INFORMATION AND COMMUNICATIONS TECHNOLOGIES

HOW TO ADD VALUE TO BUSINESS BY EMPLOYING DIGITAL TECHNOLOGIES AND TRANSFORMING MANAGEMENT APPROACHES

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Abstract: The aim of this study is to present the experience in the management of enterprises at different levels: from optimising business processes to introducing strategic business development. We have analysed the experience in creating digital metallurgy in Russia and present the experience in implementing a smart system for monitoring and diagnostics of line equipment at the Alchevsk metallurgical plant. The article reviews major issues related to the introduction of artificial intelligence systems so as to exercise automated control over production processes. These issues refer to the deterioration and depreciation of production assets which is caused by the reallocation of funds for the modernisation of production and the unpreparedness of staff for the introduction of new systems. Digital

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technologies provide new opportunities for managing corporate resources and initiating profitable activities. The article also reviews applying Design Thinking techniques and tools to the training and education of specialists for the digital economy. Entrepreneurial skills, out-of-the-box thinking, the ability to work in teams and to make decisions are essential competencies which must be acquired by students during their academic training so that businesses could be prepared for their digital transformation.

Keywords: project management, IT, design thinking, IT education, digital transformation, business process.

JEL: M15, L86.

Introduction

The transition to the digital economy requires business managers to transform their approaches to management. Regulating the business processes and developing the infrastructure of their companies are not sufficient for retaining their competitive advantages within a new environment. Running a successful enterprise nowadays requires more than merely being aware of the essential role of the information technology (IT) as a business resource. Managers must also appreciate the significance of information technology to the process of restructuring an organization. They need to be aware of the impact which IT could have on the development of enterprises and the value it could add to their business.

1. The Experience of Introducing Information Technology to the Metallurgy Industry in the Russian Federation

Although the Programme for the Digitalisation of Russian Economy was adopted as recently as in 2017, the digital transformation of enterprises in the metallurgy industry began decades ago. At the initial stage of that transformation, newly-designed automated systems were mainly deployed to the automation of production processes at an operational level (i.e. to technological operations and units). The further development of IT and intellectual property resulted in the automation and optimization of processes at a strategic and tactical level (i.e. in terms of

business processes). A number of large enterprises in Russia, for example, the Magnitorsk Iron and Steel Works Company (MMK); PAO Severstal; the United Metallurgical Company (OMK); Novolipetsk Steel Group (NLMK), etc. are already employing the methods of digital metallurgy. These enterprises have been implementing some large-scale IT projects, such as:

1. The United Metallurgical Company (OMK) together with SAP CRM has introduced a Customer Relationship Management system to make their interaction with clients more efficient;
2. The Magnitorsk Iron and Steel Works Company (MMK) has implemented a project known as 'Sniper' for cloud services and processing large sets of data in cooperation with Yandex Data Factory. During the initial stage of project implementation in 2017, the consumption of ferroalloys in the production process was optimized and an average economy of 5% was made. This means that the annual economy made might exceed RUB 275 million. (The development of IT technologies at the metallurgical enterprises of Russia, 2017)
3. Severstal has been developing a project for analyzing big data, too. As of November 2017, at the introduction stage, the company had seven mathematical models for analyzing large data sets (Big Data, 2017). Their effect was estimated at nearly RUB 300 million. Another promising prospect for Severstal is a project related to introducing the Internet of things to the production process, since despite their highly-automated production at present, devices still need to be operated by employees.
4. Novolipetsk Steel Group (NLMK) have been implementing in cooperation with SAP, a global leader in the corporate software market, a 3D mapping system for positioning employees in the workplace which is based on the Internet of things and seeks to prevent industrial injuries.

Although companies are eagerly introducing Industry 4.0 technologies, a relatively high degree of automation is still predominantly typical of the largest metallurgical holdings and enterprises only. The degree of automation of production in smaller enterprises and industries is low not only in terms of strategic and tactical levels, but also at the operational level

(level – ACS TP). This is confirmed from the statistical data provided by the TAdviser analytical agency (Metallurgical industry – Integrators, 2017) about system integrators, i.e. companies which have implemented projects for deploying IT systems in the metallurgical industry. According to that statistics, despite the fact that metallurgy is one of the most developed sectors of the Russian economy which employed nearly 2.2% of the Russian population in 2015 (Russia's economy, the facts and figures. Part 8 Metallurgy, 2015) and metallurgy contributed nearly 5% to the GDP of the country, only a small number of IT projects have been implemented in that sector of the economy so far. The share of IT projects implemented in the metallurgical industry in the total number of integrator projects does not exceed 5 to 7% on average.

