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Change of Organizational and Production Paradigms in the IT Industry: Research 2020–2023

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ABSTRACT

The experience of creating successful geographically distributed engineering teams and the COVID pandemic have made a significant contribution to the dynamics of changing the organizational and production paradigm in the IT industry from the traditional 40-hour office work to a "hybrid" work week and even to completely remote software and IT-services development. In this study, the scientific task of determining the nature of the process of paradigm shift is set and a set of scientific hypotheses is set to identify fully remote work as an established practice for a significant number of leading IT companies in Europe. To test these hypotheses, thematic industry studies of 2020–2023 were analyzed, which convincingly proved that the forced transition to completely remote development during lockdown periods and after reducing the impact of pandemic risks becomes a conscious choice: in demand, economically rational, supported by a significant number of engineers and managers in the industry. At the same time, a "hybrid" work week, combining part of the days in the office and part outside it, has also remained a popular option for organizing work in IT companies and organizations with large teams for internal automation.

Keywords: fully remote mode; geographically distributed teams; IT industry; organizational paradigm

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STATEMENT OF THE RESEARCH PROBLEM AND THE HYPOTHESIS OF THE STUDY

The IT industry is the engine of digitalisation of the global economy, outpacing many other industries in terms of annual development rates[1] due to timely management of necessary changes in the organisation of production and business processes. The efficiency of production paradigms used in software development plays a key role in the competitiveness of IT companies. Such paradigm shifts (in favour of increasing the efficiency of software production under the influence of favourable market factors) in the IT-industry occur within 10–20 years and can be easily traced on many examples: from the change of dominance of the "waterfall" model to RUP and then to Agile [1] to the standardisation of the industry, which with the same periodicity complicated its CMMI model [according to the Software Engineering Institute (SEI)] [2].

The paradigm shift described in this paper is based on economically feasible processes of outsourcing and geographically distributed teams [3]. Russian IT-companies (Luxoft, Epam, Auriga, E-style) have been leading in Europe for a long time and actively developed geographically distributed software development teams together with global corporations [4]. These trends were supported during the COVID-19 pandemic and subsequent waves of social exclusion (lockdowns) by rapid organisational changes that ensured the IT industry's transition to the paradigm of fully remote software development and service delivery [5]. Such an organisational and production paradigm — fully remote software development (FRD) — was mandatory during the 2020 lockdowns in many regions of Europe. The initial formalisation of FRD in the context of lockdowns was the subject of an author's study [6], whose main focus is to investigate early adaptation to the pandemic (March-April 2020) in the IT industry and the medium-term impact of pandemic risks on the success of remote software development

[1] URL: https://www.it-world.ru/it-news/reviews/190552.html

activities (September-October 2020). The study covered the experiences of 26 software development and IT support teams for digital services in companies headquartered in Russia, the EU and the US, including: Alphabet (Google), Amazon, BSC Group, Custis, Deutsche Bank, Evernote, Exness Global, Positive Technologies, PromSvyazBank, Sber, VTB, and Yandex. The research method chosen was a two-stage questionnaire survey using the Google. Forms tool and personal interviews with experts to discuss the findings. The study showed that Russian, global and European IT leaders have quite easily moved to the practices of fully remote off-site software development, using the accumulated experience of geographically distributed teams, appropriate to the automation of work processes.

Mature workflow virtualisation practices that have become part of modern approaches in software quality management have also played a significant positive role in this. These include: version control, continuous integration and delivery, and requirements management.

The following hypotheses were put forward in this study:

The fully remote development paradigm is the current organisational standard of the IT industry, even after the pandemic, a significant proportion of IT companies retain fully remote software development practices or hybrid models.

The paradigm of fully remote development is already reflected in all production processes: from the interaction within project teams to task and process management. All necessary changes have been implemented and production processes have been optimised to a sufficient level.

The social impact of this paradigm is significant. By 2023, IT companies have adapted to negative factors (such as, for example, de-socialisation of engineers, decreased motivation, destruction of personal ties, etc.).

