and heavy industry, has chosen ECA GROUP's indoor and outdoor Autonomous Guided Vehicle (AGV) L-S 1PT. AGV L-S 1PT (Pallet Truck) is an electrical ground vehicle of 2.20m width and 3.40m length dedicated to the transportation of pallets, roller containers and plastic pallet boxes of up to 1 ton inside its storage space.

Detailed description:

The French logistics player IDEA has chosen the autonomous logistics vehicle LS 1PT from ECA GROUP to offer efficient and innovative flow solutions. As stated by Jean-Baptiste Bernicot – the innovation director of IDEA – ECA GROUP and the autonomous guided vehicle were chosen due to the company's industrial references and their ability to consider a wide range of autonomous flow solutions.

The innovation director also explained that the partnership with ECA GROUP is strategic since the adoption of the AGV responds to a profound challenge of transformation in the way IDEA organizes and manages industrial flows.

One of the advantages of the new AGV for one tonne loads is its ability to operate day and night. On average, an autonomous vehicle can work twice as long as an ordinary forklift truck, which allows operators in the industry to reduce the number of vehicles on site, optimize logistics flows as well as the costs of operation. Autonomous vehicles can take on dangerous and repetitive tasks, thus contributing to greater safety in the workplace.

Equipped with a centralized fleet management system (FMS) to define and track the route and missions of the vehicle, the AGV LS 1PT can connect to the company's warehouse management system (WMS) to optimize the use of different vehicles. The Fleet Management System is compatible with all

autonomous vehicles in the ECA GROUP range. The stand-alone navigation system will generally not require any modification to the site's existing infrastructure.

Beneficial Results

The adoption of the autonomous guided vehicle by IDEA is expected to result in a number of benefits, such as:

- It will transport loads between buildings on industrial sites in safe interaction with pedestrians, cyclists and lorries;
- Overall availability day and night, which will improve productivity and will allows industry operators to reduce the number of vehicles operating on site in order to optimize the logistics flow as well as operating costs;
- Equipped with a Fleet Management System (FMS) to define and track the vehicle's itinerary and missions, the AGV L-S 1PT can connect to the company's Warehouse Management System (WMS) to optimize the workflow of different vehicles;
- AGVs are an optimal solution for logistics, even for harsh environments and operating conditions such as in the aluminium industry.

Access date: 30/03/2021

Provided by: INI-Novation GmbH

innoSEP

Source / Link: www.innosep.de

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others:
☐ Additive Manufacturing		
☐ Other		

Summary:

innoSEP stands for – innovative Solutions for Engineering and Programming – and it was founded in Germany in 2016 with the idea of uniting computer science and engineering, two historically independent fields, with each other. To make this possible, innoSEP has developed an advanced data analytics platform that helps companies build and run secure AI analytics apps without the need of coding.

innoSEP operates a collaborative software environment (no-code) for the entire industrial analytics lifecycle, that efficiently empowers organizations to build, deploy, and maintain specific industrial AI Apps in self-service. More precisely, by - a consideration of open-source frameworks and no-code translation, the individual functional domains (IT/OT, Analytics, business owner…) become more productive. - a visual-centric workflow that actively and understandably involve domain experts without programming skills for high acceptance and transparency. - a collaborative environment and role-based workflow breaking down competency barriers between functional domains. Thus, the AI adoption from business case modelling to data aggregation to runnable AI services is improved by innoSEP's software.

Detailed description

innoSEP operates a collaborative software environment (no-code) for the entire industrial analytics lifecycle, that efficiently empowers organizations to build, deploy, and maintain specific industrial AI Apps in self-service. More precisely, by

- a consideration of open-source frameworks and no-code translation, the individual functional domains (IT/OT, Analytics, business owner…) become more productive;
- a visual-centric workflow that actively and understandably involve domain experts without programming skills for high acceptance and transparency;
- a collaborative environment and role-based workflow breaking down competency barriers between functional domains. Thus, the AI adoption from business case modelling to data aggregation to runnable AI services is improved by innoSEP's software;

Users can build and run own AI analytics Apps in self-service through a visual interface, role-oriented workflow, and guided product modules without the need of coding.

innoSEP’s Platform runs on-premise or in the cloud, supporting Amazon Web Services (AWS), Google Cloud Platform (GCP), Oracle Cloud, Microsoft Azure etc. It contains a fully containerized deployment structure that supports both popular container management systems like Kubernetes and a standalone deployment - deployable wherever, whenever

innoSEP’s Platform provide full permission control throughout all project phases. Assign roles from project responsible, builder, domain expert and consumer across the enterprise to guarantee successful project implementation. Decide who can read, process and change data. Manage pipelines and apps in all stages – fully organized from data access to productive Analytics Apps.

Beneficial Results

The main benefit of innoSEP’s platform is that it allows companies to perform complex data analytics process without the need to code and to hire additional IT specialists. Essentially, this allows companies to rapidly prototype and scale their AI solutions in short periods of time and with very low effort. In turn, this allows them to also benefit from deeper insights, stemming from their data and to perform complex forecasting.

Access date: 07/07/2022

Provided by: INI-Novation GmbH

LACROIX Electronics

Source / Link: http://www.electronique-mag.com/article17571.html

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☒ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

LACROIX Electronics specializes in the design and production of electronic assemblies and sub-assemblies for the automotive, home automation, aeronautics, industry and health sectors. Three years ago, LACROIX Electronics began using two Fanuc cobots to gain flexibility and reactivity at its Saint-Pierre-Monlimart (Maine-et-Loire) facility. The company has chosen a first cobot to automate an X-ray counting station for coil components. This cobot places and retrieves the coils in the machine. The second is dedicated to mechatronic control at the end of the production line.

Detailed description

According to Dominique Maisonneuve, a Smart Industry Project Manager at LACROIX Electronics, the idea behind using the cobots was to be able to use the cobot on activity 1, one day, and on activity 2, the next day. Since the cobots have become more flexible, this makes it easy to use them for different and more specialized uses, with real ease of deployment and adjustment. In fact, according to Dominique, the cobots work well enough to be used to other areas of the workshop that require automated activity in short time.

In addition to this gain in agility, the other benefit of these industrial solutions (cobot, AGV, etc.) is the increase in employees' skills in automation subjects which bring new life into their careers. According to LACROIX Electronics, their approach is to automate the control of simple things, and to keep complex controls under the responsibility of highly qualified operators. In other words, the human factor remains decisive in the proper integration of the cobot within the company. Additionally, the company explains that once it is clear what the use of the cobots in the production will be, then it is necessary to determine the skills or even the additional training that the operators might need in order to be able to properly use the cobots.

Beneficial Results

The two cobots have led to a number of beneficial results to LACROIX Electronics, some of which are:

- A gain in agility;
- An increase in the competences of the employees on automation subjects;
- Environmental and economic gains: by using a flexible and modular cobot that can be used for different purposes, the company avoids over-equipping with tools that are too specific to a particular task. Such over-equipment often means superfluous expenses;
- The cobots can be easily integrated into production chains and they can easily be used and programmed by everyone thanks to their simple and intuitive interfaces.

