We don’t need no education,

*We don’t need no thought control,*

*No dark sarcasm in the classroom,*

*Teachers, leave them, kids, alone.*

‘Another Brick in the Wall’,

Pink Floyd (R. Waters and D. Gilmour)

# **MANAGEMENT IN VIEW OF DIGITAL TRANSFORMATION**

Abstract

*The current level of maintaining and developing the effectiveness of process stakeholders has become a technologically demanding task involving ever-increasing costs. The belief that the upcoming digital transformation (DT) will represent a panacea is misguided since DT requires fundamental re-education and a restructuring of the all process environments and human factors. Regardless of the business sector, DT is supposed to happen ever more quickly as technology advances; new entrants and new forms of business partnerships overturn the rules of current stream.*

*Keywords: digital transformation, knowledge structuring, process structuring, staff re-education and structuring*

## Motivation and walk-around discussion

Today, it is clear that ‘digitization’ or ‘digital transformation’ are not just catchy marketing slogans, they are an essential element in every aspect of daily life. There is no way of guessing which particular economic sector will be next to fully digitize and thus be transformed, but those who are pioneering in this direction will be and already are benefiting. Digitization concerns not only technological aspects and productivity, it also has a sociological impact, creating new cultural interrelations in the cyber-physical spaces of digitized reality.

A host of terms have been introduced to refer to digitization (e.g. digital transformation, Industry 4.0, digitization and digital economy). These appear to be associated with something specific, but there is no consensus on exactly what they mean since people on different social levels (from the ruling classes to the marginalised) interpret the ideas differently. Even in the 1970s, most people thought that everything would be robotized and digitized within 5 to 10 years, and that artificial intelligence would provide us with nutritious breakfasts and take care of our children. Numerous publications in the scientific literature and in the mass media have discussed various applications of the digital transformation in everyday life for civilians, combatants, governments and industry stakeholders. Much has happened on that front, but efforts have stalled because of over-romanticized ideas, cultural unreadiness and a general combination of the following factors:

* Ever-growing clip consciousness combined with a steady decrease in IQ over the last two decades;
* A society that is, on the whole, poorly educated about information;
* A society that tolerates and even accepts information from unproven sources;
* Information storing resources of low productivity and unclear policy by Cloud providers;
* Incompatible standards of information exchange and storage, despite the presence of the WfMC;[[1]](#footnote-1)
* Lack of secure, reliable and proven communication channels;
* Lack of legal support in the field of information exchange and use;
* Computational power.

The first seven factors can be aggregated into three classical groups: People, Technology and Processes (PTP). The last factor has played a very specific role. In the 1970s, it seemed that the growth of computational power and the miniaturization of computer chips would solve the problem of securing enough electrical power. Further, enough innovative technologies were adopted by the mainstream that the social ignorance threshold was thought to have been overcome, and a bright future seemed to be on the horizon. However, at that time, no one paid serious attention to the social and cultural problems of digitization or to the impact of digital information sources on behavioural reflexion. These problems relate to unstructured access in the web space and farther acceptance of the information content without any concern or doubt in its validity. The other problems relate to the amount of energy needed by computer facilities and corresponding calculations and mainly to the heat emission. So it seems that information will be measured in kW soon, as well as the national treasuries and currency procuring.

Digitization has already brought about notable results regarding tangible production and manufacturing, and it is sure to reach even higher heights. However, industrial digitization has not played a serious role in business strategies or in socially oriented aspects; but when considering industrial balance sheets, it is surprising that more than 30% of all energy expenses can be traced back to digitization. Some industrial business owners have even considered hiring low-cost workers to replace electrically powered devices in a bid to cut costs.

