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Analysis of digital ERP products used in construction to create a digital corporate innovations management environment



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This article discusses the digitalization of development companies as the arrangement of digital activities and resources of the construction industry, including a digitized programme for the manufacturing and distribution of construction products, including the digitization of external relationships (cooperation chains) and in-house business processes in each construction company. This means that all processes must be digitized. The main focus is the introduction of ERP systems. The results of the study show that many Russian construction companies are deeply concerned about digital transformation and the need to digitalize construction technologies to move to a new technology stage. The study supports the management of construction companies willing to grasp the current state of affairs, identify their position amid global digital transformation processes and areas that need special attention to innovations development. Efficiency assessment not only offers an opportunity to calculate the budget for a future project and trustworthily assess all the resources needed for its implementation, but also enables developers and builders to successfully reorganize in-house business processes and tighten control over the system functionality determining business involvement and a detailed description of functions required to achieve corporate goals and objectives. The digitalization of management innovative systems will enable executives to coordinate goals and objectives pursued by the company, its individual departments and top managers, have a clear understanding of the functions, responsibilities and requirements for employees to build an effective corporate management system, generate a target business model towards the implementation of a corporate information system. The complexity of using ERP systems is explained by intricate relationships between an investor, a construction customer, a general contractor, innovations subcontractors (inventors), and resulting specific features of construction scheduling.

Keywords: digital revolution, increasing productivity, innovative processes

Recently, leading development companies have been intensively introducing automated systems in various areas of development businesses. The emphasis is placed on the design process, construction control, simulation of projections and the distribution arm, as well as the optimization of the product quality and customer feedback. These systems help to consolidate all departments and corporate functions on a single platform. All departments refer to one and the same database to optimize data sharing. Digital transformation is one of strategic corporate priorities. At the same time, some factors determine quantitative tasks achievable through the implementation of digital transformation projects. A significant share of companies — 46 % — identified corporate units responsible for the introduction of new digital technologies. A smaller number of companies managed to design a working procedure. Only 25 % of respondents responded that they had managed to develop the culture of ongoing transformations in terms of the use of digital technologies, 20 % had made a list of requirements for the competencies of employees in the digital technology sector and only 15 % had implemented an effective motivation system to ensure the efficiency of digital technology projects. The goal of foreign companies is to build an integrated management system that allows analyzing all processes in the real time mode.

The companies that are customers of the development sector have a fundamental tool: a single

platform for managing a development and construction project.

First of all, it is necessary to indicate which business processes can be adapted (changed) to the present-day reality. If the process cannot be adapted, then one should think about replacing it with a new one. When working with processes, one should bear in mind that their indicators should be entered into the PDM system, while processes themselves should, first of all, be focused on handling the data of the digital counterpart of a product [1].

Automated ERP systems are most widely spread in the construction industry today. They are part of a corporate information system designated for automated planning, accounting, control and analysis of all major business processes and solving business problems of a construction enterprise [2].

Automated systems, that are available on the market, have different sets of functions and a modular structure [3]. Nevertheless, there is a certain set of functions that can be considered as the basic ones for software products. Their principal tasks include the development of a capital construction platform, annual investment budgets and schedules of project work; development and analysis of strategies concerning the financing, development, commissioning of fixed assets; work projection and control; control over the material and technical support of construction projects; management of financial and contractual

support of capital construction undertakings; issuance of analytical reports [4].

THE PRACTICAL APPLICATION OF ERP IN DAY-TO-DAY OPERATIONS OF LEADING DEVELOPMENT COMPANIES

As for the Tekta Group, an automated system supervises construction with the help of 1C: ERP Construction Organization Management. The system is in charge of several large-scale residential development projects¹. The register of work, performed within the framework of one project, can have up to dozens of thousands of lines. 10,000 specialists and workers are involved in the projects. The system prognosticates processes to take place at construction facilities, drafts the project documentation and coordinates assessments, collects applications for construction materials, analyzes the consumption of materials and funds, monitors the performance and timing of construction work.

