

WP2 Business models

D2.1 Map of stakeholders and their needs – Part 2

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EXECUTIVE SUMMARY

Gaining popularity in Europe, Building Information Modeling (BIM) is also experiencing lots of questions and discussion about the application methods and processes, problematical aspects etc. What new forms of information can BIM provide? How can BIM lead to a more efficient integrated work process, a more economically and environmentally friendly project? What are the benefits of BIM for individual project participants and different practitioners, particularly SMEs? What are the possibilities of applying BIM in other business fields? What are the problems and potential obstacles in BIM application? Questions like these are discussed in this report, to provide anyone who is interested in BIM a profound and complete view of BIM method.

As a very crucial sector in ecobim project, stakeholder needs and concerns are described and discussed here, to support the paradigm shift, which shall contribute to the forming of sustainable and eco-innovative business models.

1. INTRODUCTION

In order to identify stakeholders and their needs and concerns in relation to BIM, the ecobim project partners organized a series of workshops. The intention of the workshops was to invite stakeholders who already have experience and involvement in BIM related projects, or who are providing or applying BIM-based information in their everyday business. Different practitioners from various companies and organizations expressed their ideas and comments on these topics, each contributing with a specific view to the overall perspective.

What do we talk about when we talk about BIM? CAT, which means Content, Application and Tool. These three topics are the essential parts when BIM is mentioned and discussed. Stakeholders establish, relate to and apply a BIM model in strict dependency of their role and their tasks in a building-related decision-making process. They use BIM in different ways with their individual business focuses and perspectives. Stakeholders act as the connection between the BIM model and the applications. They incubate new business opportunities with BIM, and also provide feedback to the BIM model to improve the functionality and diversification. To be successful, the BIM model, its content and tools must suit the application and the intentions of the stakeholder.

BIM Content

What content should be included in BIM? Compared with traditional methods, Building Information Models contain not only the basic project information and design plans, but may also contain:

- the building materials and their bill of quantities;
- specific product information, ranging from technical information to health & safety declarations.

Included elements may be drawn from the model in order to represent, visualize, analyze, communicate, refine, etc.

Going beyond the building design stage, the BIM model may also contain information supporting later life cycle stages, like the operation and maintenance or deconstruction stage.

Based on the information included in BIM, selected performance indicators may also be included in the model. Indicators relating to technical performance, economic aspects, or environmental indicators may allow an early display of key performance indicators (KPI) to concerned decision-makers. Such indicators may be set individually reflecting project specific decision-makers' or stakeholders' concerns and needs. Indicators relate to the current building, they may relate to benchmark values established from reference projects, or they may originate from external definitions, such as indicators established e.g. in legislation, reporting routines or green building labeling schemes.

BIM Application

The information model can be used to virtually display a building structure, to compare various scenarios of a project, to analyze the water and energy consumption etc., which leads to a wide range of potential BIM applications. Among these, Life Cycle Assessment, Life

Cycle Costing and integration with green building certification are subject of increasing interest.

BIM Tool

BIM tools can be divided into two groups: modeling tools and analyzing tools. Modeling tools are used at the very first stage to collate data with the goal to establish a complete building information model possibly including the shapes, functionalities, spaces, structures, construction materials etc. Analyzing tools are preferably used at later stages, when various simulations are conducted to analyze and enhance the expected performance of the building.

Each of the following three workshops have an individual focus on the above three topics:

1. Finland: focus on indicators potentially applicable in BIM-supported sustainability assessment;
2. Germany: focus on BIM application potentials for different stakeholders;
3. France: focus on the BIM tools and platform.

2. WORKSHOP CONTENT

2.1 Finnish workshop

VTT organized the Finnish workshop on the 13th of June 2014 on to the topic “Guidelines and roadmap based on indicators for BIM supported sustainability assessment”. The workshop's objectives were the following:

- validate the indicators developed in ecobim project;
- rank their importance and to possibly identify missing indicators;
- analyze the availability of required data for the calculation of the indicators;
- identify business opportunities related to the use of the indicators in BIM supported sustainability assessment;
- develop recommendations for policy makers.

Table 1: Participants and organizations of the Finnish workshop.

