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REFLECTIVE MODEL FOR MANAGEMENT BUSINESS PROCESSES IN THE TECHNOLOGY TRANSFER SYSTEM

РЕФЛЕКСИВНА МОДЕЛЬ УПРАВЛІННЯ БІЗНЕС-ПРОЦЕСАМИ У СИСТЕМІ ТРАНСФЕРУ ТЕХНОЛОГІЙ

Summary. *Introduction. Innovative progress updates the problem of managing business processes of companies on the basis of reflection, which is particularly important in technology transfer systems. The study of methods and models for the economic evaluation and management of business processes in technology transfer systems using reflective practices has shown that their existing number is insufficient to describe such processes. Existing developments describe the problem in a fragmentary way, without providing algorithms for its methodological support.*

Objective. To substantiate the reflexive model of business process management in the technology transfer system.

Materials and methods. To achieve this objective, the article uses general scientific research methods. The study used: the work of scientists and practitioners on the issues of business process management based on a reflexive approach in the technology transfer system; analyses of organisations in the subject area; the results of the authors' research.

Results. The existing methods and models of business process management based on a reflexive approach in technology transfer systems are studied; a reflexive model of business process management in the technology transfer system has been developed; a method for assessing the transferability of technology to formalise the results of the author's model has been substantiated.

Prospects. Prospects for further research are the development of business process management strategies based on a reflexive approach in the technology transfer system.

Key words: *reflective approach, management, business process, technology transfer.*

Анотація. *Вступ. Інноваційний прогрес актуалізує проблематику управління бізнес-процесами компаній на засадах рефлексії, що має особливе значення для систем трансферу технологій. Вивчення методів і моделей економічного оцінювання та управління бізнес-процесами у системах трансферу технологій із використанням рефлексивних практик засвідчило, що їхня кількість недостатня для опису таких процесів. Чинні розробки описують поставлену проблематику фрагментарно, на даючи алгоритмів її методичного забезпечення.*

Мета. Обґрунтування рефлексивної моделі управління бізнес-процесами у системі трансферу технологій.

Матеріали та методи. Для досягнення поставленої мети у статті застосовано загальнонаукові дослідницькі методи. Під час дослідження використано: доробок науковців і практиків за проблематикою управління бізнес-процесами на засадах рефлексивного підходу у системах трансферу технологій; аналітику організацій предметної сфери; результати досліджень авторів.

Результати. Опрацьовано чинні методи і моделі управління бізнес-процесами на засадах рефлексивного підходу у системах трансферу технологій;

розроблено рефлексивну модель управління бізнес-процесами у системі трансферу технологій; обґрунтовано метод оцінювання трансферопридатності технології для формалізації результатів авторської моделі.

Перспективи. Перспективами подальшого дослідження є розроблення стратегій управління бізнес-процесами на засадах рефлексивного підходу у системі трансферу технологій.

Ключові слова: *рефлексивний підхід, управління, бізнес-процес, трансфер технологій.*

General statement of the problem and its relation to important scientific or practical tasks. The issue of business process management on the basis of reflection has been particularly important in recent years. Innovative technologies are being developed and commercialised at a rapid pace, requiring a review of methods and approaches to economic evaluation and the justification of their transfer strategies. By applying a reflective approach at different stages of interaction between project participants, a company can obtain up-to-date information on the implementation of a particular business process at the appropriate time. This helps to avoid business process mistakes in the early stages, to minimise wasted resources, to react quickly to changes and to ensure the productive development of the company.

For business processes in technology transfer systems, the above issues are of particular value. Being innovative, technologies are exposed to high market risks when transferred. Unforeseen problems often arise during their transfer. To avoid this, appropriate methodological support should be used to analyse and manage the business processes for such technology projects. Currently this is virtually non-existent.

The lack of methods and models presented in modern science and practice, which would serve as a basis for effective business process management based on the reflection of its participants, makes it impossible to conduct technology transfer in a reasoned manner. Therefore, paying attention to business process management based on a reflexive approach in the technology transfer system is an urgent problem of our time.

Analysis of recent research and publications. In recent years, there has been an increasing number of publications on business process management based on the reflexive approach. In particular, researchers have explored the development of new concepts and methodologies in this area [1–3], and the possibilities of applying the reflexive approach in different contexts [4–6]. Some scholars have presented methodological and practical developments [7–10], while others have highlighted cases of reflective practice in their publications [11]. Some methodological aspects of business process management are substantiated in the context of their transfer in [12]. However, no scientific work has developed methodological support for business process management based on a reflective approach for technology transfer systems. The lack of necessary methods, models and the lack of consideration of reflection makes it impossible to manage technology transfer effectively.

