

Saimaa University of Applied Sciences  
Technology, Lappeenranta  
Double Degree Programme  
Civil Engineering

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## **Possibilities of BIM in Russia**

Bachelor's Thesis 2015

## **Abstract**

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Degree Programme in Civil and Construction Engineering

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The purpose of this thesis was to explore the place of BIM in the Russian construction market. Nowadays BIM is new and confident-development technology. Many construction companies started to explore this technology. The aim is to show the level of using BIM in Russia.

The study used the data from different conferences, websites and specialized publications.

The results of the study show that BIM is a very actual topic and most of the Russian construction companies have started to implement the technology in their projects.

Manufacturer started to use BIM for product details and materials for construction needs. The Russian government started program that will require companies to use BIM.

Keywords: BIM, Russia, VDC, Building Information Modeling

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# 1 Introduction

Minor technical errors in the drawings, which occur at the design stage, can strongly influence the process of building up to missed deadlines and cost overruns of the project. One of the causes of these errors is insufficient involvement of a specialist in the work of another expert, sophisticated understanding of the junction of two overlapping projects.

Over the past 20 years the number of such errors has decreased several times, taking into account the emergence of a new and complex technology and large and complex projects. This is due, primarily, with the advent of computer technology and design automation systems. One of these systems is BIM.

Building information modeling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. Building information models (BIMs) are files (often but not always in proprietary formats and containing proprietary data) which can be exchanged or networked to support decision-making about a place. Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, wastewater, electricity, gas, refuse and communication utilities, roads, bridges and ports, houses, apartments, schools and shops, offices, factories, warehouses and prisons.

The concept of BIM has existed since the 1970s. The term 'building model' (in the sense of BIM as used today) was first used in a 1986 paper by Robert Aish - then at GMW Computers Ltd, developer of RUCAPS software - referring to the software's use at London's Heathrow Airport. The term 'Building Information Model' first appeared in a 1992 paper by G.A. van Nederveen and F. P. Tolman.

BIM is used everywhere, especially the strengths of this technology show in the Nordic countries, Britain and the United States. Created BIM standards are worldwide. Russia is at the stage of implementation of BIM technology in the construction industry. Many companies are implementing BIM in the design. The Ministry of Construction is implementing the use of BIM in the legislative sphere.

This thesis is about the introduction of BIM situation in Russia and shows the main directions of the implementation and assesses the overall situation.

## 2 Basics of BIM

### 2.1 What is BIM

The turn of the end of 20 - beginning of 21 century, associated with the rapid acceleration of development of information technologies, marked the emergence of a fundamentally new approach to architectural design which is to create a computer model of the new building, bearing in itself all the information about the future of the facility. This was a natural human response to dramatically change the information richness of life around us.

(<http://www.autodesk.ru/campaigns/aec-building-design-bds-new-seats/landing-page>)

In modern conditions it became quite impossible to effectively handle the same means overflowed the designers a huge and steadily growing stream of information, preceded and accompanied the design itself. And the result of design full of information that should be stored in a form suitable for use.

The flow of such information does not stop after the building is designed and built as a new object, entered the stage of operation, and interacts with other objects and the surrounding environment.

In addition, with the commissioning the internal processes run and life support facilities in modern parlance, the active phase of the "life cycle" of the building.

Such information "call" of the modern world around us demanded intellectual and technological community major response. It was followed by the emergence of the concept of building information modeling.

In the design environment and is widely and highly successful practical application in the creation of new facilities, the concept, however, quickly stepped over the frame set for it, and now the building information modeling means much more than just a new method in the design.

Now it is a fundamentally different approach to the construction, equipping, maintenance operation and repair of the building life cycle management of the object, including its economic component to the management of the surrounding man-made habitats.

These changes relate to the buildings and facilities in general. Finally, this is the new look at the world and rethinking the ways of human impact on the world.

Building information modeling, abbreviated as BIM is a process which resulted in the building information model.

At each stage of the process of information modeling, it has an information model that reflects the volume of processed information at this point on the building. Exhaustive BIM exists in principle, because it can always supplement available at point in time, the model with new information. The process of information modeling is collaboration between designers. A building information model each time is a result of these tasks.

It goes now to the inner meaning of the term, but today there are several definitions of it that in the basic sense of the match, with differing nuances.

This situation is due primarily to the fact that different experts who contributed to the establishment of BIM, came to the concept of building information modeling in different ways, and for a long period of time.

The very building information modeling today – is a new and constantly evolving. In many ways, its content is determined not by theoretical inferences and daily worldwide practice. The process of BIM is still very far to its logical conclusion. This leads from what one means by BIM model as a result of the activity, for others BIM is the process of modeling, identifies and discusses the BIM in terms of practical implementation factors, and people define this concept through its negation, explained in detail.

Without going into a detailed analysis, it may be noted that virtually all of the currently existing approaches to define BIM equivalent, are considered one and the same technology in the design and construction activities.

In particular, any model requires a process of its creation, and in turn any creative process involves the result.

The existing theoretical differences in the definitions do not interfere with any of the participants of discussions around the concept of BIM effectively work as soon as it comes to its practical application.

The goal is to convey the essence of building information modeling, paying less attention to the formal side of the issue, from time to time "mixing" different formulations and appealing to the common sense and intuitive understanding of what is happening, then to formulate a definition which most accurately reveals the very essence of the concept of BIM.

Building Information Modeling (BIM) is a process in which at each stage of building information model (also BIM) is created, developed and improved.

Historically, the acronym BIM is used in two cases: for the process and for the model. As a rule, confusion does not occur because there is always context. But if the situation still becomes disputed, it must be remembered that the process is primary, and the model - again, that is BIM - is first of all a process.

Building information model (BIM) is suitable for computer processing of information on future or existing buildings, thus:

- 1) fit properly coordinated, consistent and coherent,
- 2) having geometric binding,
- 3) suitable for calculations and analysis,
- 4) allowing for the necessary updates.

In simple terms, the building information model is a certain database of the building, controlled by a suitable computer program. This information is primarily intended and can be used to:

- 1) the adoption of specific design solutions
- 2) the calculation of parts and components of the building,
- 3) predicting the performance of object
- 4) the creation of project documentation,
- 5) estimating and building plans
- 6) order and manufacturing of materials and equipment,
- 7) management of construction of the building,

- 8) control the operation over the entire life cycle of the object,
- 9) management of the building as a commercial activity,
- 10) the design and management of the reconstruction or repair of buildings,
- 11) the demolition and disposal of buildings,
- 12) other purposes related to the building.

This definition is most relevant to today's approach to the concept of BIM by many developers of computer-based design tools for building information modeling.

Schematically, the information related to BIM, entered into the model, stored and processed in this model and derived therefrom for further use.

## **2.2 The practical use of the building information model**

The use of building information modeling is significantly easier to work with this new unit and has a lot of advantages over previous forms of design.

First of all, it allows the virtual model to be put together, to pick up at destination, calculate and coordinate created by different organizations, and the components and systems of the future buildings in advance to check their properties and viability, functional suitability and performance of individual parts and the whole building.

BIM technology also makes it possible to avoid the most unpleasant problems for the designers is the emergence of internal inconsistencies (conflicts) arising from the combination in a single project of its components or related parts. Rather, the problem cannot be avoided, and effectively solve by itself, spending tens of times faster than the previously used manual or CAD-approach and, most importantly, is guaranteed to identify all the places.

Building of the school of higher musical New World in Miami (USA) Architect Frank Gehry designed the technology BIM. It separately shows the components of a single model: the visualization of the general form, the outer shell of the building, supporting framework, a set of engineering equipment and internal organization of space

Unlike traditional computer-aided design systems, creating geometric figures, the result of information modeling of the building being erected is very often the object-oriented digital model of the entire structure, in which it can simulate the process of organizing its construction.

If the creators of the model do not set the task of organizing the process of construction of the building, based on the information model it is much easier to obtain than the traditional approach (Figure 1).