Access date: 31/03/2021

Provided by: INI-Novation GmbH

RZ INM Mekaniska

Source / Link: https://www.industritorget.se

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☒ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

RZ INM Mekaniska in Västra Frölunda is a contract manufacturer that is part of the RZ Group with twelve mechanical workshops around Sweden. The company is a specialist in sheet metal processing and manufactures components that are exported for final production in other parts of Europe. Recently, RZ INM Mekaniska has added a Hyper Bending System, HBS, to its machine park from the Italian machine manufacturer Starmatik, which will ensure that more secure cost calculation and shorter cycle times are in place. Additionally, the machine will enable the company to scale its operations.

Detailed description

The Hyper Bending System takes only 28.5 square meters and has automatic gripper change and tool change, which means that it is possible to add a production queue and produce without interruption. The system includes everything to automate the entire bending process; loading, positioning, bending, turning and stacking. According to the CEO of RZ INM Mechanical – Christoffer Ågren – this is the first robotization within the company and it is particularly important since it will allow the company to go into large projects.

The Hyper Bending Machine is also programmed off-line, which increases its availability and provides a more secure cost estimate. One of the product managers from the company pointed out that it is an absolute necessity in today's highly automated industrial environment to be able to program such a type of equipment off-line. Having a good availability of this type of machine equipment is very important and you get it thanks to the off-line programming. Another advantage of off-line programming, especially for a company engaged in contract manufacturing, is that you can evaluate and analyse which tools and grippers to use at an early stage in the process and get an idea of cycling time.

Beneficial Results

Some of the benefits for the company that came as a result of adding the Hyper Bending Machine are:

- Short installation time – it only took three days from when the machine was in place until the first products came out;
- The entire system is programmed off-line with Starmatik's own software SimulEasy, which generates programs for both robots and edge processes;
- The machine enables the company to evaluate and analyse which tools and grippers to use at an early stage in the process and to get an idea of cycle times. This, in turn, contributes to a more secure cost calculation on the finished detail and give the right price to the end customer.

Access date: 26/03/2021

Provided by: INI-Novation GmbH

SFM Systems and VOITH

Source / Link: https://www.sfmsystems.de/project/voith-turbo-digital-shopfloor-management/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☒ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

SFM Systems is a production management software company from Darmstadt. Their Digital Teamboard software offers manufacturing companies the means to detect deviations and solve problems by utilizing data analytics, systematic problem solving and machine learning. SFM Systems implemented their Digital Teamboard at VOITH – a global technology company – and as a result, the company was able to significantly improve its efficiencies and became much more effective in certain processes.

Detailed description

The Digital Teamboard from SFM Systems is a digital shop floor management solution that was developed by experts with experience in the implementation of shop floor management and in cooperation with in-GmbH, a software house for industrial IoT platforms. The Digital Teamboard enables companies to carry out performance dialogue with digital support, define actions and escalate them within the organization, accelerate problem solving with a digital assistant, get an overview of aggregated KPIs, get insights into deviations, actions and problem-solving processes and much more.

Extensive shop floor management has been in place at VOITH Turbo in Crailsheim since 2013. However, the high level of transparency and the analysis options created required more time for the executives. With the help of the Digital Teamboard, managers are now relieved of data collection tasks so that they have more time for problem solving and for their teams. In addition, the ability to perform analyses was further improved by the availability of digital, structured data.

Beneficial Results

As a result of the implementation of the Digital Teamboard, VOITH Turbo was able to achieve 30%-time savings for its executives. In other words, executives now benefit from working on a single knowledge base, which means that they can now transfer insights from one area to other areas and access the data. Additionally, the implementation of the solution also allowed the team of VOITH Turbo to perform fault measures 40% faster, as a result of the improved transparency among team members.

Access date: 08/02/2022
Provided by: INI-Novation GmbH

SKODA AUTO

Source / Link: https://www.asseco-ceit.com/en/about-us/case-studies/skoda-auto/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☒ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☒ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

SKODA AUTO is a leader in introducing Industry 4.0 innovations on the Czech market where it sets trends in automation and improvement of production and logistics processes. The company therefore wanted to innovate internal logistics processes in its industrial halls by deploying modern unattended automatic robotic systems, which would be characterised by reliability, flexibility, safety, the highest level of control and connection to production processes.

Detailed description

SKODA AUTO a.s. is the largest car manufacturer in the Czech Republic and one of the oldest car manufacturers in the world. It has been writing its history since 1895. The company has been part of the VOLKSWAGEN group since 1991. It has long been one of the stable pillars of the Czech economy, currently employing more than 33,600 people in the Czech Republic. The company is based in Mlada Boleslav, where one of its production plants is located, the other two are in Kvasiny and Vrchlabi.

The company has implemented more than 130 modern robots from the CEIT portfolio in its plants in logistics processes, in both traction and underrun versions. They are characterised by smart control, connection directly to production, and advanced orientation thanks to the synchronisation of the real and virtual world. Automated guided vehicles no longer need magnetic tape on the floor of an industrial hall. They scan the environment and static objects in the hall, with the paths represented in the software environment. The system imports the floor plan of the deployment site and synchronises the real and virtual worlds. Navigation and control have thus moved even more to the virtual world and represent another important step in the internal logistics innovations of the largest Czech carmaker. The transition

to a new type of navigation no longer requires interventions in the floor and also significantly increases the flexibility in modifying the paths.

The AGVs are directly connected to the individual workplaces in the hall and immediately adapt to the current situation, thus increasing productivity. The material is brought to the assembly line exactly at the time when its needed. The system evaluates traffic conditions and transmits information important for decision-making and management of individual parts of the logistics process and logistics means. At the same time, it collects information for later analysis and optimisation of logistics. Monitoring enables a clear display of the status and position of individual logistics resources. In addition, logistics process managers can influence individual elements in real time. The current fleet also includes a new type of AGVs with a load capacity of up to six tons. The logistics system is complemented by automatic peripherals, which are used for transport and transhipment of the load. In addition, they can affect individual elements in real time.

Beneficial Results

The latest logistics robot system is meeting the following requirements:

- Ensure reliable, efficient, flexible, sophisticated, and safe automation of internal logistics;
- processes in line with current industry trends;
- Ensure a continuous flow of material and stable logistics processes;
- Provide an advanced form of controlling automatic logistics means thanks to which the logistics
- system can make independent decisions and flexibly adapt to the real situation in the industrial hall;
- Provide a comprehensive online picture of the current state of logistics and thus an objective basis for further streamlining and optimisation

Access date: 26/04/2021

Provided by: QUALED

Synsor.ai

Source / Link: https://synsor.ai/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Synsor.ai offers a Visual Intelligence system for the manufacturing industry, which helps manufacturers find and prevent defects. The solution is an easy-to-integrate automated optical inspection (AOI) system that can be set up and trained in minutes, and no IT skills are required to operate the system, which makes it very useful for line workers. Despite the easy integration, the system offers an advanced level of precision, which is often achieved by larger, more complex and more expensive systems.