Towards this end, accounting systems were developed to ensure the successful operation of corporations [5].

The system was installed at 200 workstations. The information accumulated by the system was transferred to the new platform and integrated with "1C: Accounting", "1C: Payroll and Personnel Management", with a CRM system and a corporate portal constructed on the basis of 1C-Bitrix.

The software makes a list of tasks for each project and indicates the amount of work to be performed, deadlines, and costs. At each stage of construction, the amount of work may be adjusted, new items of work can be added, prices may be changed, and all adjustments are demonstrated by the ERP system [6]. The software also helps to find contractors. As a result, forecasting and approving processes have become more productive; scheduling has been optimized [7].

THE IMPLEMENTATION OF "1C: HOLDING MANAGEMENT" BY PIK GROUP OF COMPANIES

PIK Group of Companies has been on the domestic market for more than 30 years. Over the years, the company has managed to implement large-scale residential projects (more than 270 thousand apartments) not only in Moscow, but also in other cities of Russia. To increase the effectiveness of forecasting,

accounting and monitoring of operational parameters, the company needed a unified CPM system. Current CPM-class IT solutions help companies to improve the efficiency of business management, provide mechanisms for the detailed analysis of operations and forecasting through the integrated automation of processes compatible with forecasting and situational modeling, budgeting, financial consolidation, operational control (including KPIs) and reporting.

The 1C: Holding Management system was chosen as the basic software, since it addresses a wide range of issues. A forecasting model was also designed to match the current methodology of budgeting and management accounting [8]. As a result, the company selected 1C: ERP 2.0.

Further, the company is going to integrate its budgeting and quality management, computerize its maintenance and repair management operations and production processes [9].

By now the 1st stage of the ERP system implementation has been completed and the following work has been performed:

- entry of opening balances/assistance in entering opening balances;
- remote instruction of users;
- individual training sessions in the customer's office;
- integration with other software belonging to the "1C: Enterprise" system.

The analysis of ERP systems and innovative digital products used to develop a digital corporate management environment, including the use of BIM data to design budgets and deadlines, is shown in Table. These products were introduced into corporate project management systems by the leading Moscow development companies; they have been efficiently used for a number of years [10].

However, the analysis has shown that currently used digital ERP products are focused neither on planning or implementing innovative products and technologies, nor on their funding, that can be performed through the establishment of venture funds at companies, which could further increase their efficiency by means of suggested new business processes (Fig. 1). Hence, the task is to use digital ERP products to develop algorithms for evaluating and selecting innovations to be introduced into projects with the help of BIM according to proposed algorithms (Fig. 2).

Digital ERP products used to design a digital corporate management environment

Company	Name of Innovation	Type of innovation	Description	ERP Product Features	Origin
Digital ERP products for creating a digital corporate management environment	Build Visor	Organizational	Task Manager for construction projects: a list of stages and tasks, document storage, coordination and contacts	• Deadlines and performers are determined for each task. Project participants can discuss the work progress, add work reports, attach photos and documents; • all construction plans, documentation, uploaded photos are stored in one place and available to all project participants; • all project participants see each other and are always in touch	FRIL, 2018

¹ SP 333.1325800.2017. Information modeling in construction. Rules for the formation of an information model of objects at various stages of the life cycle.