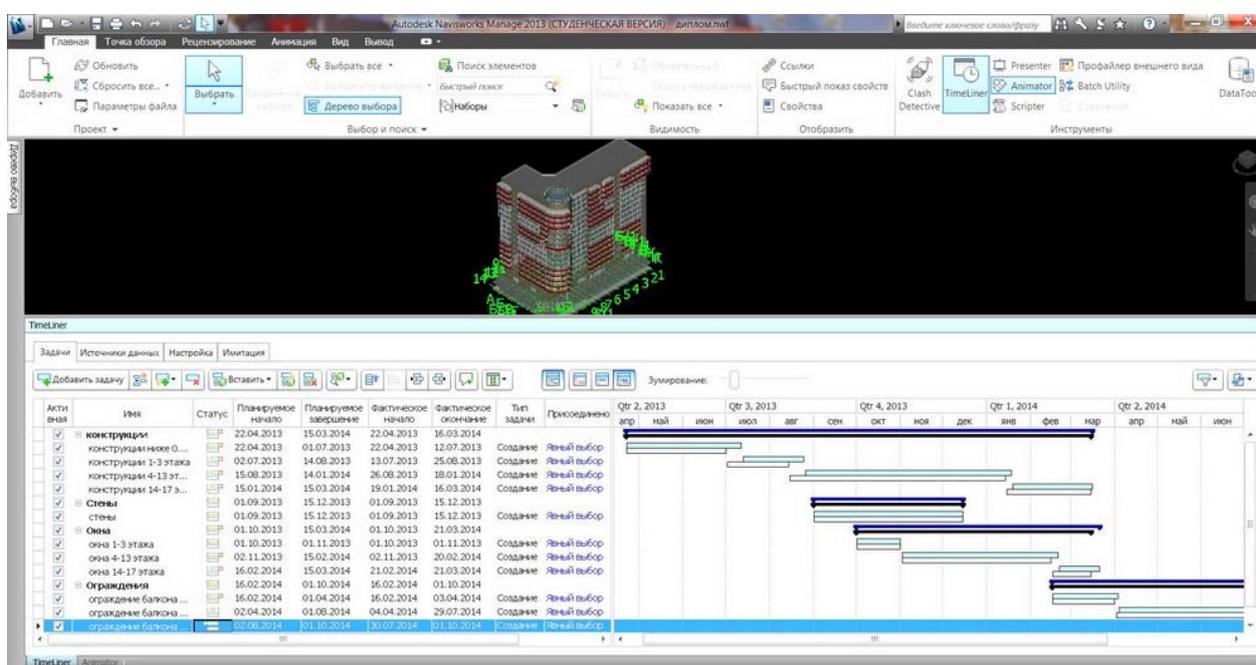


Figure 1. Schedule of construction of the building on the basis of the information model. Work in Revit Architecture and NavisWorks.

Several characteristics distinguish BIM from traditional computer models of buildings:

**The exact geometry** - all objects are set reliably in full conformity with the real, including internal structure, geometrically correct and accurate size;

**Comprehensive properties of objects** - all objects in the model, have certain predefined properties (properties of the material, the manufacturer code, the price, the date of the last service, etc.), which can be modified and used to fill in the model itself and through special file formats (e.g., IFC) abroad;

**The wealth of semantic relationships** - in the model are given and taken into account when considering such a relationship of mutual submission and connection components as "contained in", "depends," "it is part of something," etc.

**Integrated information** - model contains all the information in one central location, thus ensuring its consistency, accuracy and availability;

**Lifecycle** - model supports data during the period of design, construction, operation and disposal building.

Most often, work to create a building information model is carried out in three stages.

**The first step.** BIM is an object-oriented technology. First blocks (family) are developed - the primary elements of design that correspond to the construction products (windows, doors, floor slabs, etc.) and items of equipment (heating and lighting, elevators, etc.) and much more other that have a direct relation to the building, but produced outside the construction site and the design and construction of the object is used as a whole, and not divided into parts.

**The second stage** - modeling that is created on the site. This is the foundation, walls, roofs, curtain walls, and more. This assumes the widespread use of pre-existing (in the first stage, which, incidentally, can be carried out in parallel with the second) elements, such as framing, or fixing parts in the formation of curtain wall of the building.

**The third stage** - the further use of information created in the second stage model in a suitable format (for this purpose specially designed format IFC) in specialized applications for solving specific problems related to the design of the building.

The logic of building information modeling, incomprehensible to the most of the designers and builders of programming and corresponds to the usual understanding of how to build a house, how to equip and how to live in it. This significantly facilitates and simplifies work with BIM is the designers and builders of all other categories, as well as owners, managers and operators.

With regard to the division of the stages in the creation of BIM, it is rather conditional that this work can be carried out almost simultaneously.

It is always possible to insert windows in the simulated object, and then on again appeared reasons to change windows.

The built expert information model of the projected object becomes the basis for specialized information in its various parts, components or sections. It is widely used to create all kinds of working documentation, development, manufacturing and calculating the parameters of structures and parts, complete set of objects, ordering and installation of technological equipment, economic calculations, the organization construction of the building, the construction of financial security, as well as solutions to technical, organizational and economic questions of the subsequent operation.

One of the most impressive examples of the integrated use of BIM in the construction of a large, technically complex and very important object is the new building of the American Higher Music School New World Symphony in Miami. The design of structures using BIM technology began in 2006, building in 2008, and commissioning in January 2011, as planned (Figure 2). (<http://www.autodesk.com/solutions/building-information-modeling/overview>)



*Figure 2. Construction of the new building of the American Higher Music School New World Symphony and the future exterior and interior views*

This building has a total area of 10 000 square meters, the main hall can accommodate 700 spectators. It is adapted for webcasting and recording of concerts, as well as external video projections of 360 degrees. Its top floor has a music library, Studio conductor, as well as 26 individual rehearsal auditoriums and 6 for rehearsals of a few musicians. The estimated cost of the project was \$ 200 million, the final, which is the result of work in BIM is \$ 160 million. (<http://www.avisotskiy.com/2013/11/BIMRevit.html>)

Designing such an object carried out in a relatively short time, it has been associated with a lot of the most diverse and highly complex calculations performed by the building information model, and once again clearly demonstrated the effectiveness of the technology BIM (Figure 3).



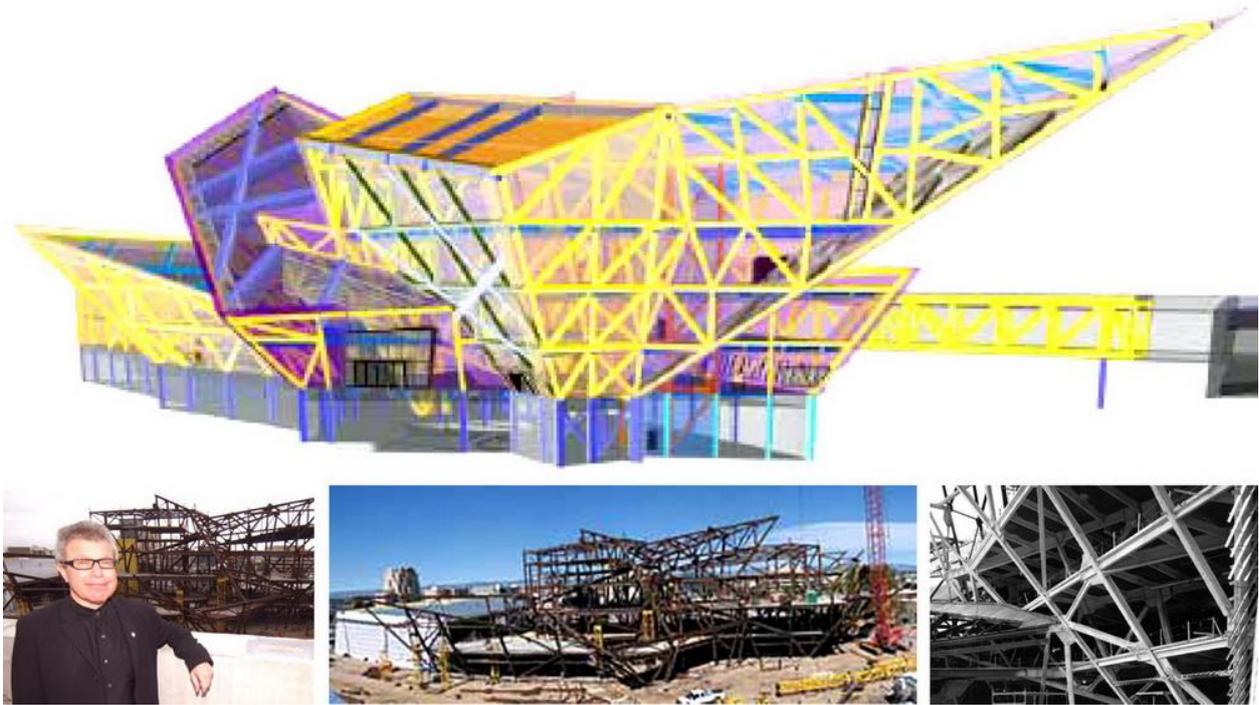
*Figure 3. Higher Music School New World Symphony: the main entrance. Architects Gehry Partners, 2010.*

Building information model can exist throughout the life cycle of the object, or longer. It contains a variety of data which can then be modified, supplemented and replaced to reflect the current state of the building.

Such an approach in the design, when an object is seen not in space but in time, that is 3D plus time, often referred to as 4D, and 4D plus information (value) to denote already 5D. While on the other hand, in a number of publications under 4D can understand 3D plus specifications, but this happens less and less.

BIM technology has already shown the ability to achieve high-speed, volume and quality of construction, as well as significant savings in the budget. For example, in the construction of

complex shape and interior equipment of the new building of the Museum of Art in the US city of Denver for interaction subcontractors for the design and construction of the building frame and the design and installation of plumbing and electrical systems it has an information model especially created for this object has been used (Figure 4).



*Figure 4. Art Museum in Denver (USA), Frederick S.Hemiltona building. The computer model and the construction of the building frame. Architect Daniel Libeskind. Tekla Structures software.*

According to the general contractor, thanks to the organizational use of BIM (model was created for testing and optimizing the interaction of subcontractors work schedule), shortening of the construction period is 14 months, and this has resulted in savings of approximately \$ 400 thousand at an estimated project cost of \$ 70 million. (Figure 5). (<http://www.avisotskiy.com/2013/11/BIMRevit.html>)



*Figure 5. Art Museum in Denver (USA), Frederick S.Hemiltona building. The final appearance. Architect Daniel Libeskind, 2006*

One of the main achievements of BIM - new possible "intelligent" efforts to achieve virtually full compliance with the performance of the new building of the customer's requirements, before the start of its construction. This is due to the fact that BIM technology allows a high degree of certainty to recreate the object with all structures, materials, engineering equipment and its processes and debug in a virtual model of basic design solutions. In other ways such a check on the correctness of design decisions is not feasible - it will simply build a model of the building in full size. In the past and modern times, and occasionally it happens - the correctness of the design calculations is checked for an already created object when the

corrections would be almost impossible. In the previous history of building there were many cases when after construction of the building its real characteristics were corrected or impose restrictions on the conditions of its operation.