Statistical data about the types of IT solutions which have been implemented by integrators are just as important and indicative (Metallurgical industry – Projects in the industry, 2017). According to statistics, metallurgical enterprises have been introducing 4 major types of automated systems:

- Automated control systems for technological processes (ACS TP, SCADA);
- Manufacturing execution systems (MES);
- Energy resource planning systems (ERP);
- Online analytical processing systems (OLAP, BI).

According to available data about the projects implemented in the metallurgy sector, the majority of IT projects relate to introducing energy-resource planning systems (ERP), whereas projects related to the introduction of online analytical processing systems (OLAP and BI) have only been implemented by single large enterprises. Hence, a lot of enterprises in the metallurgy sector have actively been introducing systems for automating their production process at an operational and a tactical level, yet only major holdings have started the automation of their production process at a strategic level.

Further attention should be paid to the automation systems which enterprises employ at an operational level, i.e. the automated control systems for technological processes (ACS TP) or the Automated Process Control Systems (APCS).

Currently, the highest level of automation in the production cycle of Russian metallurgical plants is in terms of the automation of technological processes. The practice of introducing company-designed and readily available automated control systems for the technological processes has resulted in a large number of diverse (and sometimes under-designed) automation systems. Hence, problems related to the integration of solutions often occur at this level. Furthermore, despite the design of such systems and the high degree of automation of processes, the deployment of ACS TP at present still requires human interaction with and operation of devices and equipment. Another issue is the extremely low degree of intellectualization of the automated control systems for technological processes. We will therefore next review the experience of metallurgical enterprises in introducing ACS TP intellectual technology.

2. Our Experience in the Design and Implementation of Intelligent Systems in Metallurgical Plants

An intelligent monitoring and diagnostics system for line equipment designed by members of the Business Informatics Department was implemented at PJSC Alchevsk Iron and Steel Works (Yemelyanov, 2015). The system deploys artificial neural networks to the analysis of quantitative data to assess the technical condition of line equipment without human intervention. The intelligent system consists of 5 major modules (Fig. 1):

- A module for monitoring and analyzing the current condition of line equipment;
- A neural network module forecasting the future condition of line equipment;
- A decision support model for selecting and assessing the mode of operation of line equipment;
- A module which integrates the system with higher-level information systems;
- A module for accumulating and reporting experience (data about the technical condition of line equipment).

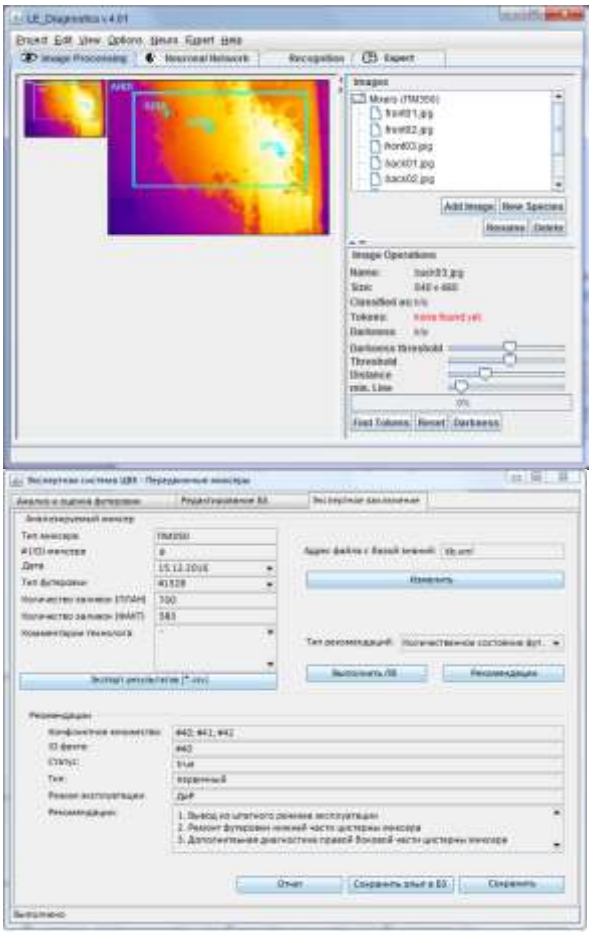

Figure 1. The intelligent system for monitoring the condition of line equipment in metallurgy

As a result of introducing the designed intelligent system, the efficiency of line equipment diagnostics increased in comparison to the automated diagnostics provided by standard systems. The operation efficiency of the diagnostics, for example, was 2.5 times as high, while the reliability of diagnostics was 0.96.