Aims of the paper. The aim of the paper is to substantiate a reflexive model of business process management in the technology transfer system. In order to achieve this objective, a series of tasks have been defined:

- to study the existing methods and models of business process management based on a reflexive approach in technology transfer systems;
- to develop a reflective model of business process management in technology transfer systems;
- to substantiate the methodology of technology transferability assessment in order to formalise the results of the author's reflective model.

Presentation of the main research material with full justification of scientific results. World practice shows that the management of business processes in the system of technology transfer should be based on a set of phased reflexive assessment of value and cost parameters of technologies. From the point of view of such an assessment, complexity is the unity of goals, objectives, contents, methods and forms. The principle of complexity in the management of business processes based on reflection in the technology transfer system provides the following functions: 1) focuses management on the final result rather than on intermediate results (this makes it possible to assess the readiness of a technology in the context of its market competitiveness); 2) facilitates a thorough and comprehensive study of a technology in all business processes of its development; 3) determines the successful preparation of a technology by adjusting the structural and functional relationships within its business processes; 4) promotes effective technology transfer.

The author's own reflexive model of business process management in the technology transfer system is based on the study of the issues of business process management based on a reflexive approach in technology transfer systems, the generalisation of the world experience in modelling business processes using reflection, the study of existing concepts and systems of technology transfer [12]. The model is based on the complexity of business process management based on a reflexive approach implemented by the following components of the technology transfer system: consumer value of technology; competitiveness of technology; technological readiness of technology; cost of technology; risk of technology. Each of these components contains a number of stages of technology assessment in terms of its readiness for transfer (Fig. 1). A reflective approach should be applied to each business process at each stage of the model.

As can be seen from Fig. 1, the business processes in the technology transfer system should be considered at three conceptual levels, which explain the content of a particular stage of technology readiness in terms of the relevant components:

– *Level I:* Business processes for assessing technology transferability;
– *Level II:* Business processes for substantiating technology transfer opportunities;
– *Level III:* Business processes for justifying the option to transfer the selected technology.

Accordingly, the stages of technology readiness are: (1) conceptual; (2) technology development; (3) finished technology (presentation of a prototype, a model, etc.); (4) technology transfer stage. The division of the model into stages enables an effective application of a reflective approach to business processes for each component.

Figure 2 shows the characteristics of the proposed reflexive model.

The proposed reflexive model of business process management should be considered from the point of view of a controlling adaptive technology transfer system. One of the important features of the model is that it is based on the multifactorial interaction of the company's subsystems with the external environment