It is particularly important to emphasize that building information model - a virtual model, the result of the application of computer technology. BIM is a virtual copy of the building.

At the initial stage of creating the model, there is a set of information that is almost always incomplete, but sufficient to get started in the first approximation. Then it's introduced into the model information updated and corrected as it becomes available, and the model becomes more accurate and intense.

The process of creating an information model is virtually continuous, because it can have an unlimited number of "clarifications". A building information model itself is very dynamic and constantly evolving education, "living" an independent life. It should be understood that BIM physically exists in computer memory, and it can be used by the software, in which it was created.

### **3 General provisions of BIM in Russia**

#### **3.1 Impact on the implementation of BIM in Russia**

In the world practice there are well known examples (Walt Disney Concert Hall in Los Angeles, One Island East skyscraper in Hong Kong, the Olympic venues in Beijing, and others) when the complex or partial use of building information modeling leads to a reduction in terms of design and construction and reduces the cost of construction of facilities.

No one has ever refused to reduce the turnaround time, improve its quality, reduce production costs and increase profits, seemingly obvious advantages of BIM, and it must be unanimous and rapidly implemented in the design and building practices worldwide.

Surveys conducted by the American company McGraw-Hill Construction in 2009 in the construction industry in North America showed that something like this happens:

Almost half of the organizations (more precisely 48%) are already using the BIM in their operations. In the pre-crisis 2007 such companies amounted to 28%.

([http://isiCAD.ru/ru/articles.php?article\\_num=14060](http://isiCAD.ru/ru/articles.php?article_num=14060) )

All users of BIM soon plan to significantly increase the share of this technology in their operations.

The vast majority of respondents directly link their business success with the introduction of BIM technology.

These results, on the one hand, show that BIM is mastered successfully in the USA and Canada. On the other hand, specialists of these countries consider that the growth rate could be much higher. And for America to preserve its role as a world leader in the construction industry simply must be higher.

A similar understanding in Europe. And throughout these regions consistently taken efforts of both the state and interested in the success of the industry associations of private a well-designed companies and organizations, experts on the further introduction of technology BIM.

In Russia, the mass introduction of BIM is still generally not observed. To be more precise, the development of BIM going on, but very slowly and little, is essentially local character and wasn't stimulated from government.

As is often the case when introducing something new, there are both positive and negative examples. Therefore periodically there are various rumors and speculation about the futility and "hazard" of BIM, based usually on ignorance, misunderstanding and their own inability.

Building information modeling is a new technology. The amount of experts is not enough. All the users are mostly classified as beginners.

The already cited US study in 2009 found out that 41% of the respondents believe that after the implementation of BIM their income increased, and 12% - that diminished (and 28% did not know that they can have a profit). At the same time 41% believe that BIM does not change the number of employees, 21% - after the introduction of BIM requires less staff, and 13% - requires more staff. Finally, 55% believe that BIM allows to reduce the cost of the project (39% believe that the decline is more than a quarter) and 30% - that there is no decline. ([http://isiCAD.ru/ru/articles.php?article\\_num=14060](http://isiCAD.ru/ru/articles.php?article_num=14060))

### 3.2 Objective need for BIM for the design and construction process.

It is well known that the farther goes the design process, the more difficult in the art to make a correction. And when the project is completed, and it comes to the construction, the painless change is virtually impossible. But if it needs something to change, the cost of these changes, on the contrary, is growing rapidly as the completion of the design and construction of the building. This situation is schematically shown in Figure 6.

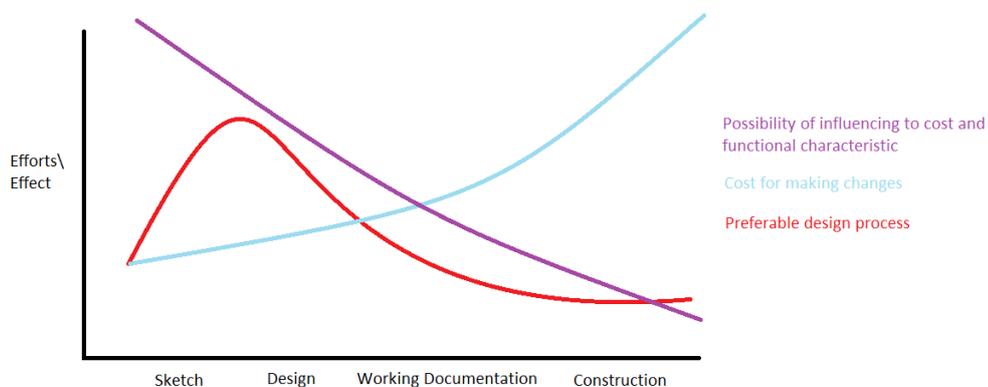


Figure 6. Curve of most effective efforts to design a building, depending on the stage of the work.

Curve graph distinguishes the most effective efforts to develop the project of the building - the preferred design process, when the costs of changes are minimal, and the result of these changes is the most significant.

The primary reason for the emergence of BIM was the desire to create a technology in which the design process would go the way of the preferred schedule 3 in figure 7.

The introduction of BIM is a strategic issue of fundamental importance for the further development of the whole industry, and timely decision - an objective necessity.

### **3.3 Domestic economic factors**

It is required to analyze what happens when the design organization, applied CAD-design technology, moves to BIM.

If it does not suggest the need to replace computer equipment (assume that computers in the organization are good and moral service life has not expired), it is necessary to carry out the following steps:

- new computers with BIM-program
- train staff to work with new programs
- create own design templates and project documentation for the new programs, the necessary library base, converted into a new format that most of the old practices and take other steps to transfer the design process for the new technology.

It should be understood that the full effect of the introduction of BIM will be achieved if all the experts of organization switch to the new technology.

It is natural that in such a transition worker productivity at first is sharply reduced (the process of development, training and skills developments, just getting used to the new), and then gradually increased, eventually reaching a higher level. As taken from different sources to expert estimates, the period subsequent smooth recovery in labor productivity is about 3-6 months, with the growth of labor productivity in the case of transition from CAD to BIM is an average of 30-50% (in cases up to 100%) (Figure 7).

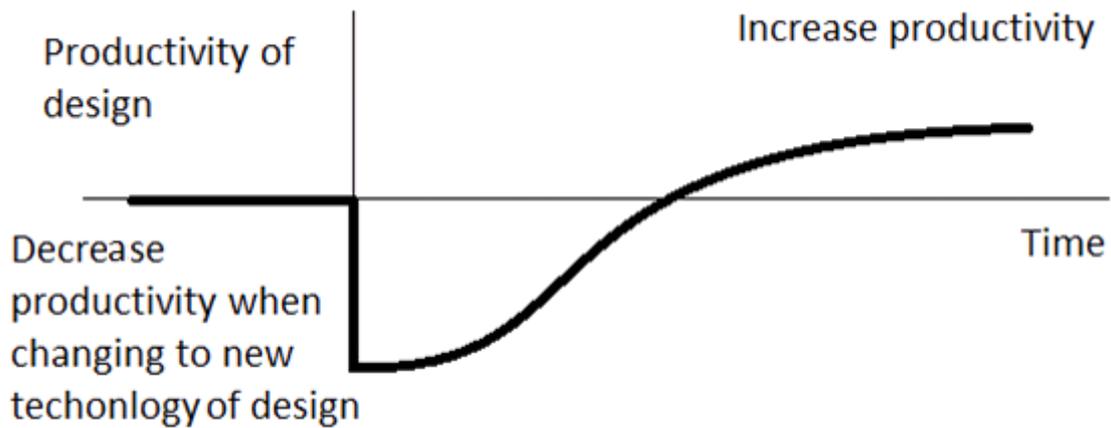


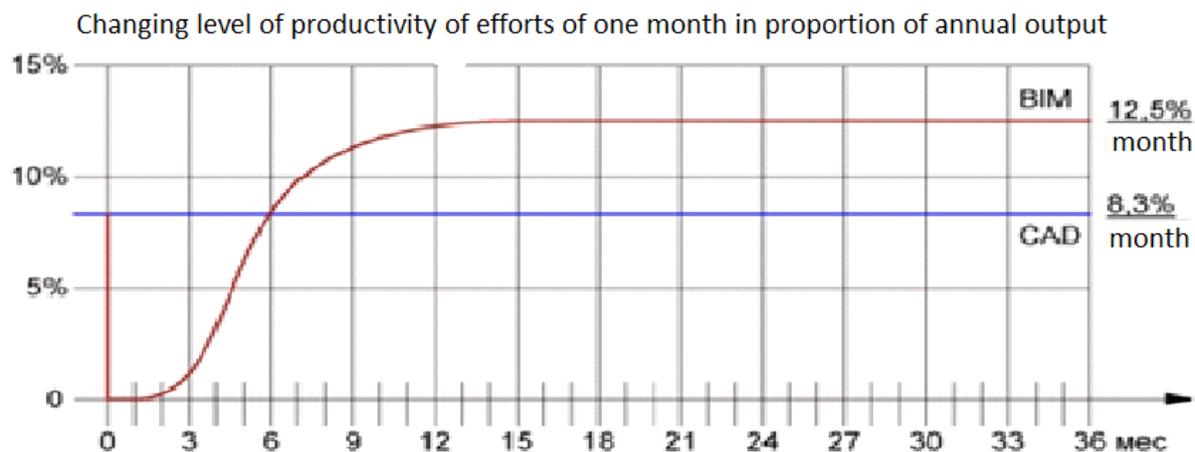
Figure 7. The qualitative nature of the change in labor productivity of designers during the transition to the new software.