Detailed description

Synsor.ai offers am optical quality control system that sees even the smallest defects. The company has developed two separate products – FIND and ACT – which are complementary to each other, and when used together ensure an advanced level of optical quality control.

FIND is a complete visual quality control system, which detects defects with high precisions. Synsor provides the hardware and the easy-to-use software to the client, install it, and train the use how to use the user interface in a few minutes. Afterwards, the product is ready to use and recognises the exact areas on a product's surface, where problems are.

ACT is a system that searches for patterns and trends in the images from FIND in real time in order to find sources of errors and upcoming errors. This is a software application, which can run on the ACT hardware, and it has an AI component, which the more it learns, the smarter it gets, and the more potential errors detect.

Both solutions could also be deployed by using existing cameras, in case the client already has. This flexibility also ensures that the solution can be implemented extremely fast, without causing any distortions to the production processes.

Thanks to the simple user guidance, the employees on the assembly line can also use the system for new parts and products, which makes it much easier to integrate the system into day-to-day operations.

Ultimately, Synsor.ai offers manufacturers a scalable solution to use image recognition for defect detection and prevention.

Beneficial Results

Some of the beneficial results for the companies using the solutions from Synsor.ai are:

- The solution is ready to use in less than 60 minutes;
- FIND also reliably detects previously unknown errors;
- Requires very few product examples to learn;
- Helps employees to quickly identify sources of error;
- Reduces rework and material waste.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Tatravagónka Poprad – Case study

Source / Link: https://www.asseco-ceit.com/en/about-us/case-studies/tatravagonka/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☒ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☒ System Integration		☐ Textiles
☐ Smart Sensors		☒ Others (railway wagons)
☐ Additive Manufacturing		
☐ Other		

Summary:

Tatravagónka Poprad is a European leader in development, design and production of freight wagons. Company Tatravagónka disposes of the most advanced technologies for material cutting with high accuracy and of certificates and attestations which confirm quality of our welding procedures. As result of extensive investments in recent years freight wagons and bogies produced by Tatravagónka meet the highest technical and qualitative requirements. Utilization of virtual reality in designing a new workplace of assembly 1st break, was a project carried with Asseco CEIT.

Detailed description

TATRAVAGÓNKA, a. s. is a Poprad-based company, Slovakia, focused on the manufacture of railway wagons with an average annual production of around 4,000 freight wagons and 10,000 bogies. However, the company is also engaged in the production of welded structures for passenger wagons. As CEO of Tatravagónka said: „*The company needed to invest in technological change due to the increasing complexity of our production. However, we would not have been able to achieve this without the Digital Enterprise tools. We were able to decide for the best solution using dynamic simulation and verification of solution designs in a virtual reality environment. It was one of several investments in our plant and we are glad that we were able to achieve the expected goal in a short time and within the given space*."

Steps taken, and project outcomes:

- individual elements of the workplace were taken into account alongside of the principles of ergonomics;
- Proposal of several variants of assembly activities cycle setup on individual operators, taking into account individual limitations and overlapping times;

- Verification of the proposed variants of assigning activities to operators was carried out directly at the company's workplace after the implementation of the proposal/design;
- Definition of a complete list of workplace equipment;
- Recalculations and evaluation of legislative requirements for manual handling of loads;
- Identification of waste and bottlenecks;
- Proposal/design of a logistics route for supply. Supermarket design to pick material for assembly workplaces in accordance with the Lean Logistics principles.

The proposal/design of the final production layout was preceded by a series of workshops with the Tatravagónka team, where Virtual Reality was used for a better idea of the designs during the implementation of the project and subsequently also during the final presentation of the output.

Designing in a Digital Enterprise environment allows you to shorten the onset time of a new system.

Beneficial Results

Benefits of the proposal:

- Effective onset of the component manufacture at newly-designed assembly workplaces;
- Floor space saving in relation to the removal of unnecessary elements of workplaces;
- Consideration of the principles of ergonomics already in the process of workplace design;
- Elimination of waste in connection with unnecessary moves within the workplace;
- Design of new assembly workplaces with verification of capacity and space requirements in the Digital Enterprise environment prior to the actual implementation phase;
- Detection of possible collision states in a detailed variant.

Access date: 26/04/2021

Provided by: QUALED

TVARIT

Source / Link: https://www.tvarit.com/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

TVARIT GmbH is a leading European AI company for industrial artificial intelligence. It aims to help the metalworking industry worldwide achieve sustainable growth and efficiency by complementing human capabilities with industry-specific AI models to reduce disruptions in production and optimize resource utilization. This is also TVARIT's vision: to lead the world towards sustainable and zero-waste manufacturing. As experts in the application of artificial intelligence for process optimization in foundries, Tvarit GmbH helps its customers to reduce rejects, reduce CO2 emissions, avoid machine failures and increase productivity with the help of the analysis of production data. With the help of Tvarit GmbH software solutions, companies like MAXION, KAMAX, and HINDALCO have achieved proven results by successfully reducing scrap in their metal casting processes by more than 35%. The software uses a unique hybrid algorithm based on the metallurgical equations of the specific casting process and uses machine learning to get more accurate insights from production data.

Detailed description

TVARIT's AI-powered technologies are applicable in a range of industries, but the company has gained significant traction in the metal production and processing industries. Steel mills, for example, are massive in data, and learning algorithms only get better as they learn. Steel mill owners confront to enhance their quality and profits glamorously from investment in AI, since AI can expose unforeseen business possibilities as well as operational competences. AI can concurrently increase safety and environmental impact – serving to prognosticate caster breakouts or decreasing overall plant waste and CO2 emissions. To reach these benefits, process specific hybrid AI models are used to analyze how the various influencing factors in the individual industrial process affect the quality of the final product. To derive these insights, the AI model uses a variety of data, such as domain input data, input material data, industrial machine data and quality control data. By analyzing this vast amount of information, the AI algorithms are able to make quality predictions that help to recognize deviations in real-time. Additionally,

root cause analyses can define the reasons for failures, and all of this data can be used for the creation of recommendations for optimal casting settings that help to reduce scrap.

Beneficial Results

The use of AI in the metals production and processing industries has been proven to lead to a number of benefits for the organisations, some of which are:

- Up to 1.100.000 € of savings per plant by reducing waste of man, machine, material & energy;
- Up to 5% increased OEE through increased productivity & reduced scrap;
- up to 7,2 GJ reduced energy consumption per plant due to reduced rework;
- Up to 60% reduced scrap with suggestions for optimal casting parameters.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Visometry

Source / Link: https://visometry.com

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☒ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Visometry is a start-up and Fraunhofer spin-off. They create Augmented Reality core technology, develop custom solutions and support their customers in integrating AR and computer vision into their business. One of their solutions is Twyn - a mobile, digital-by-design solution for quality control.