At the same time a trend is only now developing towards DT in the service sector, and the first steps are being taken from simple operational maintenance functions to conclusion provided and complicated scenario task’s resolutions. In any case, the current role of IT as a globalized vendor and enabler is as a fulcrum for worldwide DT: its role is more significant than even that of the steam engine in the industrial revolution of the nineteenth century, or of nuclear energy in the twentieth. Meanwhile, there have been no changes in the roles played by management. Digitization now provides an opportunity to shift the management paradigm from its rigidity in a socio-technical system to the flexibility and agility of a socio-cultural system. The benefits of such a shift are intelligent functions for customers affecting essential areas of human living such as in the concept of the smart city (see TechCity 2016).

Production process in digital environment turns to hybrid of robotically empowered physical assembly lines emphasized with AI management. While AI itself is a reflection of level of human will to excellence; if someone will be able in future to implement it without bugs. A number of researchers have expressed the same conclusions in a variety of works (Lay 2014, Ren 2014, Raja 2015, Rigby 2015, Tsou 2015, Neubauer 2017, among others).

In view of the existing DT, there is much talk of the skills required for the upcoming demands of transforming services, industries, manufacturing, arts and intellectual implementations. Vision of educational structuring to integrated model appears in conjunction with new skill requirements in traditional education. This structure is based on classic knowledge imbedded in education process such as computer science under the scope of economic opportunity and social mobility. Consequently, a number of new interdisciplinary educational programs and syllabuses must be changed and modified to meet the latest needs and requirements (i.e. up-to-date technical skills need to be complemented with business know-how, or medical skills with computer science, etc.).

Even with a clear view of what has to be learned to satisfy the requirements of the growing necessities from the DT process, a brand-new set of problems arises.

* How to structure new skills that align with the requirements of the approaching transformation?
* How to structure social mass of desired new skills employment?
* Who will teach folks all the wanted bunch of knowledge??
* Where will the teachers will be trained?
* Who will prepare all the necessary manuals for teachers and then for students?

It is not rhetoric whoop. A very simple and preliminary calculation gives exiting results, just try to estimate the resources that are really required for the realization of such a trend or tendency. That does not mean that it is impossible to make progress in this direction, but it is important to realize that the path will be long and difficult. And here is an attempt to show that, by default, nothing positive will happen without the risk of encountering Neo-Luddism and technophobia.

But these will, in the integral sense, result in overall changes in relations between humans and power, between mere mortals and governments; *Homo sapiens* is becoming *Homo cognitus*. From the ability to think through learning and rethinking, man is coming to an understanding of equality. The spirit of inequity is dormant until one’s vocabulary is below 2500 lexemes[[2]](#footnote-2) in one’s native language. That was obtained *a posteriori* on the long road of the history of civilization, and was used under all forms of rule to limit people’s education. Special syllabuses and curriculums were developed for mere mortals and nobles; even more grades were used in segregation. Has anything changed since those times? Much has been declared but very little achieved.

Certain researchers have proven that quantitative differences alone in the amount of information that must be adopted in education in different social sectors varies by a factor of 10. The most demonstrative factors in this differentiation are the number of lexemes used in learning resources, and the second is the volume of reworked materials in bytes. As an example, over the course of their educational career the average European (75%) gets around 3Mb of learning materials on a basis of 3,000 lexemes, but in higher education (15–18%) they get around 50Mb for their studies with around 25,000 lexemes.

A similar situation can be observed in all other countries in the developed world. The active electorate from the educated part of society only makes up 15–20% of the total. Consequently, the social majority elects politicians to power with low responsibility for their decision, since they are unable to recognize all the quirks and characteristics of politicians and the false information that surrounds them. Their active vocabulary varies around the level of 3K lexemes, while the average electoral politician uses about 7–9K in their election campaigns and manifestos (Jones 2010).

From the mid-1980s to the mid-1990s, mass media in the English-speaking world artificially reduced the level of the content of lexemes from 5K to around 2.5K, and since that time the average IQ level has decreased significantly from around 110 to around 90 (Buj 1981, Lynn 2013, Hunt 2011).[[3]](#footnote-3) Cognitive skills and the ability to justify inequity are well correlated among other features (Jones 2010, Khandaker 2011). The conclusion from the above consideration is self-evident: serious conflicts of interests, or even a red-neck revolution?