Russian researcher Igor Kozlov has analyzed the economic impact of the introduction of BIM on the example of a typical medium-sized engineering company.

To determine the cost of acquisition of new programs has taken the value of the required number of specialized jobs complex Autodesk Revit as the most effective and affordable in Russia BIM-tool technology today.

The maximum level of increase in labor productivity in the first year was taken as 30% (still a need to develop standard methods of work, establishment of reporting forms used by elements libraries, etc.), the period of the output to the maximum level - 6 months? training period - 1 month . In the second year (when used with established developments) the level of increase in labor productivity is supposed to be 50%. (Основы BIM: введение в информационное моделирование зданий, р.231)

The process of changing the level of productivity for the received settings is as follows (Figure 8).



Volume of executed work in proportion of annual volume

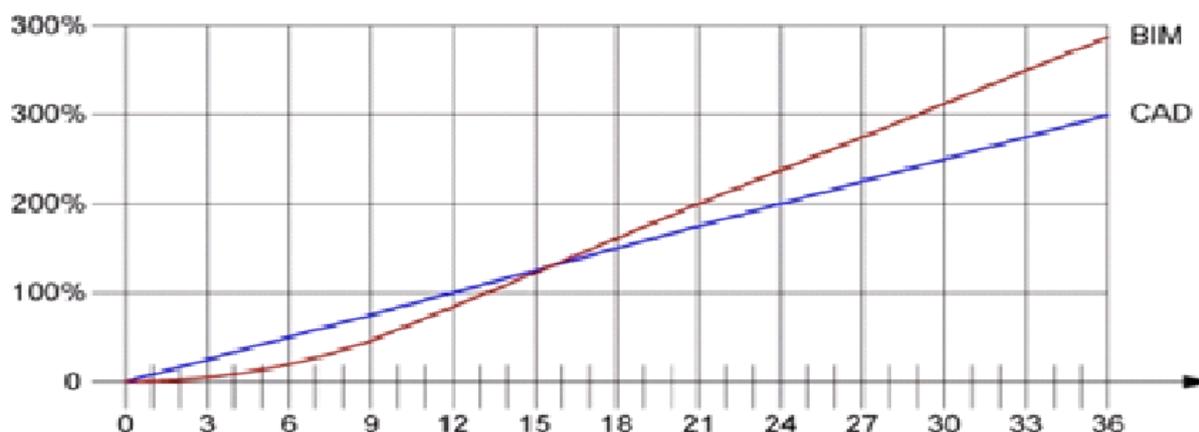


Figure 8. The calculation results are changes in the level of productivity and the amount of work done (100% equals the annual output). (Оснoвы BIM: введение в информационное моделирование зданий, p.230)

The calculations have shown that approximately 15-16 months after the transition to BIM technology the engineering company can get the same amount of work done and continue to operate with greater efficiency, while increasing wages and the overall profit.

### 3.4 Human factor

There is always the human factor, which can make any significant changes.

It would be right to consider the human factor at two levels: the immediate perpetrators in the workplace and the heads of their units, on the one hand, and the top managers of the project organization on the other.

Ordinary employees psychologically may resist the introduction of something new, because it requires effort on the development of certain changes and the normal rhythm of work. In such a situation, the ability to hide or explicit resistance to innovation is normal. But all this is solved with the right motivation. If an employee is really interested in the success of the company, he would do everything for this success.

There are cases where during the period of crisis the designers are left without work and wages, spend downtime to increase their professional skills, the development of BIM-programs and prepare the ground for future work on a new level.

That is, they volunteer, free and conscious, on their own initiative (approved by superiors) to carry out part of the program for the implementation of BIM during downtime, creating a foundation for future leap forward, because they firmly link their future activities with the current place of work.

So with great certainty it can be argued that an ordinary staff in the project organization with the right motivation to work can develop technology BIM.

At the level of management of the organizations it is somewhat different.

In practice, this usually means that the decision of the management of the staff transferred to the new technology "on the job", i.e. before lunch master BIM, after lunch returning for CAD, and all this without compromising the requirements of the volume of work (for half a day is necessary do daily rate) or planned to reduce the amount of work while reducing wages. In other words, all the hardships associated with the transition to the new technology are passed on to workers.

In this case workers will not try severely it is more important for them to maintain their level of income. A BIM technology they can be seen as the enemy, interfering with their peaceful life, and then perhaps counteract the introduction of new technology at the level of the performers with all the ensuing consequences.

Observations show that in such cases, there is nothing good for design organizations with the introduction of new technology (not necessarily BIM, any technology) is not obtained.

One option is that it should move to BIM is not the whole organization at once, but by parts. But this is the case, if it is possible to allocate a stand-alone unit or group of employees that provide complete technological cycle of the project.

The drop in productivity in the group of people has less impact on the entire organization, and the rest will then be easier to move to BIM - support in the team is already there. But it is when the engineering firm is medium sized. If it is small it is better to move all at once.

Another tip - to hire one or more employees, have to extent familiar with the technology of BIM. For example, students or graduates who are familiar with software for building information modeling. When this is not important that they do not have practical design. In the team they will be the catalyst that will speed up all the processes of transition to BIM.

A third suggestion is to bring the transitional period to help the team of experts of consulting and innovative companies, the so-called BIM-consultants. In the area of design and construction technology in Russia, such companies are still small, but they already exist.

Well-known examples of using BIM show that all cases of successful transition to the new technology of design are achieved through the proper combination of (better - all at once) these factors.

To summarize, economic prerequisites for successful implementation of BIM in the project activities are always available, a proper understanding of the management and key personnel of the objective laws of implementation - the key to success.

### **3.5 External economic factors**

If a customer receives the usual documentation (paper) form from designers and sends it to the builders to perform, he does not care what technology (CAD, or BIM, or with a compass and straightedge) the designer uses.

Interest appears if designers and builders also associated organizational and technological, that is, when implemented schemes and forms of joint activities on a common object.

The USA is now the most advanced and organized design and building market. There are negative economic effects and fear of losing their share of (very considerable), the world market has long been forced to actors' customer - the designer - the contractor "to seek the

most rapid and efficient ways of working, allowing not to leave the framework of the planned time and budget.

The main type of contract in the American and international construction industry has long been considered Design / Bid / Build (or Competitive tendering), translated as to develop / promote / Build and independently of the selection on a competitive basis for all project participants.

This approach has long had a definite plus, especially in competition between firms wanting to work on the project. But viewed an obvious drawback - the lack of the necessary coordination between design and construction companies that participate the project could never do business.

To resolve this problem in the late 1990s in the United States there was on a trial basis to practice the project under the scheme Design / Build, which means Developed / Constructed, i.e. the development and implementation of the entire project by the combined design and construction company.

To do this, set up a special institute Design - Build in the form of associations of interested organizations which develops all the necessary technical and co-ordinates legislative base implementation of this method of construction (such a coupling requires coordination with the antimonopoly legislation).

The result of this work has published in June 2008 list of 100 major US companies, practitioners of scheme Design / Build, including all of the largest US contractors.

Dissatisfaction with the general state of affairs in the construction forcing American companies to look for other alternative means of work, including with the involvement of the special PM or CM-businesses, developing and supervising the implementation of individual programs and the entire course of construction. The aim of such firms is an effective control work schedule and compliance with estimates.

According to experts, the involvement of such organizations or individuals brings the customer a significant time and cost saving (from 5 to 20% of the project cost).

It is easy to note that both of these new approaches is interested in an integrated design and construction activities based on BIM. It can confidently shows that the American construction industry since the late 1990s turned toward strategic BIM.

The revenues for most of the leading construction companies in the US are generated by about 75% by international contracts (data for 2007). Taking this into account, as well as high credibility of US companies in the global market, it can be argued that other countries will follow the path of mass implementation of BIM.

([http://isiCAD.ru/ru/articles.php?article\\_num=14078](http://isiCAD.ru/ru/articles.php?article_num=14078) )

In Russia, the complex design and construction companies are also developing. And there is hope that this form of organization of the construction business will seriously contribute to the implementation of BIM in Russia.

### **3.6 BIM standardization**

Now the world is growing as the sheer number of computer programs that implement BIM, and the number of users of these systems.

But mass adoption of BIM requires the creation of conditions for the possibility of applying different BIM-programs into a single complex, or to go from one program to another. All this presupposes the existence of a common standard for the projects (models), performed by technology BIM.