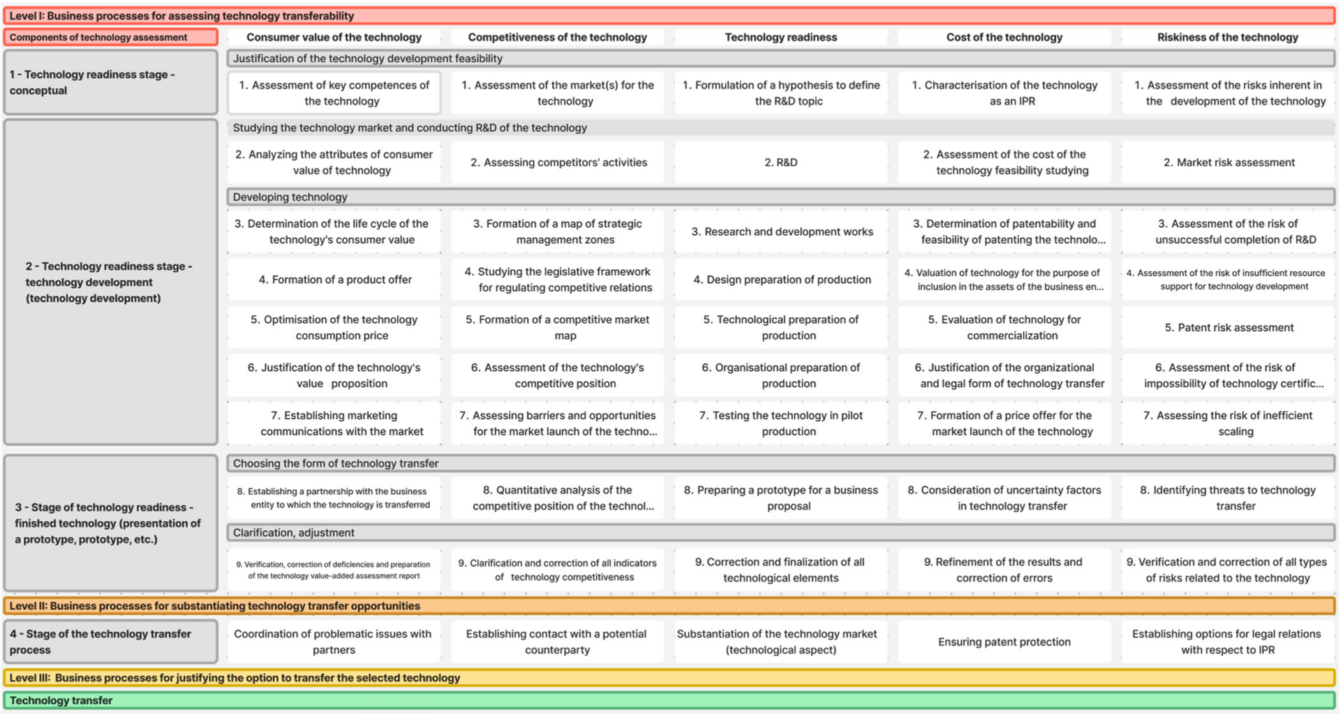

Fig. 1. Reflective model of business process management in the technology transfer system
Source: developed by the authors

and is aimed at maximising the efficiency of technology transfer. The author's model takes into account the principles of technology transfer: structural and functional relationships in the system of factors of the company's external and internal environment, which interact on the basis of transformation of knowledge into technology (goods), leading to the emergence of new knowledge, which in turn is used to generate new technologies.

Given that the assessment of technology for its transferability involves a thorough evaluation of each component of all the business processes of the reflexive model, it is advisable to establish an integral indicator of technology transferability, based in particular on the aggregation of the assessments obtained. By comparing the value of the integral indicator with the normative limits, it is possible to draw a conclusion on the transferability of the technology. To do this, it is advisable to use formal mathematical methods, for example, to consider the components of the proposed model using the polygon method.

Then, according to the reflexive model developed, the polygon will consist of five equivalent triangles (*1…5*), whose sides have the same gradation and contain nine identical divisions. Each division represents a particular stage of technology readiness for transfer according to the relevant components of the business processes. If we describe these five connected triangles as a circle, their sides (which are the radii of the circle) divide the circle into five acute angles according to 60° (360°: 5 = 72°). If we know where the technology is at the time of the assessment, we can determine the lengths of the sides of the triangles (*a, b, c, d, e*).

The area of each triangle S is determined by multiplying half the product of the two known sides by the sine of the angle α between them. For example, for the selected triangle *1*, find S using the expression

$$S_1 = \frac{1}{2} \times a \times b \times \sin\alpha \,. \tag{1}$$

Fig. 2. Characteristics of the reflexive model of business process management in the technology transfer system
Source: developed by the authors

Adding the areas of the triangles (S_1, S_2, S_3, S_4, S_5) gives the total area of the polygon $S_{polygon}$:

$$S_{polygon} = S_1 + S_2 + S_3 + S_4 + S_5. \quad (2)$$

Based on the obtained results, for the reflexive model of business process management in the technology transfer system, limits for the analysis of the values of the obtained integral indicators of technology transferability have been developed (Figure 3). The degree of weight of the value of the integral indicator to a particular limit is explained by examining the data in each specific situation.

Thus, the proposed reflexive model of managing business processes in technology transfer systems, as opposed to the existing ones, allows:

– to apply reflection in the context of specific components of business processes, which will facilitate the prompt identification of problematic issues;
– to assess the level of technology readiness for each of the model components, taking into account the reflection of the participants in this process, and to analyse the possibilities of commercialising technologies in different variations of readiness ratios by component;
– to determine the integral indicator of technology transferability, calculated on the basis of aggregating indicators for each component of the business processes, applying a reflexive approach to each of them.

The model and the method of its formalisation make it possible to aggregate interdisciplinary positions of technology assessment on the basis of reflection, to compare the levels of technology readiness when selecting projects for investment, since the values of the integrated assessments of the levels of technology readiness are based on their feasibility study. The reflexive model can also be used when deciding whether to include a technology in the company's assets.

Conclusions. The study of the problems of business process management on the basis of a reflexive approach in the system of technology transfer has updated the questions of methodological support that have not yet been considered in the science and practice of the subject. The answer to these questions was the development of the author's reflexive model. It provides for the management of business processes in the context of five components of technology research for their transferability (consumer value; competitiveness; technological readiness; cost; risk). Each of the components consists of nine stages of technology assessment, which in the theoretical and methodological context define four stages of technology readiness (conceptual; technology development; finished technology; technology transfer). The provisions are based on the modern theoretical and methodological foundations of technology transfer. To formalise the model, the author proposes the polygon method, which provides a graphical and formalised interpretation of the results of technology transferability, aggregating interdisciplinary aspects of its assessment based on the reflection of business process participants.

The author's reflexive model of the management of business processes in the technology transfer system makes it possible:

– to apply reflective practices for each component of the business process, detailed by stage. This contributes to a thorough analysis of the business processes, paying attention to elements that are usually not seen by analysts, as the methods used tend to generalise these processes;
– to regulate business processes in the technology transfer system based on an understanding of the stages of the proposed model;
– to substantiate management tactics for the implementation of business processes using the author's method of formalising the results of technology transferability assessment.