That was only one social aspect and impact arising from the long-term digital transformation of our world, a process that actually started the moment humans needed to count. The next aspect is the issue of AI, and this lies very close to the problems of servitization and semantic unevenness. AI has still not become a futuristic reality even today, but not to pay attention to this phenomenon is to assume the position of an ostrich, with one’s head in the sand. The threat is not one of malevolent or inhuman intentions on the part of AI, but in faulty concepts embedded in the basic rules of AI’s constraints. The general risk from AI is in the inconspicuous substitution of human intelligence for AI, especially in assuming that any particular resulting actions were brought about on a human’s initiative rather than having, in reality, been generated by AI.

In 1966, the University of Illinois Press published John von Neiman’s *Theory of Self-reproducing Automata*. The work essentially started a revolution in the development of artificial intelligence. The self-reproducing automata are now called intelligent agents, but the core theory embodies the same principles that were first developed in the 1960. There are many approaches to the architecture of AI that can compete with von Neiman’s theory, but the most fruitful ideas still belong to him (von Neiman 1966).

The topic of AI as a threat to human existence is extremely multidimensional and polyhedral – whole volumes could be dedicated to it. High-profile figures such as Stephen Hawking (2014) and Elon Musk (2016) have brought attention to the issue and even appealed to the international community to introduce legal regulation in the field of AI development and use. The general problem of the application of AI in day-to-day life today is not in its use and methods of utilization – it is more serious than that. An army of poorly educated novices who just read Dan Brown’s[[4]](#footnote-4) next discovery in sacred settings, starts hype coding something that could be called AI and they launch it on the ever-digesting market.

AI is not based on ordinary sequences of logical predicates, or prototypes of neural networks as most people think. Practically all of what is achieved now in AI development is an impressive imitation of intellectual activity with big gaps in parts of the human psyche and ethics. Amateur attempts at AI development can be as dangerous as untrained neurosurgeons. The results are unpredictable since what is potentially missed in the code sequences is much more difficult to test for vulnerabilities than is the case with operating systems – this is now not a rare occurrence even in market-leading products.

Since AI is such an attractive tool that can be employed in different ways to generate profits with the minimum of operational risk and therefore expenses, to wait from business any understanding of a limitation those what brings him cash is a heresy. It is also necessary to add politicians to this band of ‘misunderstanders’. This group rubs their hands with glee over the possibility of manipulating social opinion, something that becomes very simple and achievable with the help of AI applications, as demonstrated by recent political events around the globe.

When it comes to amateurish attempts to develop cheap realizations of AI, a problem of ignoring intercultural differences occurs that has never been touched on before, mainly due to the restrictions imposed by political correctness. That problem is multiculturalism. As outlined above, the greatest challenge in AI development is the study and simulation of the human psyche and ethics as natural barriers in the regulation of AI behaviour. AI’s behaviour depends on the set of rules that are elaborated by humans. These rules are not formal logic expressions, they reflect as well certain frames of human morality and ethics. The result is directly bound with creator of AI, as his carcass of ethics, morality and psyche is imbedded in AI ruling reasoning. The existed multicultural concept tends to mean that we avoid thinking about how different the results of intellectual activity could be in the field of applying logic and reasoning: human logic is taken to be universal, following Aristotle. But:

* Can we conclude the same within the framework of the human psyche and ethics?
* Have we studied these concepts sufficiently to allow us to judge how psyche and ethics depend on cultural roots?
* And how to structure ethics and psyche in order to implement them in AI realization?

