Transfer of Project Management Technologies from Information Technology to Construction Industry

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The article discusses the need for transformation of construction project management teams in connection with the digitalization of the construction industry and the increasing use of BIM technologies in the implementation of construction projects. The key to successful implementation of the project in construction during the transition from traditional methods of construction management to innovative approaches with the maximum use of information modeling technologies at all stages of the project life cycle will be the use of approaches tested for the field of information technology.
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Introductory part. The construction industry is perhaps a field of activity that will be most fundamentally subject to transformation in connection with the general processes of "digitalization". In connection with the increasing penetration of BIM technologies in the implementation of construction projects and the accompanying increase in the level of maturity of using BIM [1], there is a need to transform both the methods of working with project information and the carriers of the competencies required to work with this information - directly members of the management team project. Due to the growing use of information technology in the implementation of projects in construction, there is a real need for the use of appropriate approaches specific to the implementation of projects in the field of software development, but as part of a single team for managing a construction project.

Problem statement. In fact, we can say that the industry has already come to understand that it is necessary to rethink the usual stages of the project. In particular, the “design” stage, which usually ends with the receipt of “design documentation” (in different countries - of different composition and depth of detail) in changing conditions, is more likely to end with the creation of a “digital double” [2] of the future building (another engineering facility) that has passed checking for collisions and other inconsistencies, supported by the corresponding library of digital elements - “digital doubles”, necessary for the implementation of the project of building materials, construction and engineering equipment. And it is this created digital model that should become for those who will implement such a project in the future, albeit unusual, but obligatory for execution by “project documentation”. At the same time, a single digital model of maturity level 3 and above [3] can really include the information necessary not only for construction, but also for operation, modernization, reconstruction, and the subsequent inevitable liquidation of the object in the future. With this approach, we can say that when initiating a project in construction, one can really talk about initiating at least two projects that will go “shoulder to shoulder” - a project in the field of information technology aimed at creating a “digital double” of the future object, and, directly, a construction project related to its future physical implementation. And in this case, we can talk about the need to redistribute the "project roles" between these projects, as well as the introduction of new roles that were previously specific to the field of information technology.

Main part. It is to be expected that some approaches and, of course, best practices, such as ITSM [4], Agile [5] and DevOps [6], which grew out of them, will inevitably come into the sphere of construction projects and

their subsequent operation, which solved the same problems that exist at the borders between the areas of responsibility of "designers", "builders" and "operators" inherent in the construction industry, but in the field of information technology. In particular, a well-known information resource such as the Gartner Blog Network published a note by its research director, Christopher Little, where he proposes to use an integrated customer value cycle formed by “superimposing” (or “combining”) elements of subproject life cycles related to the activity of those who “plans”, “creates” and, in the future, exploits” [7], as shown in Figure 1:

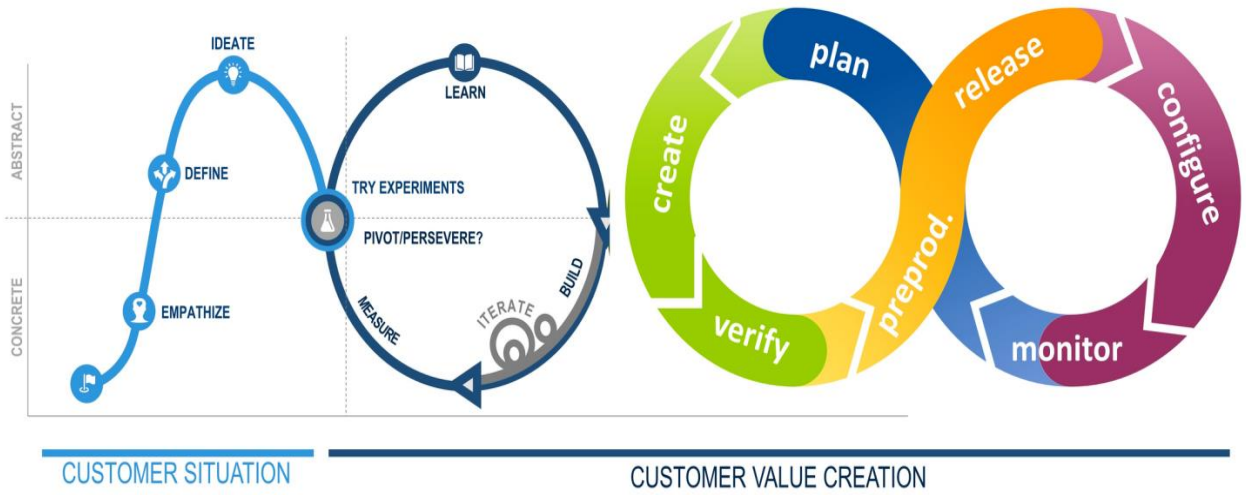

Fig. 1. A combined model of creating value for a client using Agile-DevOps logic (according to [7]).