This understanding led to the emergence, the so-called International Alliance for Interoperability (IAI) of in the United States in 1995, to unite the construction professionals and software developers from 17 countries.

The alliance engaged in the development of standards to create an environment that enables users to seamlessly migrate their design data or objects from one program to another independent participant of process during the entire life of the project, which allows, in particular, architects, designers and builders to bring together their concept of the construction of buildings. This compatibility (in modern terms - "interoperability"), is very important for countries with close co-operative construction or other industries as it significantly increases the economic efficiency of these sectors.

Similar work is being done in other countries, for example, in Singapore, a verification system of three-dimensional objects for the automated control of the executed projects for compliance with the requirements of the regional design standards. And a project or part of it may be once or repeatedly translated to the corresponding automatic checking and rechecking in the Internet.

Leaders of the Department of Construction of Singapore believe that the introduction of information technology for checking the design decisions will improve the quality and reliability of constructed objects, as well as increased productivity of experts.

Since late 2003, began a similar process in the United States. There major contracting authority and the owner of the federal property - US General Services Administration (GSA) has put forward one of the conditions for obtaining an order for the federal design of the presentation of these objects in its final form in the form of three-dimensional computer model, supported by standard National 3D-4D -BIM Program, supervised by GSA. In other words, there are already incentives for the implementation of the legislative building information modeling.

In parallel, there was also a standard NBIMS, developed alliances building Smart and the US National Institute of Building Sciences (NIBS) as a structural basis on which since 2005 they are also developing its practical implementation in the form of standard IFC.

Today, IFC is a neutral, open and object-oriented file format for interoperability in the engineering and construction industry, registered as the International Standards Organization ISO / PAS 16739. It has several varieties (IFC 2x3, ifcXML and others), also received the encoding ISO.

Now the IFC format is used in almost all the leading BIM-programs and has become the most popular in the building information modeling. Major engineering and construction companies, including the state, several countries (e.g. Denmark and Finland) have already done IFC mandatory standard for all of their projects ([www.3dsolution.com](http://www.3dsolution.com), 2014).

Later the rest of American architects are involved in the creation of standards for BIM actively, as they are seen in the spread of BIM potentially possible reduction in its role as a leader in the implementation of the construction project.

For architects it is understood that the owner, BIM, begins to take on the role of chief coordinator of construction. Therefore, to keep already received and approved two standard forms of electronic data transfer between the project participants, which eliminate the doubts of the designer object the possibility of misinterpretation of data transmitted and protect authors from the unauthorized use or theft of its intellectual property.

There is clarity that interoperability is a prerequisite of successful implementation of BIM in the world of design and construction practice.

In Russia, where building information modeling is still in its initial stage of implementation, and local programs working on this technology, processes for making BIM standards have not yet begun.

Companies that have deployed BIM exist in Russia, as their projects are created and implemented there. The world experience is useful to us, and to delay the development of the Russian rules for building information modeling is not necessary.

### **3.7 Positive part of BIM**

The presence of objective factors is a prerequisite but not a guarantee of transfer of design and construction industry to the technology BIM. Of great importance are the quality and timing. And the problem is international.

Here are examples, which at one time were a revelation to American experts and served as an additional impetus to their activities on the implementation of BIM:

**The first example.** One obvious advantage of using BIM - reduction of terms and cost reduction required for budgeting. In the US, the total cost of computer equipment of one workplace estimator is comparable to two of monthly salary. Another salary to spend on training to work in the technology of BIM.

So, as of 2007, the construction industry employed 115,000 US estimators.

**The second example.** Computer design and transfer files to other participants of the project can significantly save on time exchange of data and the cost of this exchange.

Despite of this, according to 2007 US construction companies have spent about \$ 600 million for sending working documents in paper form by mail fast FedEx.

**The third example.** Until now, the design and construction industry's leading countries of the world about 70% (according to different countries, these figures fluctuate) engineering firms do not use three-dimensional possibilities of CAD-programs.

Today the Russian construction industry is, to put it mildly, somewhat below the level of development of the construction industry in the United States in 2007. So, for Russia, these problems are more relevant.

### 3.8 The final conclusions

Like any new business, the mass introduction of BIM in the design and building practice is a long process, complicated and contradictory. It basically goes on general law for such processes. There is issue of time. The time to start implementing BIM took relatively little - in fact ten years ago the broad masses of the designers had not heard about the term BIM.

Returning once again to the study conducted by McGraw-Hill Construction, if it is logical all the respondents were divided into beginners and those who already have good experience with BIM.

These two categories of staff tried to figure out how, in their view, BIM technology is effective for a specialist.

The resulting difference in the answers is very revealing and speaks for itself (Figure 9).

<b>Plus of BIM for own work</b>	<b>Beginners</b>	<b>Experts</b>
Growing income	7%	43%
Decrease time of routine operations	14%	58%
Decrease amount of reworks	23%	77%
Easy work with clients	19%	61%
Offer new products	28%	72%
Economic calculation for new clients	28%	71%
Increase work production of specialists	46%	71%

*Figure 9. The difference in the recognition of the effectiveness of BIM for their own work novice users and experts.*

This again suggests that the introduction of BIM is desirable to help attract more experienced staff members, or BIM-advisors - their services are fully justified.

([http://isiCAD.ru/ru/articles.php?article\\_num=14078](http://isiCAD.ru/ru/articles.php?article_num=14078))

### **3.9 Implementation of BIM into housing and communal services**

Russia inherited a huge housing stock, previously almost completely state-owned. Now it, being already in different forms of ownership, requires constant maintenance and repair. The situation is complicated by the fact that over the past twenty years, the so-called "transition period", major repairs of residential buildings almost never did, in most cases, technical documentation for buildings partially or completely absent.

Periodic paper "certification" of residential buildings to determine their need for repairs is very time consuming and inefficient, as it requires the passage of time manually sorting and refinement of all previously collected information. In such a situation it is quite logical to replace paper passports of buildings on their information models.

Benefits of the introduction of BIM in housing:

1. Using a building information model of the object instead of the usual passport allows a computer to store, search, and then analyze the information gathered. The result will be the exact condition of each building, that is not used now.

2. The existing model allows for capital improvement projects of common property in multifamily housing.

3. The use of this technology makes the project:

- exact (the number of design errors reduced to almost zero)
- transparent (the project itself and all stages of its implementation at any time available for monitoring by both the performers and the tenants, management companies and the parent bodies)
- well cost-calculated (accurate estimates by the model, which are easily changed by adjusting the project)
- allows to organize well repairs and supply of construction site materials accurately specify all relationships with suppliers, in particular

- allows to precisely control the phased funding of works
- allows to control the daily work schedule, on completion of all of the information about them remains in the building information model (electronic passport object) and may be considered in the further operation of the house
- more flexible in case of making any changes, it is easier for the other houses replicated similar series.

The introduction of BIM in housing will require large investments: creation of computer jobs, training and, most importantly, developing BIM for each residential building specifically. But, in Russia, where in previous years, widespread types of housing, to work with the existing housing stock will need different information models (Figure 10).



*Figure 10. The reconstruction project of the standard five-story building.*

Secondly, every year on the program of reconstruction the country huge amounts of money are allocated, a small portion of which would be enough for a gradual transfer of utilities for BIM.

Thirdly, all developers with the introduction of a residential building in operation to transfer the relevant authorities and their information model (made on a pre-specified rules), then in the future the need to create such models simply disappears.

Finally, based on international experience and assessment of Russian experts, the introduction of BIM can give up to 30% of funds allocated today for major maintenance of the housing stock of the country.

After all, if the model shows that to repair the building heating system required 1,000 meters of new pipes, the account for 2000, no one in the organization that represents the interests of tenants. With the current state of affairs there is now an expert with access to relevant documentation and a sufficient level of skill can to verify these figures.

Region or neighborhood or a single house in implementing BIM and control on the part of the owners or tenants of savings funds for the repair, compared with the current conditions expected to is better. A control on the part of the owners can be effectively implemented primarily through access to the building information model by a special Internet service. (Figure 11).

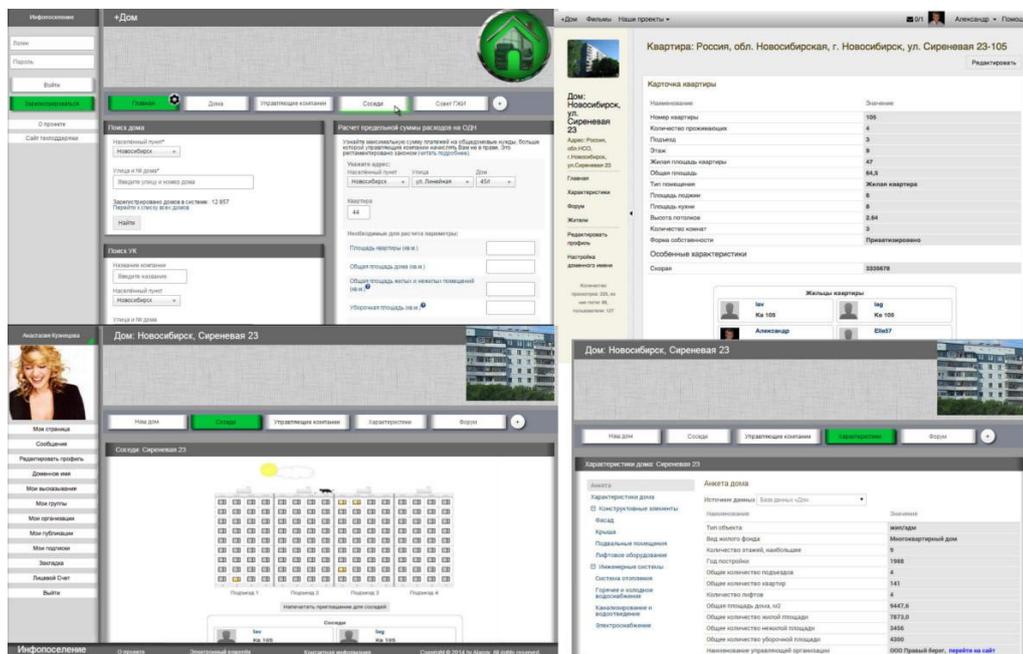


Figure 11. Interface portal "Infoposelenie": information about the house, apartment, neighbors, the management company and much more.