## Considering the position

Now consider the key aspects of digital transformation as a comprehensive term that covers all the core synonyms such as ‘digitization’, ‘Industry 4.0’ or ‘digital economy’, and everything what referred today as ‘smart’. Here the PTP abbreviation is used as mentioned above. Under the scope of DT, people (the first P) are usually regarded as a weak link or a source of operational riskin digitization and servitization managing processes. Relatively weak links must be substituted by AI. There are no practical discussions regarding attempts to reconsider and restructure DT concepts from a position of empowering human (P) abilities up to the strongest link in the resulting management structure.

In addition, computers are considered from the viewpoint of their productivity or number of calculations per second. DT will open up that issue, and the two questions of power supply and the release of heat emission from expanding computational facilities are at the top of the discussion agenda. A very simple example illustrates this perspective: sending just one message from one device to another requires enough power to heat a teacup.

Today, all the digital resources of our world consume around a third of the total energy produced. According to research by Gartner’s Group, DT will require at least double the IT power in 3 to 5 years’ time. We currently do not have such extensive reserves of power since alternative electricity sources are still not effective enough. That is another ‘brick in the wall’.

It has thus become apparent that power consumption is a key factor in DT. Consider retrieved results on request ‘digital economy’ and ‘digital transformation’ to obtain influence of first P factor. In summary, it can be concluded that digital business transformation (DBT) or digital business optimization (DBO) are the next ‘bricks’ in this wall. That leads us to the question of HR restructuring, adaptation and education.

Next is a simple diagram (Fig. 1) that illustrates very schematically the breakdown of digital economy elements, keeping in mind the impact and dependence of culture and society, as mentioned above.

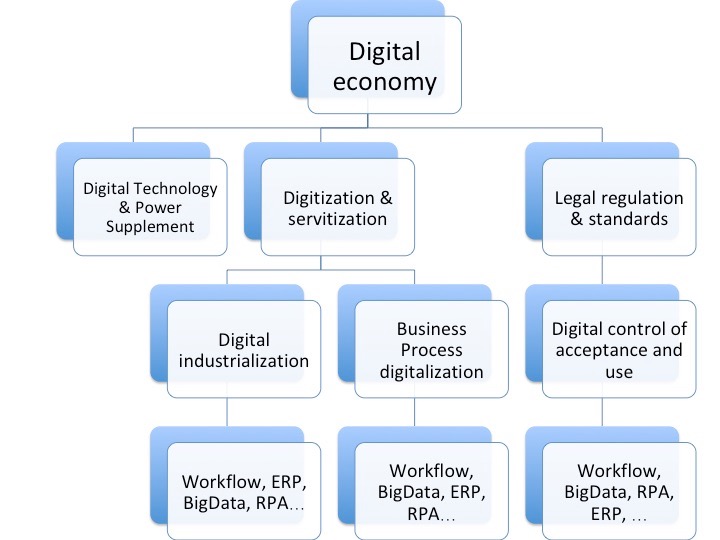


Fig. 1: The essential components of the digital economy

This diagram might be taken to suggest that the implementation of the digital economy initiative at this present moment is easy. That, however, is only an illusion arising from the apparent similarity of the blocks in the lowest row. The ‘workflow’, ‘big data’, ‘ERP’ and ‘RPA’ components mentioned above have been discussed and used for around 30 years, and a list of abbreviations such as ‘CRM’ and ‘BPR’ could extend even longer.

In all the proposed transformations among many proofs of benefits and rosy futures there is one delicate and often ignored factor of the impact on social background. In cases where social aspects are discussed, in nine cases in ten authors write about knowledge management or avoid mentioning the topic. It is clear that to touch on the theme of psychological influence on the social mass from rapid environmental transformation is dangerous: to do so is to risk losing out on budget increases if people in high places begin to doubt in perspective of the future generations.

The general problem with all these digitized information technologies is that there are few practically approved statistics. Figures indicating the implementations of particular technologies exist in the success stories of each vendor, but where are the reports on the effectiveness of the chosen enactments over the long term? Is any statistical research being carried out on the duration of the specific application utilizations and the accumulating effect of their use in real working environments?