Detailed description

Quality inspections are lengthy, costly and time-consuming processes, which have not reached a high level of automation throughout the years. Additionally, the large number of product variants (assemblies and parts) in automotive, aviation, machine construction, the high risk for consecutive errors and follow-up costs in production or repair tasks, and the high costs for inspection and quality assurance prevent 100% control and results in a significant challenge for industrial companies.

Visometry's solution – Twyn – enables organisations to perform visual quality inspections faster, assisted by a digital workflow and reduced setup times. Twyn uses Augmented Reality techniques for accurate 3D-Object Tracking based on CAD data, precise overlay visualization and documentation, and for measurement of independently tracked objects. This ultimately ensures a high degree of quality before components go into production and finds deviations faster during errors analysis audits. In other words, the inspection of components can be done in real time and on the spot, which results in significant cost and time savings.

Beneficial Results

The usage of Twyn allows companies to enjoy a number of benefits, such as:

- Increased profitability as a result of cost reduction;
- Improved efficiency – e.g., increase of sample rate of factor 8 for quality inspected parts;
- More flexibility: Support of Comparison, Measurements, Existence verification and Deformation Control;
- Available traceability - Documentation via precise overlay of real models and virtual objects;

• Mobility - use of actual tablet solutions with low investments costs; • Security: Ability to store 3D-data on premise.
Access date: 08/02/2022
Provided by: INI-Novation GmbH

Technology area 3: Technologies improving organizational aspects

5thIndustry

Source / Link: https://5thindustry.de/?lang=en

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☒ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

5thIndustry develops software applications for digitizing industrial production. Their apps revolutionize factory work by enabling direct data exchange between all levels of the company, transparent cooperation of all employees in the factory, more time for creativity and innovation instead of routine tasks. As a partner in the digitization process, the company removes the hurdles for its clients.

Detailed description

5thIndustry's main solution is the so called "5i Manufacturing Excellence Cloud", which contains apps that are designed to be flexible - so collaboration in the factory succeeds in a fully digital and integrated way. In other words, there is a cloud, where the data from the whole company is stored, and 5 applications, which support the digitalization of industrial processes. 5thIndustry's apps, also called 5i Apps, are the following:

- **5i Maintenance** – provides functionalities, related to maintenance management, management of equipment and tools;
- **5i Protocol** - creates test and routing plans, document quality & creates test reports;
- **5i Progress** - reports production progress, document faults and malfunctions;
- **5i Safety** - manages occupational safety easily, perform audits and safety inspections digitally;
- **5i Quality** - manages quality notifications and measures, analyze causes.

Beneficial Results

The platform and the applications of 5thindustry enable a seamless and continuous digitalization of all manufacturing and industrial processes. Whether production or support areas such as quality management, maintenance or occupational safety, employees work highly efficiently in an intuitive digital environment. Data is dynamically available anytime and anywhere. This brings transparency and reaction

speed to a new level. Finally, people are taking center stage and are actively involved in the design and further development of their digital working environment.
Access date: 08/02/2022
Provided by: INI-Novation GmbH

AR-Experts

Source / Link: https://www.ar-experts.de/

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☒ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☒ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

AR-Experts is an AR/VR company that has developed GIRI - the fastest platform for creating industrial Augmented Reality. The platform gives industrial companies the ability to leverage the huge potential of augmented reality (AR) in a simple, but efficient manner. Content creation is one of the main challenges in the implementation of AR systems across a company's operations, and in order to address this challenge, the GIRI app and platform enable its users to quickly create "on-site" AR content for industrial use.

Detailed description

AR-Experts' GIRI technology focuses on the main bottleneck in wide-spread utilization and implementation of Augmented Reality: content creation. It enables organizational employees to seamlessly create AR-based instructions for the purposes of production, service or product manuals. This benefits the future of work because with the GIRI App, organizations can create intuitive AR-based instructions in 90 seconds, which enables workers to perform 83% better. This tends to be particularly useful for industrial partners active in the manufacturing, field service or maintenance, where the know-how is often shared when one employee trains another employee on the spot, also known as on-the-job training. Usually, a worker spends 50-100 hours per year on training and improving its qualification. In comparison, a new worker spends up to 300 hours per year. While this sometimes incurs significant costs, outside developments, such as the COVID-19 pandemic, necessitate new flexibility requirements in manufacturing and maintenance, which in turn significantly increased the requirements for continuous training. In this case, organisations usually face two training scenarios: 1) Workers try to read the standard operating procedures (SOPs) or instruction manuals, and 2) Your experts stand next to your workers and explain them the process. Traditionally, when training from manuals /SOPs, the following is happening: workers are not interested in reading all the materials, they just browse them because they do not like to read. They overlook the important details and at the end this results in errors - poor training

is responsible for about 1.000€ monthly follow-up cost per worker. In the setup where your people are getting trained Face2Face from your real expert the following is happening. Face2Face Training is a direct cause of stress for 50% of the employees because someone is constantly looking at them. This heavily reduces the learning success. The expert (ad hoc trainer), is bound by the training, and cannot execute his actual task. This puts stress on the company and stress on the expert, because he has his own KPIS. A training depending on a few experts results in to few training capacities available. This reduces the flexibility and quality of the company.

By using GIRI and AR in general for training purposes, workers qualify themselves following Augmented Reality workflows on their AR Glasses or smartphones. The expert gets out his phone or puts on his smart glass and just records what he is doing, and then shares it with the rest of the employees, which then can rewatch the training as much as they need. Our typical experience here is, that people can train 90% of their time alone. Which enables one expert to train 10 times the amount of people.

Beneficial Results

Practice and research have proven that using AR for training purposes in industrial and manufacturing sectors leads to a number of benefits for the organisation and its employees. Some of the main benefits are:

- According to the company, workers at BMW who got trained with Augmented Reality did 62,3% fewer assembly mistakes and 83,6% fewer mistakes in the order of assembly compared to conventional paper-based training;
- Training with Augmented Reality frees trainees and experts (trainers) from stress;
- People are much more motivated because they can perform much more varied tasks;
- Because people can perform much more tasks, the whole company becomes more flexible;
- People can learn in social distance without close contact with their co-workers and your company becomes ready for post-Covid times.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

Arla Foods & Au2mate

Source / Link: https://engineering-update.co.uk/2021/01/11/reducing-waste-boosting-profits/

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☐ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

As part of a project with Arla Foods, Au2mate upgraded a control system for a Cheese Dairy facility in Denmark. Upgrading the software to Au2mate's ISA 88 standard, generated an improved and structured design philosophy. This ensured that phase sequence control was more efficient, trimming the programs to recover valuable time and recover from wash cycles quicker. Ultimately, this led to reduced waste, energy savings and to improved profit margins.

Detailed description

According to the Waste and Resources Action Programme (WRAP), dairy processors waste over 13,000 tonnes of milk every year**.** Combined with the competitive nature of the sector, dairy processors are under increasing pressure to keep waste, and therefore costs, low. When evaluating profitability in dairy, there are a huge scope of factors that can impact costs. However, there's no doubt that minimising energy and product waste is essential.