## 4 BIM implementation in Russia

### 4.1 BIM-leaders in Russia

Autodesk announced the first winners of the title of BIM-leader in Russia. They were domestic architectural and construction companies and experts who have achieved outstanding results with the help of technology BIM, a unique experience of its application in Russia and are willing to share their knowledge with other members of the architectural and building community. The first BIM-leaders have been named the company Etalon Group, Project Portal, SPb Renovation, Sibtehproekt, SODIS, Legion project and industry experts.

BIM-leaders become members initiated by Autodesk BIM-club leaders, whose activities will focus on the development of the practice of BIM in Russia - the interaction with the government and universities, the development of templates and standards, the dissemination of knowledge about the practice of using BIM. The club will operate in conjunction with dense BIM & IPD group established to promote the BIM in the construction industry, in cooperation with the state.

The first meeting of the Club of BIM-leaders has already taken place within the Autodesk University Russia 2014. Invited expert at this meeting was Nisbet Nick (Nicholas Nisbet) from the British BIM Smart Group, which is shared with the participants vision of the development of the discussion of BIM to 2025. In particular, it was talking about BIM Level 4, the so-called social BIM, which takes into account and plans facilities under construction a positive impact on their surrounding social environment.

The meeting of BIM-leaders will be held on a quarterly basis. The activities of the club will not be an incentive for the growth of the efficiency of the architecture and construction industry, but also will be a great help in business development companies of the club members: Autodesk customers are increasingly turning into large developers, who want to get the project format information model, rather than a 2D-drawing. Creating a pool of potential contractors able to work on the technology BIM. Besides being able to get a big project, BIM-Club leaders are interested in companies and experts as a platform for exchange of experience, which should enrich them with new ideas and improve their professional level.

## 4.2 Exchange of experiences in the competition

In the old days in Russia there was an extensive system of exchange of best practices in various areas of production activities. But in our time, such a system will certainly help those representatives of design and construction industry who are just beginning to learn BIM technology and are constantly in need of valuable hints and tips.

However, it was formerly socialist economy to the command center, now - capitalist, based on the principle that everyone is working on. The natural question arises, how much is it possible in general to exchange experience in a competitive environment.

The first answer: it is impossible. Indeed, why should any company already having achieved success in the development of BIM, strengthen its position in the market and rise to the next step of development, to share their ideas with competitors, technological discoveries, new organizational methods, for money. It is the competition. But the logic of the business from the perspective of one of its members is always very simple, it is better to have less competitors.

There are cases where the organization is open to talk about their achievements, because they feel confident enough and understand that the image of the company to successfully introduce new technologies strengthens its position in the market and brings new orders.

But there is almost an universally observed interesting phenomenon: as soon as one of the panelists come to the realization that BIM is good, it is usually silent.

This also makes good sense and natural logic of business - how to convince those who have not yet realized that it is clear.

Therefore, if count the number of firms that participated in the debate, and then began to quietly watch the picture of understanding the importance of BIM in Russia becomes more optimistic.

But besides themselves there are engineering firms and their employees. Over the years in the market economy, these people have learned well that if today it work in a company, then tomorrow it can be, to put it mildly, in the other company. In this case, the main significance of place for such a person comes out of own professional qualifications, which is a certain guarantee of his future well-being of life.

Then the relationship between employees of different firms may be fundamentally different from the relationship of employers and the organizations themselves. Since mastering new technologies, people raise their own professional level, that is, work not for the company but also for themselves.

Therefore, the staff (in other words end users) is quite willing to talk to each other, passing their experience and the development of BIM in return for the experience of others.

Currently, the development of BIM has an interesting situation: planning organizations and their leaders do not want to share their experiences with others, and end users, and many are doing it with great pleasure.

But there is a third party - software vendors. They are most interested in the fact that knowledge of BIM-experience programs and their use as widely as possible and more deeply is penetrated in the company, and to ordinary users.

To do this, vendors and dealers actively carry out various forums, seminars and conferences where these experiences and exchange, assisted educational institutions and user communities, organizes various competitions for students and professionals, produced a special literature supporting sites, etc. (Figure 13).



Figure 12. "Autodesk Forum 2010" in Moscow had 1235 participants.

For the successful sales of their BIM-software the developers should not just produce good programs, but also raise the design and construction industry to a new technological level. The future of BIM in Russia also depends on its activities.

### **4.3 BIM in new wave. Situation In Saint-Petersburg**

Company PSS held in Saint-Petersburg conference «BIM in practice of reduces of the risks of investment and construction projects.». The event brought together about 200 heads of construction and design organizations, as well as management and development companies. The conference participants discussed the most exciting questions in an era of change: the potential use of information modeling of buildings and structures in a difficult economic situation, as well as regulatory changes.

Presentations by experts, including representatives of the companies included in the number of BIM-leaders focused on the most pressing issues of the use of BIM in practice, and above all its economic component.

The term BIM at first glance seems very complex and everything related to the investment and construction companies, has recently become very foggy, so one of the major challenges facing us today, to make our business as transparent as possible. And BIM - this is the tool that can help to achieve this. BIM - it is not a picture in 3d, as many still think. The model itself is, of course, important, but BIM allows it to get much more: it is a complete solution, with which it can improve the quality of the project, to reduce the terms of its sales and cost, improve resource management. And clever customers already understand it, and therefore require the use of BIM - all players of the construction industry need to be prepared for it. Technical, but in reality this is just about money, which is so concerned about all of us, - says Vyacheslav Semenenko, vice president of the Russian guild of managers and developers, managing partner of KB VIPs.

([http://www.pss.spb.ru/press/news/Reliz\\_BIM\\_na\\_praktike\\_2015.html](http://www.pss.spb.ru/press/news/Reliz_BIM_na_praktike_2015.html))



*Figure 13. Vyacheslav Semenenko, vice president of the Russian guild of managers and developers, managing partner of KB VIPs*

«BIM - it is not a revolution, it is the progressive development of civilization. We are gradually going to that generated by our findings will serve not to us. In the near future, each of the participants in the project will make and use the information that is stored in the "cloud" - and have over these clouds will BIM, through which all will cooperate. The demand for BIM can be no doubt: the effectiveness of the technology to minimize the risk seen with the naked eye. The more complex the project, the higher the savings: it can reach 35% in certain stages - and all investors understood that such figures - this is very serious. "- said Krzysztof Pomorski, KB VIPs ([http://www.pss.spb.ru/press/news/Reliz\\_BIM\\_na\\_praktike\\_2015.html](http://www.pss.spb.ru/press/news/Reliz_BIM_na_praktike_2015.html) )



*Figure 14. Krzysztof Pomorski, KB VIPs*

Conference "BIM in practice" has become a platform for discussion and new regulatory changes in the industry. Olga Dashkova, deputy director of the department of architecture and urban planning activities ministry of construction of the Russian federation, online conference, the ministry of construction told about plans to improve the legislation concerning the use of BIM in the construction industry, as well as answered questions from the participants.



*Figure 15. Olga Dashkova, deputy director of the department of urban planning and architecture activities of the Russian federation ministry of construction*

"At the moment it is already clear that the penetration of BIM is growing in Russia. When there is a need to find a BIM-projects for "pilot" expertise in the ministry of construction, 25, were found compliant in just 4 days - and this is a very positive sign. Of course, they realize the companies that are changing the industry by example, the overall market, but still it means and what benefits BIM is already clear to many. While Russia, unfortunately, lags behind countries with a high penetration of BIM, but it need to understand that in order to participate in international projects and deliver our competence in the construction of the export, this technology is a must. "- said Anastasia Morozova, director of business development in Russia in the direction of architecture and construction company Autodesk. ([http://www.pss.spb.ru/press/news/Reliz\\_BIM\\_na\\_praktike\\_2015.html](http://www.pss.spb.ru/press/news/Reliz_BIM_na_praktike_2015.html) )



*Figure 16. Anastasia Morozova, director of business development in Russia in the direction of architecture and construction company Autodesk*

One of the issues which have caused the greatest number of performances was the presentation of the NCC company's experts. They presented a number of projects implemented with the use of BIM, as well as the shared experience of cooperation with Russian and foreign contractors and customers. Also, a lot of questions caused by the representative of the company A2, for which significant driver of business development was precisely the technology BIM.