In order to test these hypotheses, the method chosen is to summarise the results of industry studies conducted between 2020 and 2023, which investigated organisational production problems and the short- and medium-term impact of the COVID-19 pandemic on the IT industry. These studies covered a total of about one hundred software development teams mainly in Central and Eastern Europe.

KEY FINDINGS

During the 2020 lockdowns, IT companies switched to fully remote working without much difficulty, taking one to three weeks to adapt [6]. It should be said that this was a forced measure for many regions of Europe, so it is important to note that after the transition to fully remote working mode by the summer of 2020 for 54% of teams productivity in creating new software releases remained at the same level, and for 23% — increased. According to the researchers, this was due to: increased personal motivation of engineers; use of new communication tools; proper planning of working hours and flexible schedules. Productivity decreased in 23% of teams.

Commenting on these indicators, it should be noted that these are only the first results of rapid adaptation related to 2020. In the future, they have been changing with the increasing adaptation of IT companies to fully remote working.

93% of teams confirmed that after the transition to fully remote working, the software developed and the digital services supported have lost nothing in terms of long-term quality. That is, there is no strong link here to the personal presence of engineers in the offices.

The following factors were identified by experts as reasons for quick adaptation to remote work that allowed teams to maintain productivity and the current level of software quality [6]:

- remote working experience even before the COVID crisis (85% of teams);
- formal transformation plan, projects, leadership efforts (38% of teams).

At the heart of high productivity in software development is the motivation of engineers. About half of the surveyed teams did not confirm that “fully remote work reduces motivation in common goals and projects” [6]. Moreover, about 40% of teams in 2020 have made additional efforts to increase engineers’ motivation in the form of special events, such as:

- team building activities over the Internet;
- simplification of non-production business processes in which engineers are involved;
- development of centralised motivation programmes for developers under new conditions.

According to the experts' generalised conclusions obtained in personal interviews, fully remote work was more likely to have a positive impact on the motivation of teams during the early adaptation period in 2020. In general, the question of motivation is a key issue in the study of this scientific task: in the unscientific public space, supporters, and opponents of "working day in the office" (without special references to scientific studies) always and unconditionally link office/remote work with motivation and productivity of employees. The multi-year studies described in this paper show the evolution of this factor in 2020–2023 in the context of organisational and production paradigms.

Despite the social risks of loneliness and additional "psychological difficulties in the new remote reality" discussed by experts [7], the software industry in 2020 did not overestimate the scale of the problem of mixing personal life and career of employees. Experts did not note the materiality of the threats — increased social isolation, blending of personal and work time/space, etc. in a work-from-home environment. For 53% of teams, the problem does not exist at all — each employee can manage this aspect independently, and 47% have prepared basic corporate rules to mitigate any additional psychological and social features of FRD by summer 2020.

To summarise the survey results, by the time lockdowns were fully phased out and covid restrictions were relaxed for 31% of teams, fully remote software development had become the new standard in their organisation, i.e. companies had definitively restructured their work, with no intention of bringing engineers back to the office in the short to medium term. 61% of teams reported developing hybrid models and associated corporate rules and policies. Most experts believed that fully or partially remote software development and support was becoming a long-term paradigm, and that there would be no return to five-day work in offices. At the same time, negative aspects of FRD were highlighted — company disintegration, issues of long-term motivation and socialisation of engineers in teams, knowledge transfer between employees.

In 2020–2021, the hybrid work format gained significant popularity in the IT industry [8], also raising issues related to the long-term motivation of engineers and their involvement in project and corporate issues [9, 10]. The following study, conducted in 2021. [11], made it possible to determine the demand for fully remote work in the IT industry in Russia and new effective ways to combat the negative aspects of this production and organisational paradigm. Remote interviews with a mandatory set of open-ended questions were chosen as the research method. After their completion, the experts were sent the generalised results, which could be supplemented and commented on. In total, more than 20 experts from all federal districts of Russia participated in the research in January-February 2021, presenting their experience of software development in 2020 in Russian IT companies, banks, digital advertising agencies (including VTB, Yandex, SberTech). The roles/positions of the experts (in descending order of specific percentage) that they hold in their companies should also be specified: project manager, engineering team leader (team leader), technical director, engineer.