As part of a project with Arla Foods, Au2mate upgraded a control system for a Cheese Dairy facility in Denmark. With a yearly production of 58,000 tonnes of cream cheese, the facility contained over 3,500 individual components, all of which had the potential to reveal valuable insight into their functions, energy usage and waste. Upgrading the software to Au2mate's ISA 88 standard, generated an improved and structured design philosophy. This ensured that phase sequence control was more efficient, trimming the programs to recover valuable time and recover from wash cycles quicker. The result was a reduction in electricity, steam, and ice water use by more than 20 per cent and a 30 per cent reduction in costs for water and chemicals.

Alongside energy reduction, process automation technologies can be used to reduce product waste in dairy processing. Manufacturing Execution Systems (MES) have long been used for waste identification in processing, but when integrated with enterprise technologies such as Enterprise Resource Planning (ERP), can provide an additional safety net to reduce waste to an absolute minimum.

In a milk processing environment, for instance, a decision-maker can use production data to manage processing execution. Tracking the transformation of products from raw materials right through to finished goods, for instance, from unprocessed milk through to a skimmed or semi-skimmed product and ensuring all cleaning-in-place (CIP) is completed effectively.

Beneficial Results

The upgrading of the control system led to a number of benefits for Arla Foods, some of which are:

- A reduction in electricity, steam, and ice water uses by more than 20%;
- A 30% reduction in costs for water and chemicals;
- The dairy processing facility has reduced their maintenance costs for the control system and increased the flexibility and integration opportunities;
- Increased horizontal and vertical integration, combined with the applied MES elements (product definitions and recipes) has led to a more effective production with minimum downtime and maximum traceability and reporting;
- Ultimately improved profit margins.

Access date: 30/03/2021

Provided by: INI-Novation GmbH

Aucobo & Wieland

Source / Link: Personal interview & https://aucobo.de/en/success-story-wieland/

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☒ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☒ Other: Human-machine interaction		

Summary:

The machine-human communication is outdated. Signal lights and static screens are not targeted, cause overstimulation and increase the need for coordination. This leads to inefficient processes and machine downtimes. Aucobo increases productivity through a new way of connecting humans and machines in the manufacturing environment. Their technology enables autonomy, precision and world-class productivity to every member of the global manufacturing workforce. The Aucobo solution consists of the aucobo connector, -core and -mobile. The system optimizes the human-machine interaction, prevents silos, enables automated prioritization and delivers crucial real-time data for your decision-making.

As the leading global specialist for copper and copper alloys, Wieland supports its customers' success from numerous locations and continents – with reliable, flexible supply and the best service in consistently high quality. For the global challenges of our time such as climate change, digitalization, resource conservation, Wieland designs sustainable and innovative solutions with its products, services and technologies.

Wieland knows how to listen in order to offer its business partners exactly what meets their requirements and convinces its customers with the right solution – and has been doing so for 200 years and 8000 employees. Always striving for innovation, Wieland was looking for a process to digitize surface inspection in production.

With the help of the interaction between the aucobo solution and smart wearables, more than the originally set project goal could be achieved. Quality assurance was significantly optimized, and employee productivity increased. Since this could be implemented quickly and smoothly, there was still time to carry out another implementation, which was not planned at the beginning.

Detailed description

The challenge was to simplify the surface inspection process and the associated documentation. Previously, there was a document on which employees manually recorded the inspection information. This was then forwarded to the foreman's office and many other stations before finally being filed. The process was not only time-consuming, but also harboured sources of error. As soon as an employee forgot his signature, for example, the whole process had to be followed up to obtain complete documentation. To make this process more secure and timesaving, Wieland sought a digital solution, initially with a competing product. However, for a number of reasons, this did not meet its goals, so Wieland had to reorient itself. Since the company was still committed to the idea of digitization, it was clear that a new smart solution had to be found.

With the help of aucobo, the solution was identified to be the digitization of the inspection process with the help of smart wearables. The use of the aucobo system allows Wieland to have a much smoother process, better communication, as well as increased productivity in production. With the integration of the smart wearables, the workflow of the employees has been significantly simplified. The smartwatches are connected to the central MES (Manufacturing Execution System) so that employees are notified at regular intervals when they need to perform a surface inspection. In addition, once at the respective machine, employees can scan a QR code and are then automatically redirected to the inspection process. Once the inspection has been performed, the employee can select on his smartwatch whether everything is in order. If not, he will be shown various error options to choose from. Here, the employee can ensure that the correct information quickly reaches the responsible person by simply selecting a category.

Beneficial Results

The project turned out to be very successful and beneficial for Wieland and some of the achievements that were accomplished are:

- Quality assurance was significantly optimized.
- Significant minimization of organizational effort.
- Employee productivity increased, especially for the production staff, which is often under pressure due to production targets and deadlines, and the previous paperwork was slowing down the workflow.
- The distances within the production halls could be reduced significantly by improving the communication. The employees now only have to go to the respective plants when an inspection is required, and the reminder appears on the smartwatch.
- Digitization of the ordering of auxiliary and operating materials - previously, paper kanban cards were used for reordering auxiliary and operating materials. The data noted on them had to be manually transferred to the ordering system when ordering. This process has been greatly simplified by adding a QR code to the kanban cards. Now the cards are scanned, and this triggers the ordering process.

Access date: 19/07/2021

Provided by: INI-Novation GmbH

Awesome Technologies

Source / Link: https://awesome-technologies.de/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☒ Robotics		☒ Food and agriculture
☒ Automation		☐ Health
☐ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Awesome Technologies is a Digital Lab, which supports organisations in mastering the challenges of digitization. For this they bring in their cross-functional experience from numerous design and implementation projects. They accompany their customers from brainstorming to implementation to support and further development of their applications. It is their aim to always develop sustainable solutions, taking into account the corporate context, customers and employees. Our methods originate from human centered designs and agile project management. In this way we can guarantee a user-oriented, focused and fast implementation.

Detailed description

The primary solutions of Awesome Technologies are various Robotic und Machine Interaction Solutions, which empower skilled workers in production and assembly through the use of innovative technologies. More precisely, the company develops, integrates and operates innovative applications for collaborative robots (cobots) and automated guided vehicles (AGV). Awesome Technologies also develops intuitive operating concepts in a human-centered design approach, whether for traditional user interfaces or with Augmented and Virtual Reality.

Cobots and AGVs are supporting tools in the industry but their mass adoption is challenging and requires a lot of organizational changes. To make the process smoother, Awesome Technologies follows a set of steps, which allow the company to design and implement innovative robotics use cases. The steps are, as follows:

- Identification and exploitation of trends in collaborative robotics;
- Combining these trends with unique know-how in visualization;
- Testing of latest solutions;
- Establishment of research partnerships with universities, institutes, SMEs.