Participant	Organization	Role
Organisers		
Pekka Huovila	VTT	Key account manager
Aapo Huovila	VTT	Research Scientist
Policy makers		
Pekka Lukkarinen	Ministry of the Environment	Architect responsible for development of supervision of building
Jessica Karhu	Green Building Council Finland (FiGBC)	Project Manager
Jorma Säteri	Finnish Society of Indoor Air Quality and Climate (FISIAQ)	Executive Manager
Olli-Pekka Hatanpää	Helsinki-Uusimaa Region	Urban Planning Manager
Companies		
Paula Rantanen	Ramboll	Real Estate Consultant
Anne Tiainen	SRV (construction company)	Environmental Manager
Miro Ristimäki	Skanska	Real Estate Developer
Mika Toikka	The Helsinki Housing Production Department of the City of Helsinki (ATT)	Project Manager
Miika Liukka	Parviainen Arkkitehdit	Architect
Jukka Lommi	Arkkitehtitoimisto Tiuri & Lommi Oy	Architect

2.1.1 Recommendations for policy makers

In the Nordic countries, BIM is systematically required in large public projects by relevant organizations such as Senate Properties in Finland (a state property services agency), Statsbygg in Norway (a civil state client) and Palaces & Properties Agency, the Danish University Property Agency and the Defense Construction Service in Denmark (state clients).

In addition, large construction companies are typically leaders in the use of BIM while small companies are still often unaware of BIM in Finland.

In Finland the increasingly strict and demanding energy regulations are putting pressure on performing BIM-based analysis. One of the challenges for using BIM is that a building related documentation is often still generated and filed on paper. Therefore, the public authorities' objective of BIM application is to enable electronic supervision and complete documentation of building projects. Currently only two municipalities in Finland operate electronically. There is a need to have a proper application procedure (e.g. a filing form of the BIM) for all municipalities. Consequently there is a demand for strict and comprehensive guidance enabling public authorities to establish digital routines, showing reduced differences between municipalities and by that enabling project actors to establish and apply suitable application routines in planning and documentation processes.

2.1.2 BIM opportunities

The implementation of BIM-based design and construction in large scale is not yet reality. More time is needed for BIM development, which can be impelled by promoting BIM application at the construction site and authorities. However, most of the construction workers use currently still paper. An opportunity is seen in the establishment of BIM based information that suits the demand of all actors, from the designer to special engineers, including construction companies and on-site workers as well as authorities or special inspectors (such as health and safety inspector, site quality manager). Data acquisition and management is another crucial issue in BIM application, as it is predominantly time-consuming. Thus, there is a need for a database that has all the required data and a tool that enables easy access to purpose-filtered data and information (e.g. web-service interfaces).

Building maintenance is an inevitable stage in the building life cycle, which can also be covered by BIM application. When the information on a building's condition is updated annually, a BIM-tool should alert when maintenance or other action is needed. This functionality can attract attention from the service providers in maintenance. For the end-user, it is suggested that all benefits have to be presented or demonstrated to the customer, as this might be a significant driver of BIM development.

The support to building certification is another potential BIM opportunity. In general, certificates and classifications are recognized as beneficial, as they indicate compliance to certain levels of quality or performance. However, participants of this workshop indicated that multiple certifications of the same building should be avoided. For SMEs, especially those who serve clients with limited defined budgets, expenditure of funds to justifiable purposes are an issue of concern. Here, investment in quality is regarded as preferable over investment in documentation and communication of quality.

2.1.3 Core indicators discussion

Core indicators or key performance indicators are a frequently applied concept when communicating building aspects among stakeholders. The scope and character of indicators is largely depending on the stakeholders and their professional reference frame. Indicators may relate to a specific thematic field, or they may strive to recognize sustainability and hence combine aspects representing all primary aspects of sustainability. While sustainability in building construction is defined in international standards, the indicators

applied vary between regions, reflect development priorities and other concerns. Comparing established sustainability assessment tools, they have similarities in the general scope, but differences in detail and focus. Many international projects strived to harmonize indicators, and often resulted in core indicators.

A BIM model aiming to include sustainability information would need to identify the indicators of interest at the beginning of setting up the model. The project partners discussed a pre-selection of established core indicators at project meetings and through the owela-for-ecobim online platform (www.owela.fi/ecobim).

The establishment of common indicators would effectively benefit the communication among stakeholders throughout the building life cycle and related processes on a common platform. Finally, the 16 suggested ecobim core indicators (see Table 2) were discussed in the Finnish workshop.