The focus of the research on studying the processes of FRD entrenchment and possibilities of overcoming the identified negative aspects is related to the removal of strict restrictions in Russia imposed due to the pandemic, which made it possible to compare fully remote development with the usual work in the office, provided that the obvious difficulties are overcome, since:

- radical reduction of informal communication in the team negatively affects engineers' involvement in solving business needs of customers and software users, hampers the usual models of professional growth related to mentoring and experience sharing;
- Transferring the most important work processes to the online format in any software development

paradigm (Scrum, RUP, MSF) forces the company (and project) management to reconsider the methods of long-term motivation of engineers and change the principles of production organisation.

The 2021 study confirmed that despite the efforts of individual managers and team leaders, Russian technology companies did not pay enough attention and spent minimal effort and investment for their deeper adaptation to working in remote environments [11]. On the one hand, the problems of infrastructure and Internet accessibility were successfully solved in the companies of all experts participating in the study, and on the other hand, in Russia only some managers made additional efforts and incurred excessive costs to ensure short-term and long-term motivation of engineers. Such activities were (in descending order of prevalence) as follows:

Introducing the practice of online team building and online corporate events.

Centralised implementation of the practice of increasing engineers' knowledge of working remotely, including advice, instructions, and exchange of views on current issues.

One-off or regular engagement of specialists outside the staff (outsourcing, freelancing, etc.).

The issue of engineers' motivation in the Russian IT-industry has remained unresolved since 2021. The research has shown that the identified arsenal of methods to increase motivation is rather scarce; it did not require significant efforts and costs from the companies employing experts and included:

- using the very fact of remote work as a motivation for engineers;
- drawing attention to various distance learning courses and programmes (if the company has a centralised training function, such as a corporate university, for example).

A number of experts pointed out that social isolation is a key problem for IT teams in terms of providing comfortable conditions for professional growth, which is responsible for the observed decrease in opportunities for newcomers from 2020. A significant number of Russian companies are not taking special actions to address this problem. At the same time, experts confirmed the unconditional growth in the number and deepening of horizontal ties, the importance of electronic interaction and communication channels, and recorded the transition of the latter predominantly to electronic form even in organisations with a hybrid form of work.

In general, fully remote development by 2022 put significant pressure on process models in IT teams: on the one hand, complex bureaucratic aspects were temporarily (or permanently) simplified, on the other hand, formalisation of communications — both within the team and with customers and software users — increased. Nevertheless, the transition to fully remote software development was actively supported by engineers and managers, had a positive motivational effect, and was considered by all participants of the process as a new organisational standard even after the end of the pandemic [11].

In 2022, the Russian-Ukrainian geopolitical events (with the subsequent "technological embargo", IT specialists' migrations and increased demand for import substitution in the IT industry), reduction of pandemic risks and a relatively new trend towards the use of artificial intelligence (AI) in software engineering had a significant impact on the continuation of organisational and production paradigm shifts in the IT industry [12]. A number of major corporations (Apple, JPMorgan, MTS, Sber) have announced an effort to bring employees back to the offices on a full-time basis, but turbulent migrations of IT professionals have been observed in Eastern Europe. Moreover, previous studies indicated that the model of organising fully remote software development and IT services in European companies is already established and supported by engineering teams around the world.