Awesome technologies operate a Robotics-as-a-Service (RaaS) process, which allows the introduction of innovative and customizable solutions in clients' locations. In other words, the company performs a series of analysis, planning and implementation steps, which allows it to design the most appropriate robotics use case for a company, and to implement it.

Beneficial Results

The implementation of such innovative robotics use cases, powered by VR/AR, allows organisations to put humans and workers in the center of their digitalization journey. Instead of robots replacing people, with such solutions, workers turn into operators and are able to control more processes with less effort, and with better precision. Additionally, the availability of new types of data, insights and visualizations allows the company to radically improve its performance.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

KROMBERG & Schubert s.r.o. + CEIT

Source / Link: https://www.asseco-ceit.com/en/about-us/case-studies/kromberg-schubert/

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☐ Aerospace
☐ IoT and IIoT	☐ Programme	☐ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☒ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☒ System Integration		☐ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☒ Other: Dynamic simulation		

Summary:

KROMBERG & Schubert is an international industrial company faced a new challenge. It was necessary to get ready for an increase in production in one part of the manufacturing plant in Kolárovo, but this needed to be done on the same floor area (1,000 m2) and with the use of available capacities. Cooperation with CEIT specialists aimed to design a new production layout in the part of the production floor area to achieve a smooth material flow, define the number of workplaces, the number of workers, and positions for work in progress.

Detailed description

KROMBERG & Schubert is an international industrial company with more than 100-year history and rich experience in the field of automotive production. It is mainly engaged in the production of cable harnesses, and the company supplies components to the largest European car manufacturers. It employs more than 40,000 people worldwide. The plant in Kolárovo, Slovakia, has been a part of the company for more than 20 years.

For increasing the production of the plant in Slovakia, they used dynamic computer simulation. It brings certainty to innovative decisions because its task is to verify how the system of production (or logistics) processes will work after it is launched or after implementing changes to its parameters.

In addition to the system's production performance, it is possible to determine as part of the simulation also the utilisation of equipment and operators, the ongoing production time, the maximum and average stocks in individual warehouses, or the impact of failed products on the required production performance. The dynamic simulation also enables verification of the system behaviour in extreme situations (e.g., long-term machine failure) that can be “tested” in the safe world of a computer model. The enterprise can

avoid high losses from additional modifications to a poorly designed system by planning before the implementation.

The project, including simulations of 25 processes, lasted approximately three months and involved more than fifty production sites and machines. CEIT specialists focused on the dynamic verification of the future situation, also including the definition of bottlenecks. The task was to dynamically check the capacity of the equipment used in the new layout for the expected production and at the same time to find the optimal ratio of retyping production processes, to define the optimal amount of work in progress and the optimal utilisation of assembly workers at workplaces. They also focused on setting the product mix concerning the maximum possible utilization of workplaces and smooth material flows.

Beneficial Results

Outputs also in virtual reality

The design of the final production layout was preceded by a series of workshops with the KROMBERG & Schubert team. At the end of the project, the company obtained a precisely defined number of workplaces in the planned production, a proposal for a new production layout, a defined number of workers according to the skills matrix and the definition of positions for work in progress. The presentation of the project outputs took place originally and innovatively using virtual reality.

Access date: 12/05/2021

Provided by: QUALED

Nightingale HQ & FLS Logistics

Source / Link: Personal interview and https://nightingalehq.ai/casestudies/fls/

Technology area:	Type of good practice:	Target group:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☒ Automation		☒ Health
☒ System Integration		☒ Textiles
☐ Smart Sensors		☒ Others: Logistics
☐ Additive Manufacturing		
☐ Other		

Summary:

Nightingale HQ is a leading provider of AI-powered software that helps manufacturers integrate Artificial Intelligence (AI) into their operations without the need for significant investment in acquiring AI expertise.

Freight Logistics Solutions (FLS) needed help to modernise its data warehousing capabilities to run more efficient operations and gain a competitive advantage. The aim for the cargo transport provider was to improve their digital position and scale their business.

FLS Logistics had come to realise how much time their staff spent on spreadsheets and data and this incentivized them to find an alternative. The logistics provider wanted a data warehouse and Nightingale HQ's fast-track services were the perfect solution for them so that they could have near real-time visibility without increasing IT headcount.

As a result of the collaboration with Nightingale HQ, FLS Logistics managed to free up more than 50% of staff's time from laborious data entry!

Detailed description

Nightingale HQ consolidated data into a centralised reporting database to eliminate manual work and provide more timely insights into the business and its customers. This was done by collaborating closely with the management and technical team to deliver and build a scalable and cost-effective data warehousing and data integration process. Additionally, by utilizing a mix of scheduled and real-time data feeds, the database provides an up-to-the-minute view of the business performance.

Other objectives that were set as part of the project were:

- Consolidate data from multiple sources into one centralised reporting system;
- Deliver a cost-effective solution in terms of maintenance and scalability for the business;
- Train staff so that key digital capabilities are developed and sustained within the firm;

- Support data warehousing competencies in order to help leverage a distinct competitive advantage in the market.

Beneficial Results

The project turned out to be very successful and beneficial for FLS Logistics and some of the achievements that were accomplished are:

- Aligned prioritised technical requirements with business objectives in business modelling workshops;
- Delivered one central database using Azure SQL that consolidated multiple data sources;
- Delivered real-time data from APIs using Azure Functions. Real-time analytics support better business decision making;
- Provided a cost-effective solution using Platform as a Service (PaaS) and Serverless solutions with no ongoing maintenance burden and the ability to scale easily;
- Supporting ongoing data warehousing service in order to ensure database optimisation and backup maintenance.

Access date: 16/07/2021

Provided by: INI-Novation GmbH

PIA Automation & DUALIS IT Solution

Source / Link: https://www.dualis-it.de/pia-automation-lebt-virtuelle-realitaet-3d-simulation-von-dualis-fuer-mehr-schnelligkeit-effizienz-und-agilitaet/

Technology area:	Type of good practice:	Target group:
☐ Artificial Intelligence	☒ Company	☒ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☒ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☒ Health
☐ System Integration		☒ Textiles
☐ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☒ Other: 3D-Simulation		

Summary:

PIA Automation, a specialist in special machine construction and automation technology, uses the 3D simulation platform Visual Components, distributed by DUALIS IT Solution, as an effective tool in the areas of construction, robotics, PLC and sales. The solution leads to fast, economical and reliable processes - from the simulation of processes to the virtual commissioning of machines and systems.

Detailed description

PIA Automation is an international group of companies in the field of special machine construction and automation technology. The range of services extends from manual assembly workstations and fully automatic production lines to smart Industry 4.0 solutions. At the PIA Automation location in Grambach (Austria), the requirement arose to optimize the exchange of knowledge between sales, operations and customers, since for a long time only 2D layouts were used, which, however, offered too much room for interpretation. The use of 3D layouts should increase the transparency, efficiency and security of concepts in areas such as transfer, simulations and robot accessibility in order to ensure future viability. As a result, the decision was made in favor of the 3D simulation solution Visual Components due to the technological advantages and the service provided by DUALIS. With Visual Components, factory processes can be mapped realistically and planned in advance. Additionally, the ability of the software to generate a simulation (material flow) without any programming knowledge was one of the decisive factors for PIA Automation.