Table 2: The 16 core indicators developed in ecobim project.

ENVIRONMENT	Energy consumption	Embodied energy consumption [kWh/m ² /a]
		Operational energy consumption [kWh/m ² /a]
	Water consumption	Embodied water consumption [m ³ /m ² /a]
		Operational water consumption [m ³ /m ² /a]
	Global Warming Potential (GWP)	Embodied GHG emissions [kg (CO ₂ eq.)/m ² /a]
		Operational GHG emissions [kg (CO ₂ eq.)/m ² /a]
	Waste production	Embodied waste production [kg/m ² /a]
		Operational waste production [kg/m ² /a]
INDOOR ENVIRONMENT QUALITY	Thermal comfort	Operative temperature [C]
		Air humidity [%]
		Air velocity [m/s]
	Visual comfort	Illuminance [lux]
		Daylight factor [%]
Acoustic comfort	Noise levels [dB]	
ECONOMY	Life cycle costs	CO ₂ concentration [ppm (CO ₂)]
		Life cycle costs [EUR]

Stakeholders preferred to have “optional” indicators depending on the case in addition to common core indicators. The indicators “Air Humidity” and “Operational Waste” were suggested to be left out by some of the participants. Meanwhile, others advised to include additional indicators such as emissions from materials (e.g. expressed in percentage of low emitting materials), control of fine particles or renewable and non-renewable raw material consumption. When considering the integration with BIM application, indicators related to noise and humidity were considered to be potential problems. Although commercial parameters may vary because of different business models, it is proposed that economic

indicators should be brought in and added weight. These would boost the market drive in order to motivate also investors in the use of BIM.

Indicators are most useful if they are pre-defined but not binding, at least performance-based and not prescriptive. They should help the stakeholders to think what is important for them, consequently they would not prescribe "sustainable solutions" but rather would guide the stakeholder towards balanced suitable options. At the same time they should guide to responsible decisions. In principle, the indicators should not require, but guide.

The participants weighed the importance of the indicators and the time scale (how many years) within which they saw the indicators implemented in practice. The results are shown in Figure 1. The figures in the fourth column are the arithmetic product of the figures in the second and third columns.

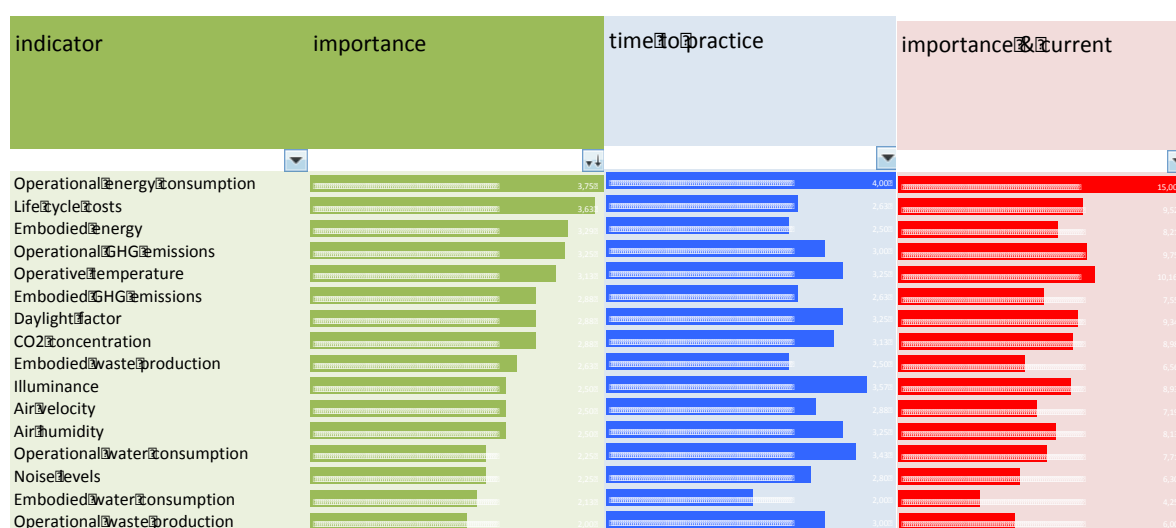


Figure 1: Weighting of the importance and time to practice of the indicators.