## Research and results

Consider the results of the valuable research presented by the group of master’s students at the BPM Chair of the National Research University – Higher School of Economics. The research results are presented in the table below and could certainly disappoint enthusiasts of the digital economy and DT initiatives. In short, it can be concluded that as long as applications of workflow methodology are not accepted in business practice and culture, any attempt to move towards digitization is made in vain. The research was based on the hypothesis that the Gartner Hype Cycle methodology is not universally sustainable and can be used as very rough estimation or even just for marketing purposes. As a reminder, here are the five main phases of Gartner’s methodology:

1. **Innovation Trigger:**A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist and commercial viability is unproven.
2. **Peak of Inflated Expectations:** Early publicity produces a number of success stories – often accompanied by scores of failures. Some companies take action, many do not.
3. **Trough of Disillusionment:** Interest wanes as experiments and implementations fail to deliver. Producers of the technology drop out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.
4. **Slope of Enlightenment:** More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.
5. **Plateau of Productivity:** Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology’s broad market applicability and relevance are clearly paying off.

Since 1995 the methodology has proven its validity after it was presented by the Gartner Group for extensive use. But in the research, an attempt was made to check ‘how often phase C ends with a fail’ in the case of the implementation of the manifested technology, since the process of implementation of anything new is seemingly not different from the innovation development process.

The core idea of business process modelling is automation, or as it manifests today: digital transformation. In the research, branded technology was chosen for study in the field of BPM (business process management). This field of examination was chosen since this is where we find the clearest evidence of influence on DT implementation in stiff-life of enterprise. The general task of business process automation realization was considered in four large mission-critical enterprises located in northern and eastern Europe. Due to non-disclosure agreements, the names and specific attributes will not be disclosed in the work, but the companies were chosen due to their annual reports, which provided information regarding improvements in effectiveness, awards for best practice in workflow implementation and similarities in the technologies used.

It is clear that any BPM system automation project will involve three general phases:

a) the study and documentation of business processes (or comparing previous results of process documentation with the current state);

b) correcting process bottlenecks or logical faults, and building process logic for the next automation;

c) the implementation of the chosen workflow variant.

The a) phase was realized on the ARIS platform in all cases. The b) phase mainly depends on the professionalism of the analytical skills applied in it. And the c) phase has many variations in terms of realization, but LOTUS was used in these cases. Consequently, an attempt was made in the study to trace the effectiveness of ARIS involvement in all stages of the enterprises’ aspiration in process management automation. That was controlled and audited by the next parameters in dependence of time:

1. Number of business process models allocated in the repository or process registry and its correlation with actual state-of-the-art enterprise architecture;
2. Update records for each model and its lag from the current date;
3. Correctness of model in obvious logic of the described process;
4. Correctness of the semantics for model description;
5. Difference between process model and realized workflow or number of iterations needed for conversion of model in digitized process;
6. Percentage of RPA steps from actual modelled process steps;
7. Percentage of end-to-end processes in workflow realization;
8. Number of interfaces between business processes and their actual interdependence from business logic;
9. Number of IT systems in bookkeeping records vs in action and use.

Indeed, the notion of collecting accurate information reflecting all nine parameters was unrealistic, but the researchers believed that the majority of business stakeholders will be interested in an unusual vision for their businesses. It would be possible to prove to company directors that this information can fundamentally improve their understanding of the effectiveness of all business, and lead the way for serious enhancement in process management and in the coordination of strategic achievement.

This is evidently not a SWOT variant, but this set of nine characteristics reveals a more or less clear picture of business process maturity. And if the angle of discussion is turned but slightly, it would be possible to answer to the questions of alignment between IT and business in the enterprise and the situation with HR. The issue of alignment between business and IT is as old as the history of IT; it was already widely discussed in the 1970s and 1980s. Many outstanding studies have been published on this topic, including Peak, Weill & Broadbent, Henderson & Venkatraman, Car, Luftman.