Beneficial Results

The technology is said to benefit the engineering, robotics, sales and marketing departments. More precisely, some of the direct benefits are:

- The solution enables PIA Automation to apply features such as 3D layout, modelling, and robot and plant simulations;

- It is possible to achieve a high degree of connectivity;
- Time-savings are achieved;
- Numerous enhancements are planned for the future, such as integration of RCS modules and the provision of an integrated augmented reality. Additionally, haptic feedback via hand tracking - i.e. operation without a controller - or covering "real" distances in the simulation are also in the planning stage.

Access date: 26/03/2021

Provided by: INI-Novation GmbH

Probility

Source / Link: https://probility.de/

Technology area:	Type of good practice:	Target market segments:
☒ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☐ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☐ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☒ Consumer goods
☐ VR/AR		☒ Pharmaceuticals and chemistry
☐ Robotics		☒ Food and agriculture
☐ Automation		☒ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others
☐ Additive Manufacturing		
☐ Other		

Summary:

Probility is a start-up that offers medium-sized and large companies an increase in work safety and efficiency in intralogistics processes. They achieve this through an optical AI sensor network that analyses the desired or entire work environment in real time and warns employees of impending collisions. The start-up currently offers their system as a package of 3 main parts. The scope varies depending on the area to be guarded. The system is based on decentralized installed optical AI sensors that enable real-time detection and location of people and objects while complying with data protection regulations. The determination of the position data makes it possible to warn the driver. In this way, the high number of accidents in internal traffic can be reduced. In addition, the evaluation of the data offers a wide range of possible applications, such as the analysis of danger areas where critical situations occur more frequently. This leads to an increased recognition of optimization potentials and, based on the data analyses, strategies for increasing efficiency in inland traffic are derived and implemented.

Detailed description

No matter the training or the experience, employees in industrial areas are often in a hurry, distracted, tired or simply focused on their work and they no longer perceive everything that happens in their surroundings. Especially in the areas that are not visible. This, in turn, often leads to dangerous situations in which employees can be hurt my moving machinery or equipment because none of them was able to sport the other one. Such dangerous situations can be avoided with Probility's intelligent system, which detects such inconspicuous areas and warns the driver. For example, most forklifts have very limited forward visibility – even when they are not loaded. A short moment is enough for a person to disappear in the driver's blind spot, resulting in a collision. Here again, our 3D sensor can recognises the person in advance and calculate their trajectory. Therefore, these situations can also be easily avoided by warning the drivers.

The system detects all persons and forklifts and recognises the potential risk of a collision. For the person who is not visible to the forklift driver, the system alerts and warns the forklift to stop. After the person is no longer in the driving path, the system gives permission to continue driving.

Currently the system consists of 3 components – ProSen, the server and ProDrive.

ProSen is the eyes and the brain of the system. By placing the system in working environment, companies give their working environment additional senses. The TPU Edge computer's processing power is specially designed for image processing and AI, which improves accuracy. In addition, the sensor is protected against external influences by IP 65.

The Server is the spinal cord of the system. Only one central contact point is required for the communication of the individual devices. Since it is very small, we can mount it at companies' desired location. Here, the incoming coordinates are fused in a matter of milliseconds and the signals are sent to the correct forklift truck. Since the data only consists of individual coordinates, the latency is very low and the scalability is very high.

ProDrive warns the driver of obstacles using visual and acoustic signals without blocking his view or distracting him. The calibration also shows the driver from which direction the obstacle, e.x. a person, is coming and how far away it is. Due to the almost non-existent latency and the very well-trained recognition algorithm, full confidence can be placed in the system, so that the driver can only concentrate on the load or the vehicle.

Beneficial Results

Apart from the obvious benefits of an improved safety for the employees, the system also offers additional benefits to the company. For example, no additional devices are needed because the system works with optical signals, and the employees do not need to wear any other devices. Therefore, every person, whether employee or postman, is recognised and protected.

The system does not need to be charged and therefore, there is no need for constant charging of the devices or mindful handling of the beacons to be protected. The employees can hence carry out their work without worries.

Last but not least, by analysing the anonymous data, companies can identify potential for optimisation, such as walking or driving routes, and thus improve the processes.

Access date: 08/02/2022

Provided by: INI-Novation GmbH

WearHealth & E.ON

Source / Link: https://wearhealth.com/

Technology area:	Type of good practice:	Target market segments:
☐ Artificial Intelligence	☒ Company	☐ Discrete (smart) manufacturing
☐ Big Data	☒ Project	☒ Automotive
☐ Digital Twins	☐ Initiative	☒ Aerospace
☒ IoT and IIoT	☐ Programme	☒ Metal processing
☐ Cybersecurity	☐ Other	☐ Consumer goods
☐ VR/AR		☐ Pharmaceuticals and chemistry
☐ Robotics		☐ Food and agriculture
☐ Automation		☐ Health
☐ System Integration		☐ Textiles
☒ Smart Sensors		☐ Others: Energy and Utilities, Oil & Gas, Mining
☐ Additive Manufacturing		
☐ Other		

Summary:

WearHealth's AI and IoT-driven platform makes it easy to assess, compare, and predict job performance in an automatic and anonymous manner so that managers are empowered to improve productivity during repetitive manual tasks, to ensure safe work execution during hazardous tasks, and to increase worker engagement and wellbeing.

E.ON is an international electric utility company with more than 33 million customers across 30 different countries. E.ON strives to make safety and health as well as environment and climate protection an integral part of all its business activities. For Health this means that E.ON aspires to be an "Employer of choice" and foster a work environment that protects workers' physical and mental wellbeing. For Safety this means an ongoing commitment to a VISION ZERO to ensure the protection of everyone involved in their operations

In order to improve the safety and health work conditions for its employees, E.ON engaged in a project with WearHealth.

Detailed description

Occupational safety is a top priority at E.ON because many maintenance workers have to perform manual tasks in hazardous locations such as high-voltage areas and work at height. Consequently, it is of paramount importance that workers are fully alert as well as physically and mentally fit for work during hazardous tasks. Besides, some technicians work alone so it is crucial to ensure that they can receive timely support in case of emergency. To address this challenge, the platform and sensors of WearHealth were used to increase awareness and alertness with real-time biofeedback

Workers were equipped with a wearable device (chest strap) and a companion app to collect data and provide actionable insights. Using WearHealth's proprietary artificial intelligence algorithms based on ISO

standards, workers could see their workload level and workload type (physical or mental) in real-time and get notified whenever their workload could lead to safety risks. On top of the real-time insights, workers could also access in-depth daily and monthly reports to reflect on their activities and promote a better work-life balance. Upon approval by the work council, team managers could see anonymized insights at a group level to open up the safety and health dialog with workers in a transparent manner. The interpretation of both real-time and in-depth insights depends on the work context. Therefore, they were correlated with operational tasks in hazardous and nonhazardous environments.