2.2 German workshop

Büro Trinius initiated a workshop organized on October 13th, 2014 as an element of the ecobim project, but also as a coordinated and shared event between three projects. Table 3 lists the participating organisers of the workshops.

Table 3: Organisers of the workshop.

Company	Project
Büro Trinius	ecobim
AEC3	BIM reference guidance for Germany (BIM Leitfaden für Deutschland)
Fraunhofer Institut für Bauphysik	BIMiD

Among the three cooperating projects it was early agreed that all preferred a small workshop in order to enable a direct dialogue and intensive discussion among participants as

much as among the projects. All the participants were very much looking forward to cross benefits and to feedback and input from each other.

The target audience was identified as stakeholders related to the planning process, resulting in striving to generate participants from architects and consulting engineers through product manufacturers to construction companies. Except for a construction company, which unfortunately had to cancel its participation on short notice, this selected target audience was covered with representatives.

For that reason, the invitation was spread directly to interested people within the organizers' contact networks, and it was additionally spread through the BIM contact platforms available in Germany. The workshop was announced on rather short notice, a way to filter immediate from strategic interest. Ultimately, 12 workshop participants engaged in intensive discussion and sharing views and experience at the workshop.

Table 4: Participants and organizations of the German workshop.

Participant	Organization	Role
Thomas Liebich	AEC3	IT and BIM services
Gerd Maurer	ATP	Architecture
Jens Glöggler	ATP sustain	consultant Engineering
Wolfram Trinius	Büro Trinius	R&D and consultant Engineering
Klaus Kreupel	coplan AG	Architecture and Engineering
Joachim Zerfass	DORMA	Product manufacturer
Marie Hohenleitner	FH München	R&D
Johannes Gantner	Fraunhofer IBP	R&D and consultancy
Peter Noisten	Fraunhofer IBP	R&D
Aude Tan	Fraunhofer IBP	R&D
Franz Madl	pbb	Architecture and engineering
Andreas Limberg	Rehau	Product manufacturer

The stakeholder workshop contents and discussions are described and analyzed here, to give a holistic and up-to-date view of the stakeholder needs, concerns and feedbacks. The topic of the workshop was “BIM with focus on the application in sustainable construction context”, bringing three BIM-related activities and projects to a common forum. The object of ecobim project in this workshop was to

- Present the current and future BIM application,
- Collect feedback from BIM users,
- Identify stakeholder needs and gain feedback, and
- Support and establish networking among stakeholders.

Initially, the workshop participants were confronted with the results of the Finnish workshop. While there was general understanding and agreement with the presented results, the presentation generated some surprises, e.g. related to the low ranking of acoustic performance - which is regarded as a key subject for user-friendly offices and homes, for instance.

In general, the participants pointed out that indicators should not be set by ecobim project or by a BIM-based suite of application tools, but that the model and the tools should be established in a way that the user can define and choose the indicators. Ultimately, it may be the client or external stakeholders defining the indicators to be communicated, or these may be related to a rating or certification scheme with its specific content and requirements for documentation. High flexibility and adaptability was a key concern.

2.2.1 BIM development

To most architects and engineers, BIM is a technology supporting integrated planning that is considered as a method, and leads to the achievement of sustainability. Individual clients and large client organizations are the very first initiators to start the BIM route. Thus, they also need to be consulted towards BIM at very early stages of a project. Some specific industries are ahead of the main business, like buildings for automotive industries, and require BIM-based projects also outside their core business. However, a significant push from German public bodies is not recognized in this field, digital application for building permits is not yet enabled by administrations in Germany, also resulting in a lack of support of the introduction of BIM in organizations and project teams.

The development of BIM processes also provokes a clash of established routines and branch-regulation with new approaches, as soon as they cause deviation from established approaches. At first, BIM-based planning teams need at least one large partner, as BIM coordinator. It is necessary and essential to include BIM competences in the project team, especially to manage BIM processes. When full benefit is to be obtained, all actors need to work at the same platform. The platform should enable all planning disciplines to act concurrently while allowing the handling of information at different degrees of completion. The latter as sequential planning and revision leads to situations where one discipline has concluded their work, while others are at the initiation. The concept of coordinated and harmonized planning stages may be an outgoing concept with the application of BIM.

To increase efficiency of coordination, various interfaces should be reduced (or converted into connectors), transparency of the planning process should be enhanced, and planning disciplines and routines should be synchronized. At the same time, the ability of abstraction should be maintained to simplify the approaches.