The focus of the next 2023 study [13] aims to understand the level of entrenchment of fully remote development / hybrid format in the practice of European companies. The study was conducted from December 2022 to January 2023 and covered the experience of 48 teams headquartered in European countries: from Kazakhstan and Russia (Yandex, Sberbank, VTB, etc.) to Germany and

France (Deutsche Bank, ATOS IT, Finastra, etc.). The research method used: questionnaire survey with the help of Google.Forms tool, in some cases — remote interviews. Thus, more than 58% of the respondent teams in 2023 work remotely, and only less than 13% of the total number had to return to offices full-time after the pandemic threats diminished. More than 60% of experts did not note a direct correlation between the shift in the organisational and production paradigm of software development towards fully remote processes and the long-term quality level of software development, which confirms the conclusions of an earlier study [6]. At the same time, for 63% of teams from the 2023 study, the productivity level did not change when switching to a fully remote (and even hybrid) model, while in one in five teams it increased significantly. Thus, we observe a high increase in the demand for the organisational and production paradigm of fully remote work (from a conditional 31% in 2020 to a conditional 58% in 2023) and an increase in productivity for a stable part of companies, which confirms hypothesis No. 1 for solving the set research problem.

For a part of IT companies and banks with strong in-house development, the choice in favour of a hybrid model of work organisation remains significant — this is how about one third of the teams whose representatives took part in the survey work. Only in 20% of companies the top management of the organisation continues centralised improvement of processes of fully remote work of employees, in 2/3 all improvements were made earlier, and some details are being finalised. Approximately 70% of experts noted that they have already implemented all the necessary changes in communication with customers and partners in their companies. For about 30% of teams, the adjustment of these processes continued in 2022: interactions became more formal, special policies and regulations appeared, tools for electronic communication channels were adjusted and customised [13]. This indicates a high level of consolidation of these processes in the practice of IT-companies, which confirms the second hypothesis of the study.

As noted earlier, the fully remote manufacturing paradigm has not only an economic or production impact but also a social impact on the engineers involved. Earlier studies [6, 11] pointed out various problematic points:

- strict dependence of engineer's productivity on the provision of working conditions outside the office;
- reduced social activity of employees — both forced (during quarantine) and after the pandemic (when working remotely);
- confusion of working time and space with personal time and space.

The study [13] confirms the complex form of mixing personal and work time and space for employees (and their family members) when working fully remotely in the IT industry. More than 63% of the experts in the study indicated that despite the significant impact of the fully remote software development model on the balance of work/personal time and space of engineers, in their teams, employees deal with such emerging complexities on their own. Only 16% of IT companies in 2023 continued to use internal instructions and regulations to formalise the organisation of production processes in this aspect. Also, more than 80% of respondents reported that by 2023 their companies had already invested their efforts and resources in the significant development of fully remote software development processes, and in 20% of cases the investments fully justified the set objectives as early as 2020–2021. The experts also noted that fully remote working processes in IT companies have already become part of the corporate culture and are rapidly introducing various changes, such as:

- increasing complexity of basic rules of information security and authorisation, operation of work equipment, etc.;
- increase in the number of part-time employees in IT companies regardless of the type of company and the subject area being automated.

At the same time, more than 58% of experts indicated that the absolute majority of engineers in their teams are happy and motivated by the

introduction of fully remote working. At the same time, for some respondents, further efforts in the medium term to increase motivation within project teams (through joint online and offline meetings, informal communication models, "1–1" talks) are relevant.

Together with the results of the first study, this partially supports hypothesis No. 3, leaving the conclusions from the second study valid. Therefore, despite the lack of invested effort and resources for remote working on the part of some part of IT companies, in general engineering teams have found ways to overcome the negative aspects of FRD.

Let's consider the trends of 2022 that actively influence the dynamics of organisational and production paradigm shifts in the European IT industry:

- use of AI in software engineering;
- turbulence of migration flows in Europe;
- the "call to office" factor.