It is very important for lone workers to have the peace of mind that comes from knowing that if they suffer an accident the emergency response will be as fast and efficient as possible. Consequently, an AI-driven man-down system was incorporated into the companion app. If the system detects a potential emergency situation, such as violent movement followed by an extended period without motion, it sends an SMS alert to the emergency contact. The SMS alert contains both the location and the heart rate of the worker so the response team can act in a timely and effective manner. This was done respecting the highest data privacy standards. For example, GPS data was only made available in case of an emergency.

Beneficial Results

Apart from the obvious improvements of the health and safety working conditions, the project led to a number of other intangible benefits for E.ON, such as :

- 81% of the workers increased their awareness;
- 80% of the workers felt more supported by their employer;

Access date: 08/02/2022

Provided by: INI-Novation GmbH

REFERENCES TO EUROPEAN POLICIES

The development of skills and competences relevant to the new innovative and creative economy are at the heart of the European industrial strategy, Recovery plan for Europe and Youth Employment Support. Innovation and competitiveness thrive on the creativity and skills of individuals. With the Industrial strategy for Europe and the SME strategy adopted in March 2020, the European commission acknowledge the importance of skills for the twin green and digital transitions. Training, upskilling and reskilling have to be a core part of the economy. A five-year plan to help people and businesses develop more and better skills, called “Skills Agenda for sustainable competitiveness, social fairness and resilience”, was adopted in July 2020. It sets quantitative objectives to be achieved by 2025 and aims to equip to upskill and reskill the workforce.[17]

For detailed information, you can familiarize yourself with the relevant documents through the links provided below.

European Industrial Strategy,2020,
Link: https://single-market-economy.ec.europa.eu/industry/strategy_en

Recovery Plan for Europe
Link: https://ec.europa.eu/info/strategy/recovery-plan-europe_en

Youth Employment Support: a Bridge to Jobs for the Next Generation
Link: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1594047420340&uri=CELEX%3A52020DC0276

An SME Strategy for a sustainable and digital Europe, 2020
Link: https://ec.europa.eu/info/sites/default/files/communication-sme-strategy-march-2020_en.pdf

Skills Agenda for sustainable competitiveness, social fairness and resilience, 2020
Link: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2020:274:FIN

[17] *Skills for industry, European Commission, Website link: https://single-market-economy.ec.europa.eu/industry/strategy/skills-industry_en . Retrieved on 24.04.2022*

CONCLUSION

Having the right strategies in place has always been a central pillar in organizations' quest for a superior performance, operational excellence and ultimately for a competitive advantage. However, creating and embracing such new value-creating strategies tends to be a function of an organization's ability to leverage and adopt new technologies, which in turn depends on the skills and qualifications of its employees. Technology has always been of key importance for the competitiveness of the European industries and there are no indications that this might change in the near future, especially due to the fundamental role that Europe plays in driving industrial innovation on a global scale. However, as a result of the changing demographics worldwide along, geopolitical events, as well as the exponential rate at which new technologies arise, it seems that Europe will have to make fundamental changes in the ways companies and people adopt new technologies and use them to drive further the growth of their sectors and industries.

The catalogue "Skills and Competences for Work in Industry 4.0" provides an overview of 64 good practices in terms of policies, initiatives and learning practices - accompanied by different stakeholders' opinions – as well as an overview of technology use cases enabling the transformation processes. This collection of good practices and uses case references was designed with the goal to become an impact-provoking blueprint that hopefully serves employees, company decision makers, policy makers and educational institutions, as a way to tap into the open innovation potential of Europe, and to benefit from ideas, innovations and game changing initiatives.

References

Mike Moore, "*What is Industry 4.0? Everything you need to know";* TechRadar; November 2019. Retrieved in Wikipedia November 2020
IQS Directory, "*Ultimate Guide: Everything You need to Know About Industry 4.0"*, Website link: https://www.iqsdirectory.com/resources/ultimate-guide-everything-need-to-know-about-industry-4-0/. Retrieved on November 2020
Dr. Andreas Hauser, "*Paving Your Smart Manufacturing Roadmap",* October 2020. Website link: https://www.tuvsud.com/en/resource-centre/stories/smart-industry-readiness-index. Retrieved on December 2020
Changing nature and role of vocational education and training (VET) in Europe, Website link: https://www.cedefop.europa.eu/en/projects/changing-nature-and-role-vocational-education-and-training-vet-europe/publications. Retrieved on February 2021
Hessian Ministry for Social Affairs and Integration, *Operation of the month*. Website link: https://soziales.hessen.de/arbeit/fachkraeftesicherung/betrieb-des-monats. Retrieved on March 2021
Chris Heron, "*What is a Transversal Competency?",* March 2019, Vivalogy.com. Website link: https://vivagogy.com/2019/03/04/transversal-competencies-2/. Retrieved on March 2021
Megan Ray Nichols, *Must-Have Skills for Industry 4.0,* October 2019, ControlGloval.com, Website link: https://www.controlglobal.com/blogs/guest-blogs/must-have-skills-for-industry-4-0/. Retrieved on May 2021
Indeed Editorial Team, *Creativity Skills: Definition, Tips and Examples*, December 2019, updated June 2022. Website link: https://www.indeed.com/career-advice/career-development/creativity-skills#:~:text=Creativity%20is%20the%20ability%20to,things%20from%20a%20unique%20perspective. Retrieved on May 2021
Dylan Goldby, *10 Creative Skills You Need to Keep Creating*, 2018, CreativeLive.com. Website link: https://www.creativelive.com/blog/10-creative-skills-you-need-to-keep-creating/. Retrieved on December 2020
Skills You Need, *Social Skills*, 2019. Website link: https://www.skillsyouneed.com/ips/socialskills.html#:~:text=Social%20skills%20are%20the%20skills,%20thoughts%20and%20feelings%20with%20others. Retrieved on May 2021
Kweilin Ellingrud, Rahul Gupta, and Julian Salguero, *Building the vital skills for the future of work in operations*, August 2020, McKinsey & Company. Website link: https://www.mckinsey.com/business-functions/operations/our-insights/building-the-vital-skills-for-the-future-of-work-in-operations. Retrieved on April 2021
Quora*, "What are contextual skills in management?",* Website link: https://www.quora.com/What-are-contextual-skills-in-management. Retrieved on April 2021
World Economic Forum. *The Future of Jobs: Skills Stability*, Website link: https://reports.weforum.org/future-of-jobs-2016/skills-stability/. Retrieved on January 2021
World Economic Forum. The Future of Jobs: Chapter 1: The Future of Jobs and Skills, Website link: https://reports.weforum.org/future-of-jobs-2016/chapter-1-the-future-of-jobs-and-skills/. Retrieved on January 2021
Skills for industry, European Commission, Website link: https://single-market-economy.ec.europa.eu/industry/strategy/skills-industry_en. Retrieved on April 2022