Among all the BIM procedures, information management is a very crucial issue. At first, it is essential to consider providing a parametric database with different optional fields of application, which can adapt to and meet regionally different requirements. Thus, it should be adaptable and flexible for different countries, actors, roles and focuses. The generation and maintenance of datasets are the next steps. After the content and character of information in datasets has been defined, various providers are required to deliver a sufficient scope of integrated elements of information. A bi-directional functionality is important to complete information successively. The BIM model contains the combination of all the information, which provides perspectives, and aims to visualize currently important or prioritized aspects, which means that the visualization is "time dependent" or "planning stage dependent" or "decision dependent". Visualization can lead to inspection and changes; especially due to premature detailing the focus may be distracted from the current planning stages' main tasks.

BIM is said to revolutionize planning. It however still remains a question where BIM development is heading to in the future. Definitely, new roles and different roles in various business opportunities will come into being.

2.2.2 BIM benefits

From the perspective of all the BIM practitioners, BIM enhances the culture of cooperation. Meanwhile it is a bi-directional planning and execution model, which also provides a basis for later life cycle stages like facility management.

At the planning phases of a project, BIM software enables early accuracy, and can provide easy access to details, thus distracting from the questions in early stages and enabling detailed planning at sketch. At the same time, by linking building information from one topic to another, BIM reduces efforts to generate information for services, and minimizes replication of information gathering, which enables integrated and coordinated efficient work, reduces the number of interfaces and interactions and in effect the sources of potential errors. For consultants, these benefits undoubtedly decrease effort and cost needed for specific services.

An established BIM model can be a reliable basis for tendering and contracting. When the generation of simplified families is completed, stepwise specification, generic products to specific information can be defined in the model. As a result, it enables links to simulation or calculation tools, documentation, certification etc., which leads to higher efficiency in planning, and faster replies to decision-making concerns.

2.2.3 BIM concerns

Even though BIM brings significant benefits to various practitioners and enables the incubation of new business opportunities, there are concerns relating to the application and processes.

Available models (plug-in calculation tools) must suit the current purpose. As an example, environmental life cycle assessment may be such a plug-in. As there are large varieties in the purpose of LCA application, such plug-ins either need to be adaptable in their approach and result generation, or a range of specifically suited tools need to be available. While some LCA application intends to quantify indicators to communicate to a building certification, others may intent to guide the decision maker from early decisions towards a building optimization along the planning process. The availability of the one or the other should not dictate the purpose of application, and a change of tools for different result applications may provide quantitatively different results, leading to confusion. The availability of BIM-ready LCA product data sets may be an issue of concern.

BIM quality also becomes an issue, like the delivery processes, communication standards, quality management, data availability, exchange and refinement, among which data management appears to be the largest new challenge. The data from manufacturers sometimes are too detailed, contributing to the risk of over-detailing at early stages.

Being the basis of BIM application, the BIM tool itself is another inevitable concern. Project groups are typically set up individually for each project. Similar to the current situation with online project data solutions, project partners may need to handle several BIM suits at the same time, when involved in multiple project organizations. Without a unified BIM kernel, actors related to design and building projects may need to be able to provide their services

compatibly to a wide range of BIM application suits. Especially smaller architect and engineering firms face difficulties originating from lacking uniformity and communication between software platforms, resulting in high staff and training efforts and costs for software and licensing.

Besides, semi-automated calculation and simulation tools may lure actors into fields beyond their competence. Tools may enable activities without deeper understanding. But the ability to apply a tool does not equal consultancy in the subject field.

Furthermore, there are concerns from architects and engineers about the increasing project complexity caused by BIM. It is required to have simultaneous, concurrent and coordinated work in the planning team. If the whole project team is not at the same stage at the same time, it will lead to a BIM model at different levels of accuracy or detail. New topics like sustainability introduce more project partners with more perspectives, increasing the demand for coordination. It is still doubted whether BIM may be able to reverse that trend. The generation of BIM application experience is also a problem. Between projects, teams reconfigure each time anew. It appears difficult to gain and apply experience, to provide lessons from one project to another.

Sometimes the phenomenon of sustainability dilemma may happen, when information is not available at the best time of application, while all data is accessible too late in the decision making process.

