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IMPROVE PRODUCTIVITY THROUGH DIGITAL MANUFACTURING

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Abstract: *In the future the digitalization and "Industry 4.0" will be in every step of the product lifecycle from design to the manufacture, service, and maintenance. Through digitalization, the companies will be able to operate and program the complex CNC machine tools that will be ready to respond more flexibly to the market demands and at the same time to boost their productivity. Work preparation and production can be breaking down further into additional process steps, ranging from tendering to quality assurance. The demand for digitalization solution can be illustrated thru the following targets and questions what every production company must define and establish: 1. How long time will be the part on the machine to be manufacturi; 2. Is that CNC machine tools (what is able and have the technical characteristics) available; 3. Are necessary new cutting tools for this new job; 4.The CNC operator is familiar with the CNC control equipment; 5. Does the workpiece tolerance correspond with the customer specifications. Is not so easy to link up all this requests and to find the best solutions in time and to have high productivity. Digital manufacturing will give us the preliminary units costs and delivery deadline that must be determined to be able to tender for a job correctly. Today, the amount of time a workpiece will require for machining can be calculated quickly reliably and very important, without trial runs, using CNC simulation solutions. This recommendations from our paper can be an answer at the production companies and the advantage of this implementations is that can be made step by step. The solution of this implementation should be in concordance with the company's requirements and resources.*

Key words: *digitalisation, Industry 4.0, cnc.*

Poboljšajte produktivnost kroz digitalnu proizvodnju. *U budućnosti će digitalizacija i „Industrija 4.0" biti u svakom koraku životnog ciklusa proizvoda od dizajna do proizvodnje, servisa i održavanja. Kroz digitalizaciju, kompanije će moći da upravljaju i programiraju složene CNC mašine alatke koje će biti spremne da fleksibilnije odgovore na zahteve tržišta i da istovremeno povećaju svoju produktivnost.Priprema rada i proizvodnja se mogu dalje razbiti na dodatne procesne korake, u rasponu od raspisivanja tendera do osiguranja kvaliteta. Potražnja za rešenjem za digitalizaciju može se ilustrovati kroz sledeće ciljeve i pitanja šta svaka proizvodna kompanija mora definisati i uspostaviti: 1. Koliko dugo će deo na mašini da se proizvodi; 2. Da li su CNC alatne mašine (ono što su u mogućnosti i imaju potrebne tehničke karakteristike) na raspolaganju; 3. Da li su potrebni novi alati za rezanje za ovaj novi posao; 4. CNC operater je upoznat sa CNC upravljačkom opremom; 5. Da li tolerancija radnog predmeta odgovara specifikaciji kupaca. Nije tako lako povezati sve ove zahteve i na vreme pronaći najbolja rešenja i imati visoku produktivnost. Digitalna proizvodnja će nam dati preliminarne jedinične troškove i rok isporuke koji moramo odrediti da bismo mogli ispravno da se prijavimo za posao. Danas se količina vremena koje će radnom komadu trebati za mašinsku obradu može brzo, pouzdano i što je veoma važno izračunati, bez probnog rada, koristeći rešenja za CNC simulaciju. Ove preporuke iz našeg rada mogu biti odgovor kod proizvodnih kompanija, a prednost ove implementacije je što se može raditi korak po korak. Rešenje ove implementacije treba da bude u skladu sa zahtevima i resursima kompanije.*

Ključne reči: *digitalizacija, Industrija 4.0, cnc.*

1. INTRODUCTION

Digitalization -about used terminology Industrial Internet,[1, 2] is a term and refers to the integration of complex physical machinery with networked sensors and software.

The industrial Internet draws together fields such as machine learning, big data, the Internet of things and machine-to-machine communication to ingest data from machines, analyze it (often in real-time), and use it to adjust operations.

Industry 4.0 [2] is a project in the high-tech strategy, which promotes the computerization of traditional industries such as manufacturing. The goal is the intelligent factory (Smart Factory), which is characterized by adaptability, resource efficiency and ergonomics as well as the integration of customers and business partners in business and value processes.