These two aspects (maturity and alignment) now gain in importance since DT requires a clear understanding of the readiness of economic entities for the waves of digitization. Again, the question of how deep workflow is integrated in business processes can be answered from the angles of maturity and alignment. Each measurement from above nine factors is a particular indicator of enterprise diagnosis. All values presented in the table are non-dimensional in the range 0–1 so as to be comparable with each other for differences in scale sources. A, B, C, D are mentioned before four mission-critical enterprises in business areas such as airports, railroads, bridge maintenance and healthcare.

Without a long excursion around the reviewed results of the research, here are the conclusions arrived at:

1. General controllability of the discovered businesses is low and maintained mainly by the professional skills of experienced personnel.
2. Effectiveness of process modelling is quite low, which seriously hinders the implementation of low-level process automation, e.g. workflow.
3. Knowledge level of modelling personnel is not sufficient to support digital transformation as a macro process, and there is no will to improve this knowledge.
4. Business and IT architectures are not correlated and synchronized, and there is a lack of serious investment in digitization.
5. The D and E phases are not achieved in the Gartner Hype Cycle. Interest wanes as process modelling and further IT implementations fail to deliver, or require many iterations for final productive result. Continued implementations are a factor of personnel responsibilities and reputational risks.
6. There is no hype trend or tendency towards DT on the level of executive personnel due to a lack of motivation and the existence of fear.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Factors | A | B | C | D |
| 1. BP models in repository and its correlation with actual state-of-the-art (model relevance) | 0.2 | 0.3 | 0.5 | 0.2 |
| 1. Update records for each model and its lag from the current date (model actuality) | 0.4 | 0.3 | 0.1 | 0.2 |
| 1. Correctness of model in obvious logic of the described process (logical sustainability) | 0.5 | 0.4 | 0.4 | 0.3 |
| 1. Correctness of the semantics for model description (tool’s applicability) | 0.4 | 0.3 | 0.4 | 0.2 |
| 1. Difference between process model and realized workflow (modelling effectiveness) | 0.1 | 0.1 | 0.2 | 0.04 |
| 1. Percentage of RPA steps from actual modelled process steps (digitizability) | 0 | 0 | 0.03 | 0 |
| 1. Percentage of end-to-end processes in workflow realization (IT involvement) | 0.2 | 0.1 | 0.3 | 0.1 |
| 1. Number of interfaces between business processes (system complexity) | 0.5 | 0.6 | 0.5 | 0.7 |
| 1. Number of IT systems in bookkeeping records vs in action and use (IT architecture sustainability) | 0.2 | 0.3 | 0.5 | 0.2 |

*Table 1: Nine factors explored in the research illuminate the ‘dark side of the moon’ in companies with bright reports*

## Conclusion

Indeed, without scholar illusions not only the above considerations but combined observations of the current and preceding situations in implementation of IT methods and tools in real life and projects have accumulated in the next short inference.

1. In spite of the fact that DT appears to mainly affect technology and the infrastructure of the communication environment, its main impact is actually the cultural transformation of enterprise social levels.
2. Any enterprise is a socio-technical system in which information performs the role of an interface between man–man and machine, but their activity is based on knowledge, which is particular semantic information that is required for the system to support its own existence and to achieve goals in a condition of unincreased entropy. In reality, the analysed semantic information is uneven and unsynchronized. Nowhere is entropy controlled.
3. Therefore, to make DT worthwhile, it has to structure the enterprise’s semantic information to build activity ontology and unified information field/space. Meanwhile, it has to structure the personnel’s knowledge in communicating the logic of executing processes that will impact on the effectiveness of IT implementation and digitization.
4. As long as low levels of DT ensures the adaptation of personnel to the new communicating culture, a higher level of servitization has to be structured in order to maintain new developing communicating facilities to reflect the activity of staff.