The direction for further research is to develop business process management strategies based on a reflective approach in the technology transfer system.

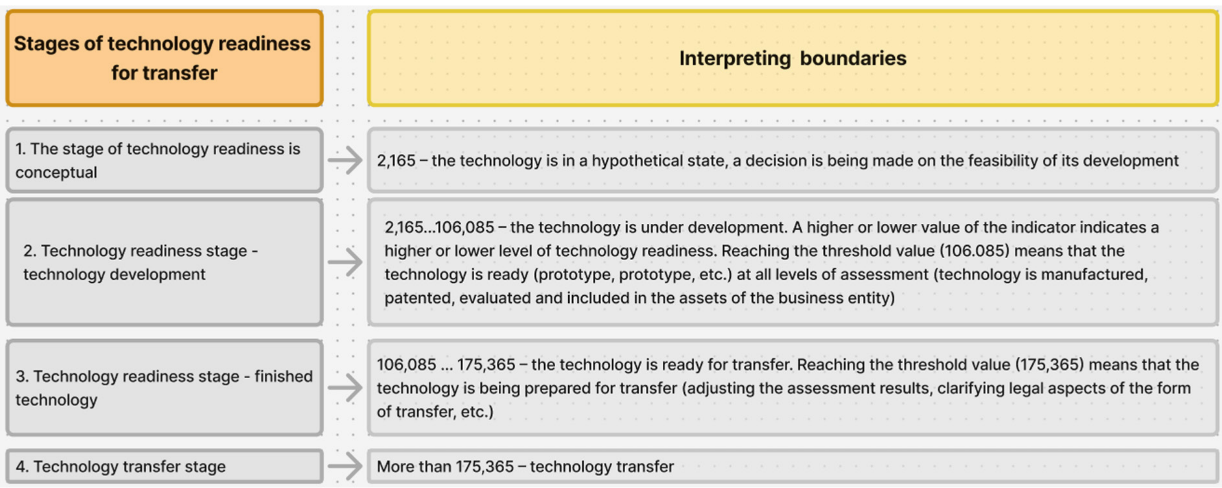

Fig. 3. Limits of integral indicators of technology transferability
Source: developed by the authors

References

1. Baiyere, A., Salmela, H., & Tapanainen, T. (2020). Digital transformation and the new logics of business process management. *European Journal of Information Systems,* 29(3), 238–259. doi: https://doi.org/10.1080/0960085X.2020.1718007.

2. Balzert, S. Fettke, P., & Loos, P. (2012). A Framework for Reflective Business Process Management. *2012 45th Hawaii International Conference on System Sciences*, Maui, HI, USA, 3642–3651. doi: 10.1109/HICSS.2012.58.

3. Coghlan D., & Shani A. B. (Rami). (2018). *Conducting action research for business and management students*. London, UK: Sage.

4. Lyons, P., & Bandura, R. (2024). A reciprocal — reflective approach to learning: concept and model. *European Journal of Training and Development,* Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/EJTD-09–2023–0133.

5. McCormack, O. (2019). How research on reflection has changed my view on reflective practice. Avaliable at: https://info-ted.eu/how-research-on-reflection-has-changed-my-view-on-reflective-practice/ (date of access: 25.05.2024).

6. Chi, A. L. (2023). Reflective Practice: Tools and Challenges in Difficult Contexts. Canadian Journal of Language and Literature Studies, 3(4), 1–16. doi: https://doi.org/10.53103/cjlls.v3i4.100.

7. Coghlan, D., & Shani, A. B. (Rami). (2014). Creating action research quality in organization development: Rigorous, reflective and relevant. *Systemic Practice and Action Research*, 27, 523–536.

8. Hanafiah, M. H. (2020). Formative Vs. Reflective Measurement Model: Guidelines for Structural Equation Modeling Research. *Int. J. Anal. Appl.,* 18 (5), 876–889.

9. Alejandro, A. (2021). Reflexive discourse analysis: A methodology for the practice of reflexivity. *European Journal of International Relations,* 27(1), 150–174. doi: https://doi.org/10.1177/1354066120969789.

10. Rogers, S.L. et al. (2024). Further development of the reflective practice questionnaire. PeerJ, 12: e16879. doi: https://doi.org/10.7717/peerj.16879.

11. McGarr, O., & McCormack, O. (2014). Reflecting to Conform: Exploring Irish students discourses in reflective practice. *The Journal of Educational Research,* 107(4), 267–280.

12. Mrykhina, O. B. (2018). Transfer tekhnolohii z universytetiv u biznes-seredovyshche: paradyhma, kontseptsiia ta instrumentarii otsiniuvannia [Technology transfer from universities to business environment: paradigm, concept and assessment tools]. Lviv: Lviv Polytechnic Publishing House. 440 p. [in Ukrainian].