The experience accumulated by introducing the intelligent system helped us identify two major issues in terms of implementing artificial intelligence systems at the ACS TP level:

1. Depreciation and amortization of production assets which is due to the lack of funds for renovation and modernization. Hence, the introduction of a single new unit into the system or the technological process may result in the need to replace a large number of expensive devices or units. In some cases, this might render modernization impossible at all.
2. The issue of the personnel not being prepared for the implementation of new systems, especially the introduction of artificial intelligence systems, since operating such systems requires relevant qualifications and competences.

Despite the issues which we identified, the prospects for the further deployment of IT in the metallurgy sector are optimistic as companies operating in the sector are increasingly interested in export markets where competition is growing, including in terms of introducing IT and intellectual property into production processes.

3. Personnel as an Active Resource in Transforming the Business Models of Companies

Current trends in customer demand and the dynamic, sometimes unpredictable changes in customer needs, tastes and preferences require changing the business patterns and identifying new prospects for business development, which, according to Gartner's terminology, implies constantly identifying and actively benefiting from short-term opportunities, since: 'A favourable business situation may occur unexpectedly and such occurrences are becoming more and more frequent' (Vision for the future of the digital world at the conference Gartner Symposium, 2013).

Dynamic changes in public attitudes and approaches to information and digital technology require that companies constantly revise their core business activities and transform them into digital ones. New industries and sectors of economy appear in response to changes in the demand for

goods and services; the feasibility of business ideas is increasing; the nature and methods of production are changing and so is their value to customers. We should also note that the changes affecting business processes nowadays are not only in terms of the personnel or the IT which companies employ. These changes also modify the business context and environment in terms of the new goals which are set by the information society. Due to the growing needs of both business and consumers that rely on modern technology in their daily activities, consumers are now increasingly using products and services from supply networks instead of relying on the distribution of goods from suppliers to consumers through supply chains. Customers use digital technology to quickly find the services they need. All that customers need to do to find a supplier or provider who can meet their demand is click on an Internet link.

Digital transformation is increasingly approached as the major factor for the successful development of enterprises. Key trends in digital transformation include the growing significance of customer experience (customer-centricity) and the attribution of a personal nature into customer interaction with a brand interaction (personification); the transformation of operation models so as to be flexible to respond to changing market conditions and new cutting-edge technologies (hyper intelligence, informed decision making, fast implementation); the Internet of things as a key driver of digital transformation; the introduction of digital thinking in corporate culture (Agile and cross functional teams) and new working principles to ensure efficient and highly productive performance); the establishment of multi-channel ecosystems which reflect customers' personal values after analyzing customer needs and preferences. Mobile applications have already become a must for most service-providing entities.

The establishment of business models is a continuous process which involves adjustments to changing market conditions. A business model which is highly competitive today may prove to be out-of-date or totally obsolete tomorrow (Clark, Osterwalder, Pigneur, 2012).

The process of transforming business models requires that customer experience, consumer segments and distribution channels be reviewed. Nowadays consumers are knowledgeable about technologies since the interaction between the physical and the digital world contributes

to the rapid establishment of new patterns of behavior and the occurrence of new, revolutionary methods of ensuring customer engagement. Changing the approach to customer relations has therefore become a priority. Insufficient customer communication, poor quality of provided services and the lack of interactive mobile applications have a negative impact on the image of an entity. User-experience should therefore be employed in all channels for communication with customers.

Employees are another major factor in the process of transforming the business of an enterprise. An important issue is acquiring and disseminating the knowledge required for improving the business processes; gathering and processing different types of information, including unstructured data. The lack of preparedness among employees for introducing innovative digital technologies in an enterprise may result in disrupted infrastructure development and loss of competitive advantages in terms of production schedules and the quality of products.

The introduction of innovative business models poses new requirements to employees' competences. Scientific forums on the prospects and opportunities for developing digital economy focus on a set of competences which will be required from specialists, and above all, creativity; entrepreneurial thinking'; the ability to process data quickly and to make 'out-of-the-box' decisions. Such forums also emphasize the importance of developing team skills and personal development through lifelong learning. Such soft skills are essential for employees of large companies which find it most difficult to adjust to new management mechanisms and technological platforms to meet the requirements of the digital future.

The demand for goal-oriented and enterprising employees on contemporary labour markets is higher than it has ever been. Entrepreneurial skills, creative thinking, the ability to work in teams and to take decisions in unusual circumstances should be cultivated and developed in students during their university training so that enterprises could be prepared for digital transformation.

To keep up with the process, companies are already opening the position of a Chief Data Officer (CD) in their management structure. The

question remains, though, how to raise the efficiency of the university training provided to the future leaders of the digital world.