The application of artificial intelligence in software development is the integration of software engineers' efforts using specialised AI tools (e.g., large language neural models like ChatGPT or add-ons over software development environments like Copilot), which can be used to accelerate and simplify the development of key IT project artefacts — from user documentation to auto-tests. Significant positive dynamics have been observed in the growth of the ability of such AI tools to create software code and design various models [14]. Due to extensive media coverage, such tools have gained widespread visibility and validation in a large part of European IT companies by 2022. The cumulative positive impact from the use of AI tools leads to an increased cross-functionality of the engineer and at the same time to his/her ability to solve independently uncomplicated related tasks. Obviously, in the process of long-term change of organisational and production paradigms in the IT-industry, the factor of using AI in software engineering will have an impact at all levels:

- personal (need to update skills in working with AI);
- project (change in roles and areas of responsibility);
- corporate (change in core business processes as AI is implemented).

However, the influence of this factor currently remains uneven in European countries and is rather limited in the short term to quickly obtain undeniable competitive advantages in IT-business [15]. This is due to the overall high dynamics of processes in the IT industry and the constant "technological pressure" on IT companies: changing expectations of consumers, regulators, and partners. Increasing the role of working interaction of engineers with AI tools (rather than increasing the time of human communication on cross-functional tasks) contributes to the consolidation of fully remote working practices in the industry.

Migration turbulence in Europe in 2022–2023 also aims to consolidate the fully remote development paradigm. There are many reasons for this turbulence — it combines corporate-organised and independent movements of IT specialists between countries. The difference in managerial attempts to influence these processes is indicative: in Eastern Europe, large IT corporations (Sber, MTS) seek to forcibly return employees to their offices, while in Western Europe (Portugal, Spain, Italy, Germany, Norway) various government programmes are being developed to attract "digital nomads", i.e., IT specialists who consciously choose different countries to work and live in, but seek to avoid taxation errors [15].

To conclude the consideration of the current trends of 2022, which influence the dynamics of the change of organisational and production paradigms in the IT-industry, it is worth mentioning the factor of the "call to the office". This psychological phenomenon (because it is difficult to find economic reasons) is that in every pandemic year and after it, there are calls from large IT corporations, perfectly adapted back in 2020 to FRD, for employees to return to the office for a 40-hour working week. The reasons are many: from the "moral aspect" to "loss of a general sense of corporate culture", but they have nothing to do with economic performance and with the motivation of engineers, the problem of increasing which really hasn't found its solution

during 2020–2023. The factor of spontaneous "call to the office" on the part of senior managers will persist. The study of this psychological phenomenon in 2020–2023 research has not given a clear answer,— the most consolidated are the opinions of engineers and managers that a part of senior generation top managers in global corporations "do not know how to manage remote teams" [11] and "do not understand the significance of trust in the IT business" [6]. It is obvious that the "call to the office" factor does not reduce the level of support for fully remote development among engineers and managers, but simply reorganises the flows of specialists to different IT companies during the current paradigm shift [16].

CONCLUSIONS

The confirmation of all hypotheses proves that the paradigm of fully remote development is the current organisational standard of the IT industry. Even after the reduction of pandemic risks, a significant part of IT companies retains this practice or apply hybrid models of work organisation. Production and organisational processes in such companies are optimised and support this format in all significant aspects: from interaction within project teams to task management. At the same time, from 2020 onwards, this paradigm will continue to have a significant impact on social aspects: from desocialisation and reduction of long-term motivation of engineers to deterioration of the knowledge transfer procedure. A significant number of teams have managed to overcome some part of this negative impact, but centralised corporate investments in these processes and new technological tools remain in demand.

The following conclusions should be drawn with regard to the scientific problem of determining the nature of the process of changing organisational and production paradigms in software development:

1. The paradigm of fully remote development of software and IT services is in demand and relevant for a significant number of the world's leading IT companies, it has proven its production and economic efficiency and is increasingly less associated with the pandemic factor.
2. The demand for the hybrid form of working remains high. For a significant part of organisations, it is a managerial response to the inability to solve problems with long-term motivation and productivity of engineering teams, rather than a technical necessity.
3. The organisational and production paradigm shift in the IT industry continues, but its dynamics are not uniform across European regions or industry segments. The process is highly influenced by factors that are difficult to formalise (like "call to office" or geopolitical events), but the strong support for fully remote working among engineers and managers in the industry make its prospects robust.