*Figure 17. Boytsov Alexander, head of the design, company NCC.*

In the conference "BIM in practice" the participants had the opportunity not to hear presentations by experts, but also to obtain answers to their questions in private conversations and in public debate. As it turned out, one of the most pressing issues was a move to BIM and the sequence of the introduction of this technology. Experts noted that the best approach is project by project implementation, through which there is a smooth transition to a new model of interaction within the company and with customers, suppliers and partners.

"Our conference - one of the largest platforms where professionals can receive answers to them arising in connection with the BIM questions from leading experts and practitioners. - we see that the interest in the use of BIM is growing as the number of those who are already working in BIM. GCC was one of the first who began to promote BIM in Russian, and are happy to see the results of our work. In the future, including through the initiatives of the ministry of construction, BIM demand will grow, and therefore, the Russian investment and construction business will become more competitive both on the local and overseas market" - sums Constantine Biktimirov, PSS.

([http://www.pss.spb.ru/press/news/Reliz\\_BIM\\_na\\_praktike\\_2015.html](http://www.pss.spb.ru/press/news/Reliz_BIM_na_praktike_2015.html))

#### **4.4 Technology implementation plan in BIM industrial and civil construction**

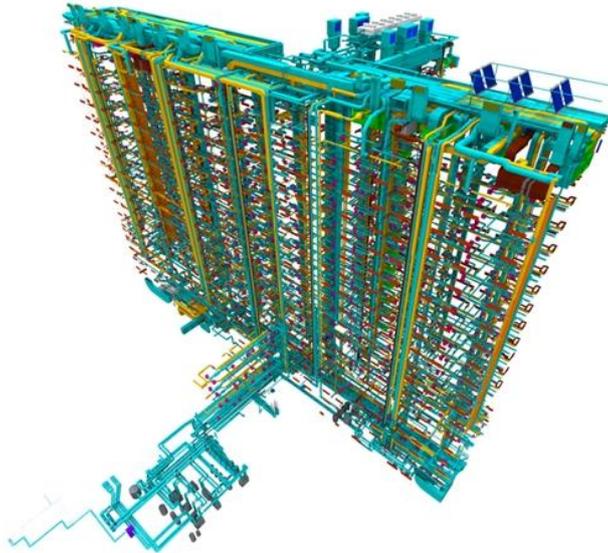
At the end of December 2014 the ministry of construction approved the plan for the phased introduction of BIM in the field of industrial and civil engineering in the design, for up to three years.

##### **4.4.1 December 2014: approval of the plan**

At the end of December 2014 the ministry of construction approved the implementation plan for building information modeling (BIM - building information modeling) in the field of industrial and civil construction. The document was developed in conjunction with Rosstandart, the expert council under the Russian government and other institutions on economic modernization and innovative development.

According to the plan, by March 2015 the expert council under the government of the Russian federation must complete the selection of "pilot" projects, the design of which was carried out with the use of BIM-technology, and in November 2015 - to carry out their expertise in order to establish the requirements necessary for the application of BIM.

According to the results of the analysis at the end of 2015 the ministry of construction intends to prepare and submit for approval by the government a list of legal, regulatory and technical acts, educational standards, subject to change and development.



*Figure 18. One of the selected "pilot" projects*

The results of the pilot projects and the use of BIM-examination of technologies in industrial and civil construction will be reflected in legal acts and educational standards

In December 2017, it is planned to prepare specialists in the use of BIM in the field of industrial and civil construction, as well as experts of the examination.

The Russian developer of CAD "Ascon" has the plan with the ministry of construction - focus of the government and agencies to technology design, but considered that the document submitted by the ministry of construction looks realistic, "after the introduction of BIM in the framework of a single design institute often lasts more than a year not always successfully finishes. This requires a very serious funding and dedicated team to support design tools, creating directories, etc. ([http://ascon.ru/events/?ev\\_id=1219](http://ascon.ru/events/?ev_id=1219), 2014)

BIM is now usually involve a foreign software, which is more expensive. In this connection there is also the question of who will finance a massive shift to the designers of these systems. According to the company, to develop a mechanism to "improve the

competitiveness of the Russian building complex in the world market" is possible when the technology will be available to the masses.

#### **4.4.2 Expected impact**

The Ministry of Construction expects that the implementation of measures for the phased implementation of BIM-technologies will improve the competitiveness of Russian building complex on the world market, improve the quality of research, design and construction of facilities, reduce the cost of the design phase and the examination of project documentation, as well as reduce risks of emergency situations.

The ministry noted that the current practice is increasingly used as architectural design creates a computer model of the new building, which carries all the information about the future of the facility. CAD (Computer Aided Design) technology BIM allows to visualize in 3D-format all the elements and systems of the building, calculate different variants of the laitt, as well as to bring them into compliance with the applicable regulations and standards, to analyze the performance of future buildings, simplifying the selection of optimal solutions.

#### **4.4.3 March 2015: Start of realization**

In March 2015 the Ministry of Construction shows that part of the phased introduction of BIM in the field of industrial and civil construction formulated criteria for the selection of pilot projects prepared using BIM-technology.

Steps for introduction:

- experience of the organization in terms of the implementation of projects using BIM-technology;
- the presence in its staff professionals working with BIM-technology;
- developed by the documents regulating the procedure of information modeling;
- the use of specialists in the organization of the project of a unified information model of the main sections of the project (architecture, design solutions, estimates and others.);
- the existence of organizations to manage 3D-environment with embedded data and an agreed means combining data.

The formation and selection of pilot projects will be the Ministry of Construction of the first stage of the plan for the implementation of BIM-technology in the Russian construction

A further step would be the selection of pilot projects corresponding to these criteria and their subsequent examination.

According to the agency, according to the analysis of examination of selected projects prepared using information modeling in the field of industrial and civil construction, it must be defined list of legal, regulatory and technical acts, educational standards, subject to change or develop.

#### **4.5 The introduction of information modelling, government relations**

The expert community is willing to work together with the Ministry of Construction on the introduction of information modeling (BIM) in Russia.

In Moscow there was a meeting of the BIM-leaders. Expert's architectural and construction market discussed the implementation plan approved by the Ministry of Construction about information modeling (BIM) in Russia and agreed that a contribution to this process can make the company successfully master the technology. As a result the meeting made a priority list of actions required for the implementation of quality BIM in the building industry. This plan is designed to complement and extend the plan of the Ministry of Construction and facilitate the industry transition to modern control technology information about the object construction.

"The fact of the appearance of the order № 926 (APPENDIX 1) of the Ministry of Construction and Housing plan BIM implementation in Russia, a very important event, giving the industry a strong impetus to move in the right direction. However, the steps listed in the version adopted by the Ministry of Construction of the plan is not enough, for the first time. Fully support the active position of the professional community - companies successful in the practical application of BIM, ready to unite for the development of key documents required for the Russian construction market. To assist the customer has drafted model contracts for the design using BIM-technology. "- said Marina King, executive director of NP" Intelligent Building ", the head of the initiative group on development of the National Implementation Plan BIM.

Judging from the course of the debate, first of all, a professional architectural and construction community considers it necessary to begin work on a coordinated BIM-model standard, which will be able to build all market participants working with BIM.

Such a standard should describe all the key steps involved in creating a BIM-object model, including asking process that allows to determine exactly which data must be entered into the information model, at any stage of the project and who of the project team has to do this on the basis of what information, contained in the model adopted these or other management decisions, and so forth.

«BIM-standard - this is a set of recommendations and templates with Legacy rules of the organization all stakeholders information modeling . This document will be a kind of navigation for all participants BIM-projects. It will be similar to the traffic rules that explain the functions and roles of the project participants, and it also contains a set of standard and open-to-use forms of documents can be, templates, and so forth. " - said Arsenty Sidorov, head of the construction of the complex control of GC "Etalon".

The expert opinion on the critical importance of the overall BIM-standard is confirmed by vendors supporting the implementation of technology BIM. In late 2014, Autodesk conducted a study about domestic companies who fail in the way of implementation of BIM. It reveals patterns that have caused this failure, and usually it was the fact that the whole company focuses its efforts on the development of the software, while BIM, according to software vendors - is primarily new processes of interaction between all specialists in the life cycle of the facility construction. Of course, companies can go the way of creating their own BIM-standards. However, the grand interest in the technology experience for Russian designers and builders is not much, and a typical example of a British Standard PAS 1192 will significantly increase the effectiveness of the implementation of BIM and facilitate this task.

"The use of BIM is not yet binding on the state level, we see that the introduction of technology in domestic companies is already underway, as in the current economic situation is doubly concerned about all the tools and technologies that increase productivity and reduce unforeseen expenses / risks .Today our goal - to help these companies as soon as possible to adopt the best practices of the implementation of BIM» - says Anastasia Morozova, head of the architectural and construction trends Autodesk.

In addition to the BIM-standard a professional community finds it necessary to begin coordinated work on the following key objectives:

- The development of a single classifier of materials, equipment and building structures. The presence of the classifier can be attributed to each element of a building without a detailed description of a particular category and assign a unique code that allows to get one of the main advantages of BIM - quickly and accurately calculate the cost of the project at any stage. This work will be carried out in close collaboration with government agencies responsible for pricing in construction;
- Common terminology and understanding of the level of detail of the information model (LOD) and the level of information (LOI). An important part of the BIM-standard, showing how the model should be full of information in each of the decision points. These requirements can synchronize expectations of BIM-project as a part of customer and the contractor and subcontractors;
- Path transformation project organization during the transition to BIM - changing the organizational structure, methods for assessing the duration of the project, loading staff motivation and remuneration.