► End of the Table

Company	Name of Innovation	Type of innovation	Description	ERP Product Features	Origin
Digital ERP products for creating a digital corporate management environment	Adept	Techno-logical	ERP for construction management includes software for calculating and verifying the cost of design and survey, a construction project management system, budgeting software, an electronic document management system and a portal for monitoring construction work and maintaining executive documentation	• 30 % cost reduction thanks to a single repository of the estimate documentation; • the possibility of using the database of the estimate documentation; • the work of employees of 61 power plants at all branches in a single system	Private investor, 2020
	Gectaro	Product-focused	A service for construction and repair management. Helps to control estimates, work schedules, finances, supplies, construction, tasks, documents and reports	• Reduction of the estimate preparation time from 7 days to 1 day; • search for and identification of problems in schedules; • real-time monitoring of all that's happening at the facilities; • optimization of 33 % of working time and investment in scaling; • transparency of reporting, optimal communication between colleagues in different departments	A state-owned bank, 2019
	Traceair	Organizational	A cloud service that calculates the amount of work performed, for example, earthworks, using drones and compares it with estimates and acts of work performed	• The accuracy of control over the pre-set standard parameters of contractors' work is up by 10–15 % and reduces initial estimated costs by about 10 %	International investor, 2017
	Skyeer	Product-focused	Online platform for data management and instant analysis	• Orthotransformed image in natural colour rendering for accurate determination of positions of construction facilities; • digital topographic model. • three-dimensional textured overview model; • values of vegetation indices needed to determine the biomass of crops and analyze their development patterns; • using a thermal imager to make videos to identify sources of heat loss from buildings; • video recording and real-time broadcasting	VTB, 2019
	Mobile solutions for construction	Techno-logical	Digital solutions for construction control: monitoring the quality of construction work, consultations made using mobile devices, monitoring the amount of building and assembly work performed and the project deadlines, assurance of occupational safety and control over the process of construction in terms of fire, industrial and environmental safety	• Interaction between the construction control service and contractors in a single information space; • access to up-to-date project documentation and data on facilities; • all information about detected and eliminated violations is available 24/7; • breakdown by category; • research data on contractors, types of work, categories of comments and deadlines for corrective actions, employees of construction supervision authorities; • flexible integration of the product with 1:C, BIM, CAD and PDM systems in operation within the company	Skolkovo, 2018