Globalising markets and the establishment of the network economy are opening up new prospects for companies to attract and successfully employ open teams, hence, the new requirements to managing team work, establishing communication and implementing various projects within a new environment. Leading companies have already started their own business schools so that they could not only train their future employees but also make sure that accumulated knowledge is retained and exchanged among their staff. Knowledge exchange joint programmes between different companies are also becoming popular.

To be prepared for the digital economy, individuals should possess interdisciplinary knowledge and a wide range of competences in the different sectors of the economy, i.e. they will be expected to think and act innovatively and creatively, to think outside-of-the-box and to come up with solutions in a highly unpredictable environment. The digital society has access to an enormous volume of data; hence, customer communication will require studying thoroughly customer preferences and employing new approaches. Those are but a few of the opportunities provided by the methods and tools of Design Thinking.

4. Design Thinking and Cultivating Competences of Innovators

The philosophy of Design Thinking is based on the implementation of projects by multidisciplinary teams; the establishment of communication between team members; the exchange of interdisciplinary knowledge; the engagement in interactive and reflexive processes. Design Thinking relies on divergent and convergent thinking, systematic reasoning through various processes and analyses conducted from different perspectives.

What opportunities does Design Thinking provide to companies? The Digital Economy needs competent employees who are able to analyse emerging market opportunities and efficiently transform the business models and the business processes within an organisation so as to adjust

them to digital markets. Globalising markets and the Network Economy enable companies to attract and employ open teams. They will therefore need to manage teamwork, establish communication and implement projects in a new business environment.

Leading companies have already established their own business schools so that they could both train their future employees and make sure that accumulated knowledge is preserved and exchanged among their staff. Different companies have started organizing joint programmes for knowledge exchange. Employees will be expected to possess interdisciplinary knowledge and a wide range of competences in the different sectors of the economy, rather than specialize in a single area. They will also be expected to think and act innovatively and creatively, to think outside-of-the-box and to offer solutions in a highly unpredictable environment. The digital society has access to an enormous volume of data, hence communication with customers will require studying customer preferences thoroughly and employing new approaches. Those are but a few of the opportunities provided by the Design Thinking methods and tools. The approach is based on the ability to employ implicit knowledge and empathy which is an essential feature of the contemporary trend of shifting the focus of business activity to people. The major stages of the process – empathising, focusing, generating, selecting, prototyping and testing are implemented by employing different combinations of multiple tools.

As a matter of fact, we have recently made a transition from the knowledge economy to the experience economy in which the leaders will be those who are aware who their consumers are and what demands they have, i.e. those who empathise with their clients (Nussbaum, 2005). During the November Forum in 2017, Hermann Gref pointed out that centralized ecosystem platforms could provide 360-degree view of customers in order to meet their demand. ‘The winners will be those who can meet more customer needs’ (Gref, 2017).

Empathy underlies most Design Thinking techniques. Design Thinking is above all about studying the context and exploring the ecosystem so as to identify those covert consumer demands which might help add value to digital business. Awareness of customer experience and

customer attitudes and feelings aims to add to developed innovative products further user-friendly features. Intuitive and creative thinking opens up to companies the prospects of the 'Imagination economy' (Bidshahri, 2018).

We need to emphasise that in addition to being employed in the training of prospective employees who will expand the digital space by providing new useful services and innovative products, Design Thinking tools are essential to the development of skills which will enable professionals to deal with difficult situations and solve problems in a highly unpredictable environment.

Conclusion

In summary of the observations and analysis which we presented so far, we may conclude that:

A major factor behind the low rate of digital transformation of the metallurgy sector in the Russian Federation is the amortization of production assets as a result of the insufficient funds which were allocated for their renewal during the previous decades. Furthermore, we need to be aware that within the context of Industry 4.0, renewing and updating production assets alone cannot ensure the competitiveness which companies need. Enterprises should instead replace and upgrade their equipment and devices to a higher level – that of intelligent systems.

Currently, the degree of automation of both production and business processes in metallurgical enterprises in the Russian Federation varies wildly from the level of introducing document management systems (DMS) in some enterprises to the level of deploying artificial intelligence technologies, the Internet of things and Big Data in other enterprises.

In order to increase the performance efficiency of both individual enterprises and the metallurgical sector as a whole, it is necessary not only to introduce systems for automating operational and tactical production processes (ERP, CRM systems, etc.) but also to employ systems for the automation of processes at a strategic level (BI-systems).