Technological basis are cyber-physical systems and the internet of things. Experts believe that Industry 4.0 or the fourth industrial revolution, could be a reality in about 10 to 20 years. Meanwhile, in the United States, an initiative known as the Smart Manufacturing Leadership Coalition is also working on the future of manufacturing.

Industry 4.0 as part of networked world business networks smart products supporting actively manufacturing process network of human beings, machines and resources factory interfaces with smart mobility, smart logistics and smart grid.

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It is about collaboration productivity!

Industrial internet in the future next natural development step is to expand from virtualization of manufacturing to virtualize the whole company and its ecosystem. Snapshot from current company performance can be basis for simulation. Through simulations can be tested different future scenarios: raw material price, energy price, production machinery capacity and productivity, transportation cost, etc. As a result, best fit can be played in production.

2. EXPLANATIONS AND HOW TO WORK

Digitalization is fundamentally changing our working environment and society (Fig. 1). Billions of intelligent devices and machines generate massive amounts of data, creating a bridge between real and virtual worlds. Turning these vast amounts of data into value is a real source of competitive advantage for both businesses and economies. However, the level of preparedness for this change varies widely from country to country.

Fig. 1. Digitalization changing our working environment.

Upswing for Romania trough digitalization:

1. Can't build a house without foundation. Foundation would be great education. Industry professionals are needed. The ones who can play the virtual factory simulations (Smart Factory Game).
2. Part of foundation is virtual factory builders. Could there even be synergies with game industry? Finally, it's only a question of building a strategy game linked to parameters from real business.
3. Romania is fertile soil for implementation, pioneers can be found in industry.

Industry 4.0 in products workshop products, parts, assemblies, and end user products will benefit from in all its varieties and applications. New engines carry a lot of digital information as well monitoring of the machine condition is one of the approaches where information technology is widely used. Collecting this data from several engines gives valuable information for further development of the engine itself and above all new value adding services.

New technologies - like Industry 4.0- enable new products and new services interaction.

New world order generates new needs for products and to create new business opportunities.

Today, Digitalization drives the evolution of demand:

1. Artificial Intelligence- Purpose, 2. Digital- Agility, 3. Industry -Efficiency, 4. Trade- Scale, 5. Agriculture-Survival. Fig. 2.

3. THE TARGETS

Technologies that shape the digital age. The breadth and depth of these changes herald the transformation of entire systems of production, management, and governance. The targets are:

I. VELOCITY Mobile Internet, cloud Technology, Processing power, Big Data, New energy supplies and technology. 3 Internet of things 4. Sharing economy, crowd sourcing.

II. SCOPE: Robotics, autonomous transport, artificial intelligence, advance manufacturing, 3D printing, advance materials, biotechnology,

III. SYTEMS IMPACT: Future of jobs survey, World Economic Forum.

Why is everyone talking about digital? Digital developments are disrupting almost every industry in every country Top mature industry by 2020 Top new industries by VELOCITY Aerospace & Defense Chemical, Materials & Food Electronics Oil & Gas Engineering & Construction, Pharmaceutics & Healthcare Auto mobile ICT Energy & Power Urban Logistics Alternative energy 3D printing Cyber security Big Data Managed services Virtual commerce Cloud computing 1.

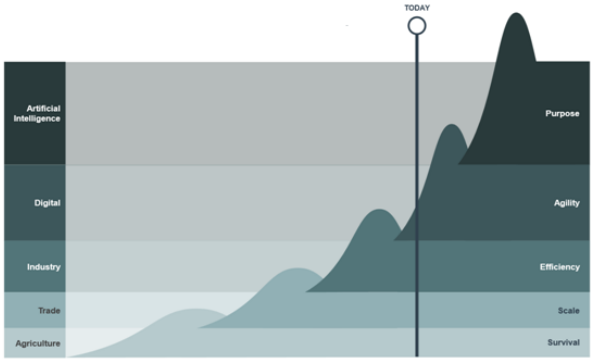

Fig. 2 Digitalization drives the evolution of demand.

SCOPE Metals & Mining Waste management Wellness industry 1. SYSTEMS IMPACT Market size potential [3].