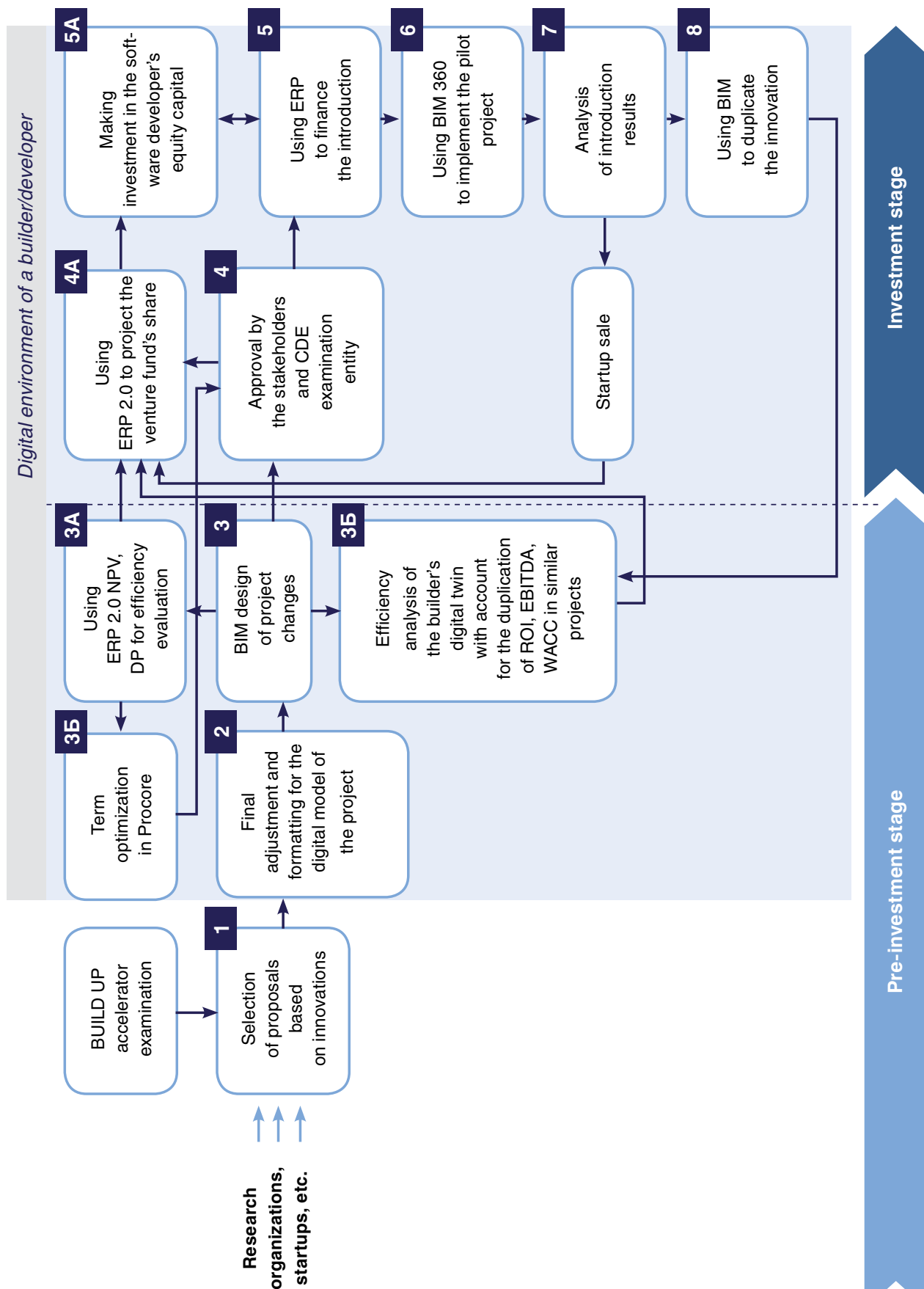


Fig. 1. Stages of an investment and construction project typical for a developer

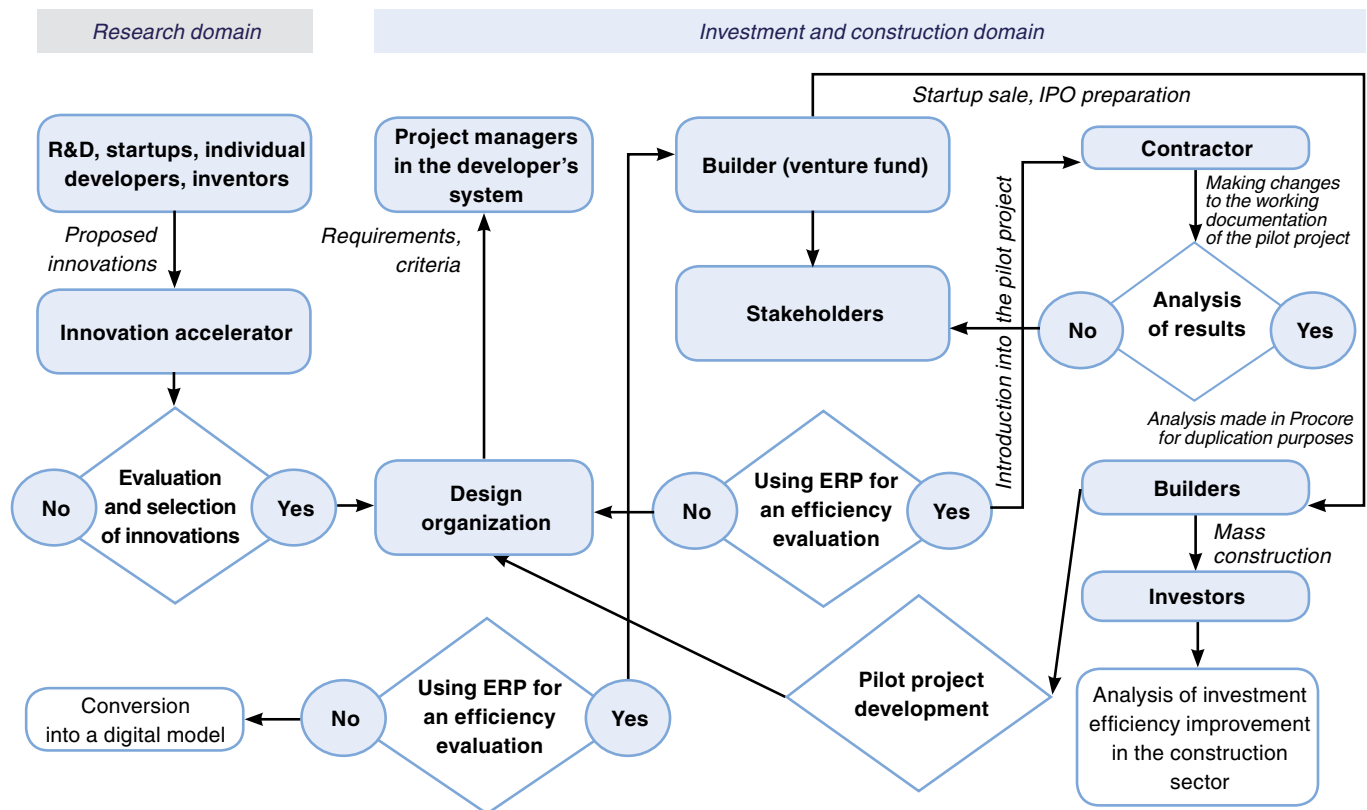


Fig. 2. Proposals on the algorithm of digital innovation management in the organizations of the investment and construction sector

CONCLUSIONS

- The study has proven the need to clarify the digital transformation procedure in construction based on the innovative system integration of current planning and controlling procedures for investment and construction projects [11, 12].
- Digital transformation needs a single digital platform, including an information model of the project life cycle and digital corporate management platforms based on 1C and PRO-CORE, which will significantly increase the effectiveness of investment programmes and projects at all levels of the construction management hierarchy [13].
- Information flows attributed to the main business processes need to be harmonized taking into account the methodology of digital changes and a functional approach to in-house audits, examination of innovative designs and budgets, construction control and bank support [14].
- To further improve the efficiency and competitiveness of companies, it is necessary to develop suggested algorithms for evaluating and selecting innovations in the digital environment of builders and real estate developers. Algorithms will simulate their implementation using BIM and forecast supplementary effects for corporate customers².

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Анализ используемых в строительстве цифровых продуктов ERP для создания цифровой среды управления компанией