Until recently, human resource was perceived as the major factor of business processes in enterprises and an integral part of the organizational capital of the company, yet the introduction of industrial technologies 4.0 has began to replace people with programs, robots, etc. This, however, does not imply that in the digital era, the functions of people in the process will be minimized. To accomplish the goals whose focus is on the implementation of new business tasks in a dynamic and changing environment will require employees to have excellent teamwork skills, to be able to use their competencies efficiently, to be focused and successful, to think outside-of-the-box and to offer innovative solutions, to actively deploy the accumulated individual and collective intellectual capital so that implementing various Design Thinking techniques could become an integral part of human activity in enterprises.

References

Altukhova N., Vasil'yeva E. Model' kompetentsiy i printsipy monitoringa rezul'tatov gosudarstvennogo upravleniya na osnove ontologiy, Godishnik (Year-book of D. A. Tsenov Academy of Economics), Svishtov, 2017. Volume CXX. pp. 33-69

Bidshahri, R. (2018). These Are the Most Exciting Industries and Jobs of the Future. https://singularityhub.com/2018/01/29/these-are-the-most-exciting-industries-and-jobs-of-the-future/ , Accessed: 29.01.2018.

Big Data. (2017). http://www.tadviser.ru/index.php/%D0%A1%D1%82%D0%B0%D1%82%D1%8C%D1%8F:%D0%91%D0%BE%D0%BB%D1%8C%D1%88%D0%B8%D0%B5_%D0%B4%D0%B0%D0%BD%D0%BD%D1%8B%D0%B5_(Big_Data). Accessed: 24.10.2017.

Clark, T., Osterwalder, A., Pigneur, Y. (2012). Business Model You: A One-Page Method For Reinventing Your Career. John Wiley & Sons.

Interview with Herman Gref. (2017). It is Unpleasant to be in the center of what is called disruption. https://rb.ru/story/gref-synergy/ Accessed: 28.11.2017.

Metallurgical Industry - Integrators. (2017). http://www.tadviser.ru/index.php/%D0%9A%D0%B0%D1%82%D0%B5%D0%B3%D0%BE%D1%80%D0%B8%D1%8F:%D0%9C%D0%B5%D1%82%D0%B0%D0%BB%D0%BB%D1%83%D1%80%D0%B3%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B0%D1%8F_%D0%BF%D1%80%D0%BE%D0%BC%D1%8B%D1%88%D0%BB%D0%B5%D0%BD%D0%BD%D0%BE%D1%81%D1%82%D1%8C?ptype=integrator#ttop. Accessed: 24.10.2017.

Metallurgical Industry - Projects in the industry. (2017). http://www.tadviser.ru/index.php/%D0%9A%D0%B0%D1%82%D0%B5%D0%B3%D0%BE%D1%80%D0%B8%D1%8F:%D0%9C%D0%B5%D1%82%D0%B0%D0%BB%D0%BB%D1%83%D1%80%D0%B3%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B0%D1%8F_%D0%BF%D1%80%D0%BE%D0%BC%D1%8B%D1%88%D0%BB%D0%B5%D0%BD%D0%BD%D0%BE%D1%81%D1%82%D1%8C?ptype=on_otr#ttop. Accessed: 24.10.2017.

Nussbaum, B. (2005) The Empathy Economy, Business Week. www.businessweek.com/bwdaily/dnflash/mar2005/nf2005037_4086.htm/Accessed: 16.12.2009.

The development of IT technologies at the metallurgical enterprises of Russia. (2017). Metal–Courier Journal, No.1, 2017, http://metalexpert.com/web/OpenMEMKNews.nsf/Pages/zhurnal_metall_kur_er_25.html/$File/Металл-Курьер_25_янв_2017.pdf, Accessed: 20.02.2017.

Russia's economy, the facts and figures. Part 8 Metallurgy. (2015). https://utmagazine.ru/posts/10561-ekonomika-rossii-cifry-i-fakty-chast-8-metallurgiya. Accessed: 30.06.2015.

Vasileva, E. (2018). Dizayn-myshleniye: nemnogo o podkhode i mnogo ob instrumentakh razvitiya kreativnogo myshleniya, izucheniya kliyentskikh zaprosov i sozdaniya idey : monografiya. Moskva, RUSAYNS, p. 204

Vision for the future of the digital world at the conference Gartner Symposium/ITxpo, 2013. (2013). http://www.crn.ru/news/detail.php?ID=84923. Accessed: 10.04.2013.

Yemelyanov, V. (2015). Intellektualizatsiya informatsionnykh sistem monitoringa i tekhnicheskoy diagnostiki futerovannogo oborudovaniya, a monograph, 2015. Yemel'yanov V.A., Yemel'yanova N.Y. – Sevastopol': RIBEST, p. 160

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