Workshop participants wondered whether BIM would be strengthening larger firms at the expense of smaller firms. BIM as an enabler of efficiency is regarded as offering large potential, as one thing is for sure: SMEs need to be economically effective, even more than larger firms.

2.3 French workshop

2.3.1 Format and participants

The French ecobim project partners CSTB and LASCOM organized a BIM/PLM (PLM = Product Life Management) webinar with 129 participants (staff from LASCOM and CSTB excluded). A chat was organized to collect questions at first. The questions were put forward by the participants and documented after the workshop. Parts of those were discussed during the webinar.

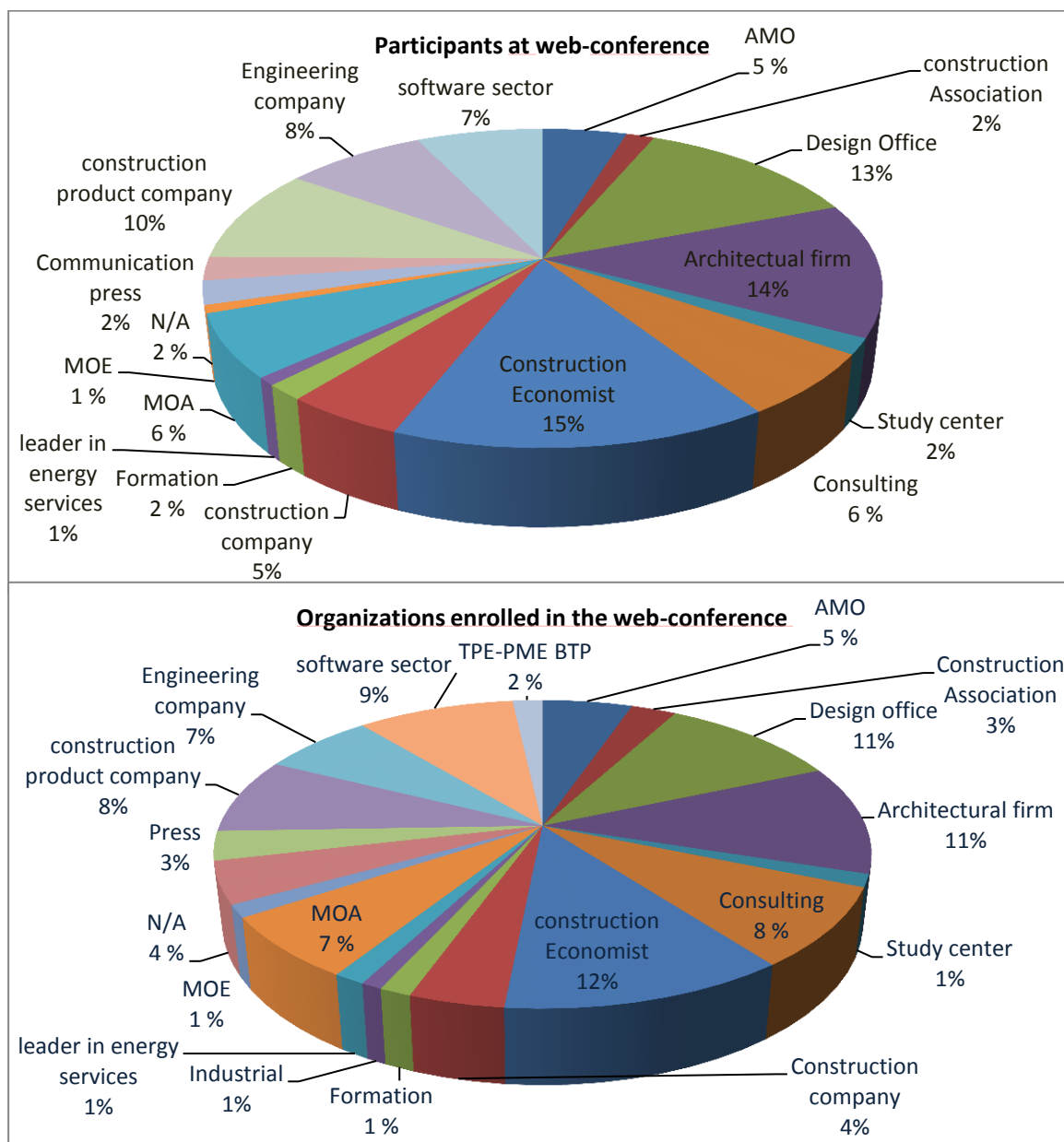


Figure 2: Pie charts showing the organizations enrolled in the French web-conference and participants at the web-conference.