## **5 Housing development in NCC Company**

BIM concept has appeared for more than 20 years ago. This is not a new technology based on many years of innovative work across the world. NCC concern today operates not a concept BIM, but a concept VDC (Virtual Design & Construction) / BIM - building information model is, and it is tightly associated with the design itself, with the model. But when it comes to the problems of the developer, NCC should look at the scene from the point of view of business and business processes. There is a concept VDC, which includes BIM, integrated company management system, in the decision. For NCC BIM is one of the key tools of the business process, a tool for decision making in marketing, sales, information management, collaboration, and so on.

### **5.1 Application Model VDC / BIM worldwide**

NCC operates in eight countries, and in each of them apply this model. In Germany, NCC last year, has been recognized by the developer number one in Sweden and every year among the top three. In addition, NCC are conducting scientific and research work in this area in conjunction with Stanford University and with Autodesk, Microsoft and other software developers.

### **5.2 Situation in Russia**

NCC adhere to uniform standards of work throughout the world, including in Russia. In terms of ownership of the program and the use of BIM-model in Russia is already very good examples. The part of ownership, quality of the model contractors could in 2-3 years to master the technology at a very good level. It is recognized by foreign colleagues. Another issue is that the culture of using information model is low. There is understanding of how to use the information in the business processes. Therefore, if we talk about all the participants in the process of design and construction involved in the Russian projects we are talking about BIM, instead of VDC.

### **5.3 Choosing a contractor in Russia**

Contractors are required to possess the technology of information modeling. In recent years, NCC demands in this area are gradually increased. NCC recommended that designers use BIM, and then said that those who are using BIM, will have a better chance at winning the

tender, and is currently working with BIM - it is a prerequisite of cooperation with NCC in Russia. All contractors have to use it to work on key sections - architecture, construction, engineering systems. That is to say BIM covers approximately 70-80% of BIM on Russian facilities. This journey took two years at NCC, and many contractors have passed it along to with NCC and have grown substantially in the professional sense. The current task in Russia - is to further improve the quality of the model and start using BIM on site.

#### **5.4 Evaluation of the Russian government initiatives**

In other countries, especially in Finland, NCC has been actively involved in the activities of the various organizations involved in the development of information technology in the construction industry at the state level. Meanwhile, in Russia there is a program of the Ministry of Construction for the examination of objects at the level of 3D-models. But the most useful to the industry, it would require its contractors to use BIM on all objects of public procurement, as it happens, for example, in the UK. The share of government orders today is very large, so such requirements would give a significant impetus to the development of the industry. And it could be fixed by national standards. The BIM for the Russian states is a great tool for monitoring. Today, with all the amount of the tender considered by hand, it is difficult for the customers to check whether the object is real. If the calculation is carried out in the model, this process becomes completely transparent for the customer.

#### **5.5 The main content of NCC activities related to BIM in Russia**

NCC will show one of the major foreign projects where BIM is a system VDC. To share experience on the Russian example of one of the latest local projects - the residential complex «Skandi Klubb» 1200 apartments in the center of St. Petersburg, where all of major subcontractors are working on the basis of BIM.

At the site «Grona Lund» NCC is implementing BIM to the construction site. Project engineers are using an Internet tablet to use 3D models directly on the construction site. This helps installers to install complex engineering components such as the intersection of all the utilities in the basement.

As for the main promise of activity NCC, it is this: companies do not embed BIM, if companies just buy a computer and send people to training. The transition to BIM is the path that takes time, and it is impossible to pass it quickly. For NCC deal with people and to train

them quickly and implement business processes is not enough. This change in the work culture, the culture of thinking and approaches.

## 6 Conclusions

Data published on the websites of Russian Ministry of construction, shows the deterioration of the main indicators characterizing the financial and economic activities of construction companies in the 1st quarter of 2015 in comparison with 4st quarter of 2014, and reduced business confidence in the construction sector in the 4st quarter of 2014 in comparison with the 3rd quarter of 2014. In this difficult economic situation BIM can help to way out of the crisis.

The government is still a major player in the construction sector, which is responsible for the continuous development. Talking about who can help organizations of construction industry to improve its business climate, it is, certainly, the government. There are tasks of the government: creating information framework, introducing the construction market a new technology and related procedures for creating, introducing and enforcing building information model of the object (BIM). If the use of BIM will be released on the government level, it will create the conditions for its development and implementation.

The time to raise the issue of compulsory BIM in Russia for state projects is coming.

Bringing together the needs of the investor, the customer, the designer, the builder and the operational organization - all participants in the life cycle of an object – BIM will be implemented. While there is no interference of the state (the main investor), BIM technology in Russia will remain an area of the initiative.

It should be noted that to start using BIM is a very important and difficult task for the Russian construction. It will require large expenditures for the implementation of new technology, but the results of the transition to BIM will surpass all expectations. The projects will be implemented faster, better and in large volumes. As soon as the state will introduce the requirements for BIM in the examination of projects, it will start the implementation of BIM with great force.

## Figures

**Figure 1.** Schedule of construction of the building on the basis of the information model. This work in Revit Architecture and NavisWorks.

**Figure 2.** Construction of the new building of the American Higher Music School New World Symphony and the future exterior and interior views

**Figure 3.** Higher Music School New World Symphony: the main entrance. Architects Gehry Partners, 2010.

**Figure 4.** Art Museum in Denver (USA), Frederick S. Hemiltona building. The computer model and the construction of the building frame. Architect Daniel Libeskind. Tekla Structures software.

**Figure 5.** Art Museum in Denver (USA), Frederick S. Hemiltona building. The final appearance. Architect Daniel Libeskind, 2006

**Figure 6** Curve most effective efforts to design a building, depending on the stage of the work.

**Figure 7.** The qualitative nature of the change in labor productivity of designers during the transition to the new software.

**Figure 8.** The calculation results are changes in the level of productivity and the amount of work done (100% equals the annual output).

**Figure 9.** The difference in the recognition of the effectiveness of BIM for their own work novice users and "experts."

**Figure 10.** The reconstruction project of the standard five-story building.

**Figure 11.** Interface portal "Infoposelenie": information about the house, apartment, neighbors, the management company and much more. Novosibirsk, 2014

**Figure 12.** On "Autodesk Forum 2010" in Moscow was in 1235 participants.

**Figure 13.** Vyacheslav Semenenko, vice president of the Russian guild of managers and developers, managing partner of КБ ВИПс

**Figure 14.** Krzysztof Pomorski, КБ ВИПс

**Figure 15.** Olga Dashkova, deputy director of the department of urban planning and architecture activities of the Russian federation ministry of construction

**Figure 16.** Anastasia Morozova, director of business development in Russia in the direction of architecture and construction company Autodesk

**Figure 17.** Boytsov Alexander, head of the design, company NCC.

**Figure 18.** One of the selected "pilot" project.

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## APPENDIX 1

The order № 926 of the Ministry of Construction.



**МИНИСТЕРСТВО  
СТРОИТЕЛЬСТВА И ЖИЛИЩНО-КОММУНАЛЬНОГО  
ХОЗЯЙСТВА РОССИЙСКОЙ ФЕДЕРАЦИИ**

(МИНСТРОЙ РОССИИ)

**ПРИКАЗ**

от "29" декабря 2014 г.

№ 926/пр

Москва

**Об утверждении Плана поэтапного внедрения технологий  
информационного моделирования в области промышленного  
и гражданского строительства**

Во исполнение пункта 12 протокола заседания президиума Совета при Президенте Российской Федерации по модернизации экономики и инновационному развитию России от 4 марта 2014 г. № 2 **п р и к а з ы в а ю:**

1. Утвердить прилагаемый План поэтапного внедрения технологий информационного моделирования в области промышленного и гражданского строительства (далее – План).

2. Департаменту градостроительной деятельности и архитектуры создать рабочую группу при Министерстве строительства и жилищно-коммунального хозяйства Российской Федерации в целях решения вопросов, возникающих при реализации Плана.

3. Контроль за исполнением настоящего приказа возложить на заместителя Министра строительства и жилищно-коммунального хозяйства Российской Федерации Ю.У. Рейльяна.

Министр

М.А. Мень

/Translation below/

**Translation:**

**THE MINISTRY OF  
CONSTRUCTION AND HOUSING AND COMMUNAL SERVICES OF  
THE RUSSIAN FEDERATION  
(MINCE TROY RUSSIA)**

**ORDER**

29 December 2014

#926

**Moscow**

**Approving the plan for the phased introduction of information technologies in the field of modeling of residential and industrial construction.**

Pursuant to paragraph 12 of the Protocol of the meeting of the Presidium of the Council under the President of the Russian Federation for economic modernization and innovative development of Russia from March 4, 2014 No. 2 **order**:

1. Adopt make, "the tenth plan phased building information modeling technologies in the field of residential and industrial construction (hereinafter plan).
2. Government of urban planning and architecture, created a working group under the Ministry of construction and housing and communal services of the Russian Federation in order to address issues arising in the implementation of the plan.
3. Control over the execution of this order to designate the Deputy Minister of construction and housing and communal services of the Russian Federation.