It is worth noting that due to the greater “squeeze” of projects in the field of information technology over time, approaches to project management in this area are the undisputed leaders in modern project management technologies, both in terms of using existing project management methodologies and their rethinking and development.

Results. For the effective implementation of such "mixed", both for the tasks to be solved and for the technologies used, modern "hybrid" projects at the intersection of information technologies, technologies for the organization of construction production, and also, in some cases, technologies for the production of building materials and structures, it is necessary review existing approaches to the formation of management teams for such projects. The issues of organizing a project management team and managing their role-based communications are one of the key elements affecting the success of a project, which has been given attention for a long time [8]. On the other hand, it is obvious that there is not enough training for specialists in the construction industry in precisely those areas that would be close to both BIM and project management, as shown in a guide such as Building Information Modeling for Project Managers [9].

It is expected that the need to expand the role of the project manager is forecasted, to ensure the possibility of his maximum involvement in issues related to both project management and understanding the logic of obtaining the final product using, in this case, BIM tools (Figure 2).

All this is fully consistent with the roles described in a compact but capacious study based on the analysis of a standard such as ISO19650 [10], in which the following roles specific to the project management team using BIM are highlighted:

a) Project Information Manager,
b) Task Team Manager,
c) Task Information Manager,
d) Interface Manager,
e) Information Author,
e) BIM Manager,
g) BIM Coordinator,
h) BIM Technician / Modeller.

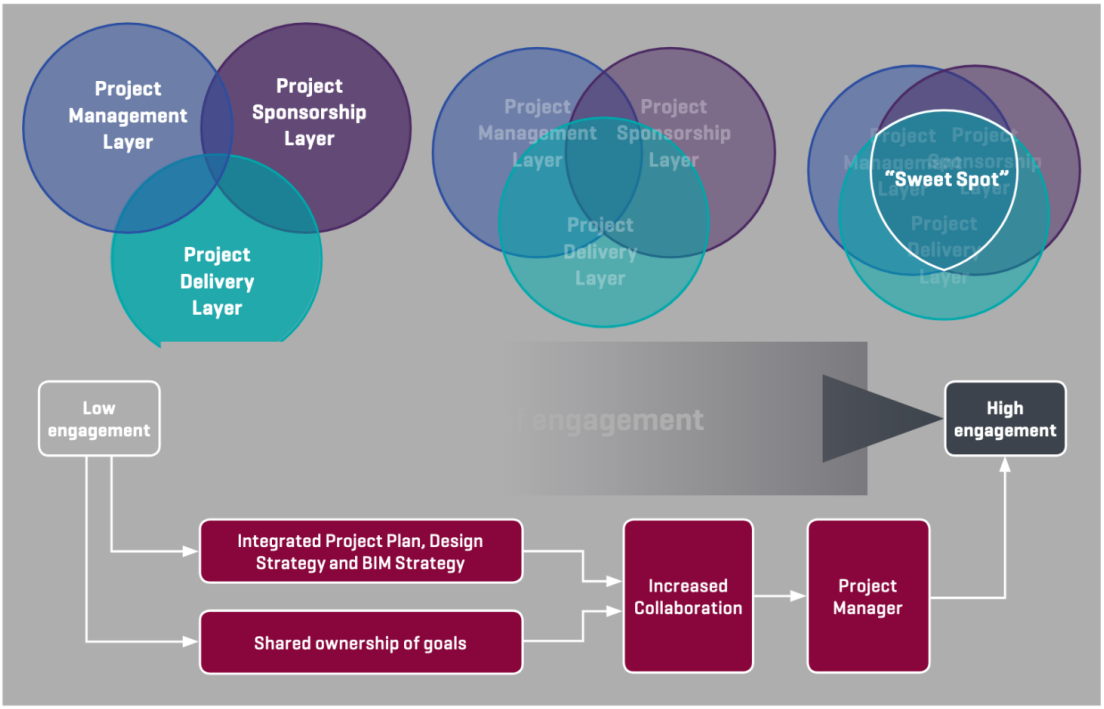

Fig. 2. Expanding the role of the project manager in the implementation of BIM (according to [9]).