В данной статье рассматривается проблема цифровизации деловых структур как организация цифровой деятельности и управление ресурсами в строительстве, включающее оцифрованную программу производства и осуществления строительной продукции, которая, в том числе, предусматривает оцифровку внешних взаимосвязей (кооперационных цепочек) и внутренних бизнес-процессов в каждой строительной компании. Это значит, что все процессы должны быть оцифрованы. Основное направление — внедрение ERP систем. Итоги исследования показали, что многие российские строительные компании существенно озабочены цифровой трансформацией и необходимостью цифровизации строительных технологий для перехода на новый технологический этап. Проведенное исследование окажет поддержку руководству строительных компаний в понимании текущей ситуации, их места в глобальной цифровой трансформации и направлений, которым надо уделять особое внимание. Оценка эффективности дает не только возможность рассчитать бюджет будущего проекта и реально оценить все ресурсы, которые потребуются для его реализации, но и успешно реорганизовать бизнес-процессы организации и усилить контроль за функциональностью системы — определения вовлечения бизнеса и детального описания требуемых функций для решения поставленных целей и задач. Реализация мероприятия по автоматизации системы управления позволит согласовать цели и задачи, стоящие перед компанией, с целями и задачами, стоящими перед отдельными подразделениями и топ-менеджерами, четко понять функции, ответственность и требования к сотрудникам для построения эффективной системы управления компанией, сформировать целевую бизнес-модель компании для внедрения корпоративной информационной системы. Сложность применения ERP-систем в данной индустрии обусловлена такими особенностями строительного производства, как наличие весьма сложных взаимоотношений: инвестор — заказчик строительства — генеральный подрядчик — субподрядчики, и вытекающими отсюда особенностями календарного планирования.

Ключевые слова: цифровая революция, повышение производительности, инновационные процессы

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