REFERENCES

1. Rakovskii A. Agile, DevOps, CI/CD. How development concepts have changed. iTentika. Nov. 16, 2022. URL: https://itentika.ru/agile-devops/ (In Russ.).
2. Fenton E. Carnegie Mellon 1900–2000: A centennial history. Pittsburgh, PA: Carnegie Mellon University Press; 2000. 299 p.
3. Massey A. P., Montoya-Weiss M.M., Hung Y.-T. Because time matters: Temporal coordination in global virtual project teams. *Journal of Management Information Systems*. 2003;19(4):129–156. DOI: 10.1080/07421222.2003.11045742
4. Pashchenko D.S. Research in CEE-region: Changes' implementation in software production. Geographically distributed teams: natural and organisational features of software development projects. *Programmnaya inzheneriya = Software Engineering*. 2017;(2):88–95. (In Russ.). DOI: 10.17587/prin.8.88–95
5. Deutsch W. COVID-19 is changing key business relationships. Chicago Booth Review. 2020. URL: https://review.chicagobooth.edu/entrepreneurship/2020/article/covid-19-changing-key-business-relationships
6. Pashchenko D. Fully remote software development due to COVID factor: Results of industry research. *International Journal of Software Science and Computational Intelligence*. 2021;13(3):64–70. DOI: 10.4018/IJSSCI.2021070105

7. Sunil P. How COVID-19 is impacting HR practices in APAC: Pay freezes, cautious hiring, and more. HumanResourcesOnline.net. Mar. 27, 2020. URL: https://www.humanresourcesonline.net/how-covid-19-is-impacting-hr-practices-in-apac-pay-freezes-cautious-hiring-and-more
8. Narain S. Post COVID-19 pandemic: Hybrid-work model in the new-normal. DownToEarth. Sep. 10, 2020. URL: https://www.downtoearth.org.in/blog/governance/post-covid-19-pandemic-hybrid-work-model-in-the-new-normal-73313
9. Safonov A. Yu. Personnel management during a pandemic. *Moskovskii ekonomicheskii zhurnal = Moscow Economic Journal*. 2020;(5):59. (In Russ.). DOI: 10.24411/2413–046X-2020–10318
10. Ralph P., Baltes S., Adisaputri G. et al. Pandemic programming. *Empirical Software Engineering*. 2020;25(6):4927–4961. DOI: 10.1007/s10664–020–09875-y
11. Pashchenko D.S. Russian experience in organizing fully remote software development: An industry study of 2021. *Programmnaya inzheneriya = Software Engineering*. 2021;12(6):311–318. (In Russ.). DOI: 10.17587/prin.12.311–318
12. Barenkamp M., Rebstadt J., Thomas O. Applications of AI in classical software engineering. *AI Perspectives and Advances*. 2020;2:1. DOI: 10.1186/s42467–020–00005–4
13. Pashchenko D.S. Fully remote software development as a new standard in the IT-industry: European study 2022–2023. *Programmnaya inzheneriya = Software Engineering*. 2023;14(5):217–224. (In Russ.). DOI: 10.17587/prin.14.217–224
14. Luzniak K., Bazyliński K. How does artificial intelligence enhance software development? Neoteric. Apr. 14, 2022. URL: https://neoteric.eu/blog/how-does-artificial-intelligence-enhance-software-development/
15. Schlagwein D. The history of digital nomadism. In: International Workshop on the Changing Nature of Work (CNOW). 2018. URL: https://www.researchgate.net/publication/329182172_The_History_of_Digital_Nomadism
16. Pashchenko D. The consolidation of the fully remote software development practice in Europe: Study of 2023. *Computer Science Journal: Open Access*. 2023;1(1):102. URL: https://www.yumedtext.com/files/publish/published-pdf-6-CSJ-102.pdf

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