Finally, to make Digital Transformation prosperous, it should be able to *structure* activity information into a unified semantic field so called *semantic kernel*, then to *structure* personnel skills due to the processing logic requirements in view of elaborated semantic, then to *structure* digital services due to personnel skills requirements in accounting of interrelating communication, then it’s good to *structure* external environments to achieve breath of agility, and finally to try to take off with all that has not been yet structured.

The work is dedicated to Pr., Dr., J.Becker, of Münster University since one of Jörg’s main statements as to what "Information Systems" is all about is "Strukturieren, strukturieren, strukturieren".

**References**

Buj, V. (1981). Average IQ values in various European countries. *Personality and Individual Differences*, 2, 168–169.

Carr, N.G. (2008).  The big switch: rewiring the world, from Edison to Google. New York: W.W.Norton.

Hawking, S. (2014). <https://www.osp.ru/news/articles/2014/47/13044144/>.

Henderson, J.C. & Venkatraman, N. (1993).  Strategic alignment: leveraging information technology for transforming organizations. *IBM Systems Journal*, 32 (1), 4–17.

Hunt, E. (2011). Human Intelligence. Cambridge University Press, 437-439.

Khandaker, G.M., Barnet, J.H., White, I.R., Jones, P.B. (2011). A quantitative meta-analysis of population-based studies of premorbid intelligence and schizophrenia, *Schizophrenia Research*, Nov; 132(2-3): 220-227.

Lay, G., (Ed.). (2014). Servitization in Industry. Switzerland: Springer international Publishing.

Luftman, L.  (2000).  Assessing business-IT alignment maturity. *Communications of the Association for Information Systems,* 4 (14), 1–50.

Lynn, R., Vanhanen, T. (2013). Intelligence: A Unifying Construct for the Social Sciences. Ulster Institute for Social Research, 2013.

Musk, E. (2016). <https://www.theguardian.com/technology/elon-musk>.

Neubauer, M., Stary, Ch. (2017). Industrial Challenges. In M. Neubauer & Ch. Stary (Eds.), S-BPM in the Productive industry – A Stakeholder Approach. Springer open.

Peak, D., Guynes, C. S., & Kroon, V.  (2005).  Information technology alignment planning – a case study. *Information & Management*, 42 (5), 635–649.

Raja, J., Johnson, M., Goffin, K. (2015). Uncovering the competitive priorities for servitization: A repertory grid study. *Academy of Management Proceedings.* Academy of Management, (1).

Ren, C., Wang, W., et al. (2008). Towards a flexible business process modelling and simulation environment, *In Simulation Conference, WSC 2008,* Winter, pp. 1694-1701, IEEE.

Rigby, D., Bilodeau. B. (2015). Management tools & Trends 2015. London: Brain & Company.

TechCity, Nesta. (2016). *TechNation 2016*. Transforming UK Industries.

Tsou, H., Hsu, S. (2015). Performance effects of technology-organization-environment openness, service co-production and digital-resource readiness: The case of the IT industry. *International Journal of information Management*, 35(1).

Von Neiman, J. (1966). Theory of self-reproducing automata. Urbana and London: University of Illinois Press.

Weill, P. & Broadbent, M. (1998). Leveraging the new infrastructure. Boston: Harvard Business School Press.

Westerman, G. (2017). Leading digital: Turning technology into business transformation. *Business Digest*, MIT Initiative on the Digital Economy.

1. WfMC – The Workflow Management Coalition was founded in 1993 and became a global organization of adopters, developers, consultants, and university and research groups engaged in workflow implementation and BPM. [↑](#footnote-ref-1)
2. Lexeme is a minimal unit of language that has a semantic interpretation and embodies a distinct cultural concept. [↑](#footnote-ref-2)
3. This is not a discussion of the validity of the data or methods of analysis presented by the referenced authors, but observations of student results in 3 European universities over the last decade correlate well with their conclusions. [↑](#footnote-ref-3)
4. D.Brown is the modern popular novelist (http://danbrown.com/origin/). [↑](#footnote-ref-4)