This system of three "enlarged" standard roles in the project:

– Task Team: Individual or organization who is responsible for the production of the design outputs related to a discipline-specific, package-based or time-based task. This includes the previously mentioned:

– BIM Author: is the content creator,

– Interface Manager: manage coordination and clashes,

– Task Information Manager (TIM): Direct the production of information using agreed standards and reviews information deliverables,

– Task Team Manager: Coordinated design and approves information deliverables.

– Lead Supplier: Individual or organization who is appointed by the Employer, responsible for coordinated delivery of all design information AND / OR appoints task teams (predominantly first tier contractors)

– Employer's Representative: Individual or organization for whom the contract is executed or delivered.

– Even for this system and role model, it is possible to draw an analogy from the sphere of professional certification that exists in the field of project management and specifically for one of the Agile approaches - for certification of professionals using Scrum. As stated in the Scrum Founding Guide: "Scrum is a framework for developing, delivering, and sustaining complex products. This Guide contains the definition of Scrum. This definition consists of Scrum's roles, events, artifacts, and the rules that bind them together" [11].

The Scrum Team consists of a Product Owner, the Development Team, and a Scrum Master. Each of the roles, respectively, has its own certification requirements, and, accordingly, passed certification as a Scrum master, will be called a "Certified Scrum Master", etc:

– The Product Owner is responsible for maximizing the value of the product resulting from work of the Development Team. How this is done may vary widely across organizations, Scrum Teams, and individuals.

– The Development Team consists of professionals who do the work of delivering a potentially releasable Increment of "Done"product at the end of each Sprint.

– The Scrum Master is responsible for promoting and supporting Scrum as defined in the Scrum Guide. Scrum Masters do this by helping everyone understand Scrum theory, practices, rules, and values.

Moreover, if you carefully read the description of each of the roles in Scrum, you can draw the following analogy with the role model "BIM Level 2 Business Systems Certification":

Product Owner = Employer's Representative

Development Team = Task Team

Scrum Master = Lead Supplier

It is important to understand that the availability of knowledge in the field of "BIM as a tool" among specialists on the part of the executing organization (organizations) involved in the implementation of the project does not guarantee the success of the entire project. A similar situation exists in the implementation of IT projects. The presence of knowledge in the field of “directly technologies” among IT specialists implementing projects also does not guarantee the success of the entire project. For projects in the field of information technology, as was noted for an example of using an approach such as Scrum, it was proposed to supplement the model of “aggregate competences of the project team” with a serious focus on maximizing the value of the project being implemented through the role of Product Owner. Similar logic can be traced in the recommendations on the formation of the project team and expectations for the competencies needed by the participants of the modern construction project. According to [10], with reference to AEC BIM Technology Protocol V.2.1.1, it is necessary to ensure the continuity of the decision-making system at the following three levels, as shown in Figure 3:

	Strategic						Management				Production	
Role	Corporate Objectives	Research	Process + Workflow	Standards	Implementation	Training	Execution Plan	Model Audit	Model Co-ordination	Content Creation	Modelling	Drawings Production
BIM Management	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N
Coordination	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N
Modelling / authoring	N	N	N	N	N	N	N	N	N	Y	Y	Y

Fig. 3. BIM Skills Matrix (no [10]).

As can be seen from the above matrix, confident possession of the entire set of skills given in the aggregate for all three levels, it is hardly worth expecting from one specific person, regardless of the level at which he is in the organization. Therefore, it is worth saying that the possession of BIM technologies should be considered much broader than simply “tool ownership”, for example, of one or another software package from one or another leader-producer of specialized software, which are not so few today in the world. It is worth talking about an integrated multi-level system of knowledge that requires an appropriate training system - both specialists and managers of construction industry enterprises.

Conclusion. To the existing system of managerial decision-making in the implementation of projects in the construction industry, it is necessary, as it was done in the field of information technology, to involve specialists responsible for operation. Special attention should be paid to the training of specialists in the field of operation of buildings and structures, including knowledge in the field of BIM technologies in the requirements for their competencies, which will really organize the work of all participants in a construction project throughout its entire life cycle in the logic “operation” - “construction” - "design". Only then can we talk about the readiness of the construction industry to create a ConOps (Construction+Operation) model similar to DevOps in the field of software and information systems development.

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