The two important data's who must take in consideration in production are: the unit costs and the delivery deadline.

Digitalization is very competitive in this area. Now the time of manufacturing can be calculated reliably and very fast. For this is not necessary to have any trial run, only to use the CNC simulation capabilities of the CAM software. Together with the time of preparation (who at every workshop is different but know by every CNC operator particular) we can establish the time for delivery.

To gain an overview of machine performance and utilization, operators can consult the overall equipment efficiency indicators, which are read out from the CNC. Machine utilization can be displayed on a PC or a mobile data device using the software from the modern CNC equipment.

Production managers can use these data to assess the availability of the relevant machine.

It allows to find out the exact status of an order online during a shift.

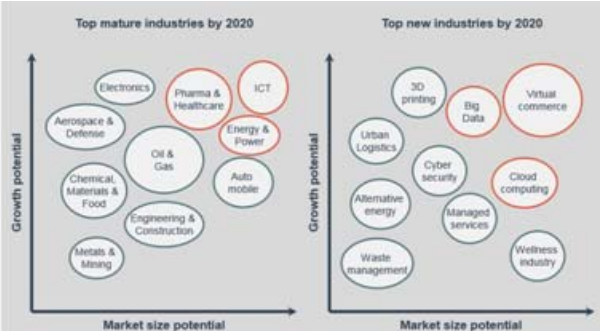

Fig. 3. Industrial's area and new branch of digitalization

Thanks to this transparency can respond quickly to machine malfunctions and shift the production of urgently needed part to another machine.

G code and graphical programming is an option for simpler individual work pieces.

The best and more advantages will be obtained to use the offline programming for more complex workpieces or to increase the output of the machinery and make production more flexible.

But the solution with an integrated CAD/CAM - CNC process chain is even more efficient.

One most important factor in resource planning for CNC production is tool availability. Today are programs who can provide a real -time overview of availability and prevent time-consuming searching during production. With this option, the user can immediately see the required tools are in the desired machine. More than that, are software (yet integrated in the numerical control) who can quick and reliable compare tool requirements for specific manufacturing jobs with stocks of tools throughout the factory. The tool requirement list is then automatically sent to the tool setting device, and the identified geometric data are sent to the CNC's tool offset memory. If there are any tool shortages, the data are immediately forwarded to higher-level ordering systems.

Users have long become used to the digital word when it comes to private means of communication. A similar look and feel in the control system make for easy CNC operation. The new numerical control equipment's have a user-friendly operator interface that is based heavily on the operating philosophy of PCs and the gesture-based operation that users are familiar with from Smartphone's and tablets is now available on the machine.

4. CONCLUSION

If the machine manufacturer's service staff need to access data on the machine or CNC externally, this immediately raises the question of data security. Now the digitalization maintenance allows the monitoring of machine status, with the machine raising the alarm in the event of a fault. This shortens the times required for diagnostics and minimize serious consequences such unforeseen machine downtimes and major damage. It also means that maintenance work can be carried out proactively, eliminating unnecessary periods of machine downtime.

Collaboration has never been easy, and companies have long struggled to solve collaboration challenges. However, as products and development ecosystems continue to get more complex, collaboration needs have increased. Unfortunately, poor collaboration comes at a high price. It results in delays, errors, and increased costs, all of which have an impact on profitability. The good news is that digitalization technologies, such as the cloud and innovation platforms, can help to significantly overcome barriers and improve design collaboration across the enterprise.

Recommendations and the steps based on industry experience are:

- Understand the true cost of poor collaboration on both engineers and the entire company.
- Invest in digitalization improvements to increase engineering efficiency.
- Recognize the significance of collaboration requirements on engineers from the number of people involved, different departments, and processes impacted.
- Ensure excellent collaboration between engineering and manufacturing to overcome knowledge gaps and support seamless hand-offs.
- Support effective collaboration between design engineers and simulation analysts to empower engineers to catch problems and design more competitive products.
- Considered digitalization technologies, such as cloud and an innovation platform, to support and enable better collaboration processes

5. REFERENCES

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