2.3.2 BIM concerns on tool and platform

During the webinar the new BIM/PLM solution “LASCOM AEC BIM Edition” developed by Lascom and CSTN in ecobim was presented. In addition to this product specific issues, the stakeholders forwarded more general questions about the BIM process, mainly focused on the BIM tool and platform (application interface, cooperation work mode etc.). Various concerns in accordance with different topics are listed here.

BIM tool:

- Integration interface with Revit (synchronization with the BIM principles while importing and exporting files).
- Digital participation and communication of a tool.
- Uniqueness and competence of a certain BIM tool.

- The possibility of storing all the execution plans in the model.
- Integration of environmental information into BIM.

BIM platform:

- Who is the administrator of the platform and what are the associated costs for a project?
- Integration of economic aspects with the architectural work on the PLM platform.
- Management of the BIM interface for all the stakeholders at the construction phase.
- Do all the stakeholders involved in the construction need to model everything in 3D? How are the different interfaces managed?
- Cost of transforming to BIM (training, investment, software etc.) can be a barrier decelerating the adoption of BIM in France.
- Management of financial problems and responsibilities of various changes.
- Coordination of different work in project team. How is for example the simultaneous work of the economist, architect and HVAC engineer on the BIM and PLM managed?
- Management of the platform. Is your solution a tool for the BIM manager or for the project manager (in a project where BIM is used)? Who is the manager of the collaborative work space?
- Right of access to the project BIM platform, the right of action. Among the numerous stakeholders, who has access to a project? What does the “right of action” or “right of consultation” mean? What tools are needed for this digital participation?
- The sequence of tasks of different stakeholders in design phase. How are those managed taking into account the needed order of different tasks and the delays of each of tasks?
- Time management in BIM application. How can you ensure that all the actors involved in the project keep their data up-to-date?
- Management of intellectual property of the BIM. What is the definition of a BIM manager and which are his responsibilities?
- How is the security of information managed? With passwords or other solutions?
- Collaboration content in BIM application (document sharing, data security etc.). What does the collaboration enabled by your solution concretely mean? Sharing documents?

Specific questions:

- Can we use BIM to realize the handover?
- What is the price of the presented solution?
- What is the difference of your solution with other PLM platforms?
- The necessity of the PLM/BIM solution is clear for new construction, but what about the existing buildings and renovation projects for example?
- What are the additional properties of your solution compared to a traditional plan and data storage systems combined with a certain IFC viewer lambda?
- Are your tools compatible with the Inventor tools used in mechanical engineering?
- Can we imagine using a 3D scanner to create the 3D model of an existing building?
- How the fire properties of building materials treated in BIM?
- In your solution you are presupposing that all the stakeholders would have the needed tools. How is this possible? At what price? Only for the duration of a project?

3. CONCLUSIONS

Although it's still at the initial stage of BIM application, various benefits and potentials have been shown to different practitioners, together with inevitable challenges and obstacles. Moving forward with BIM provides new potentials and opportunities to be explored and developed. Nowadays, the most commonly mentioned new application appears to be the integration with LCA and certification systems. Due to the variety between building certifications and the rapid development of systems and of available data, locking to a certain application should be avoided, in order to incubate potential market and business opportunities.

The balance between BIM benefits and concerns is a very crucial point for further BIM development. There are basically two factors that could affect the balancing point, one being the BIM process and tools, the other being the stakeholder applications. Yet another one is the development and content of green building certifications schemes. The BIM process and tools are the supporting point of the whole BIM leverage. When the process is organized properly and the tools are developed and used efficiently, it may have remarkable influence on the whole BIM industry. At the same time, different stakeholder perspectives and their own applications of BIM would add to the weight of BIM benefits or concerns, which would also change the situation of the whole BIM leverage, in other words, the successful BIM development.

Last but not least, being a crucial factor for BIM development, positive support from administration can provide BIM a proper political environment. The other way around, BIM structures should also adapt to established legal contexts, roles and responsibilities in the planning stages, as well as the regional standards like ASHRAE, EN etc.

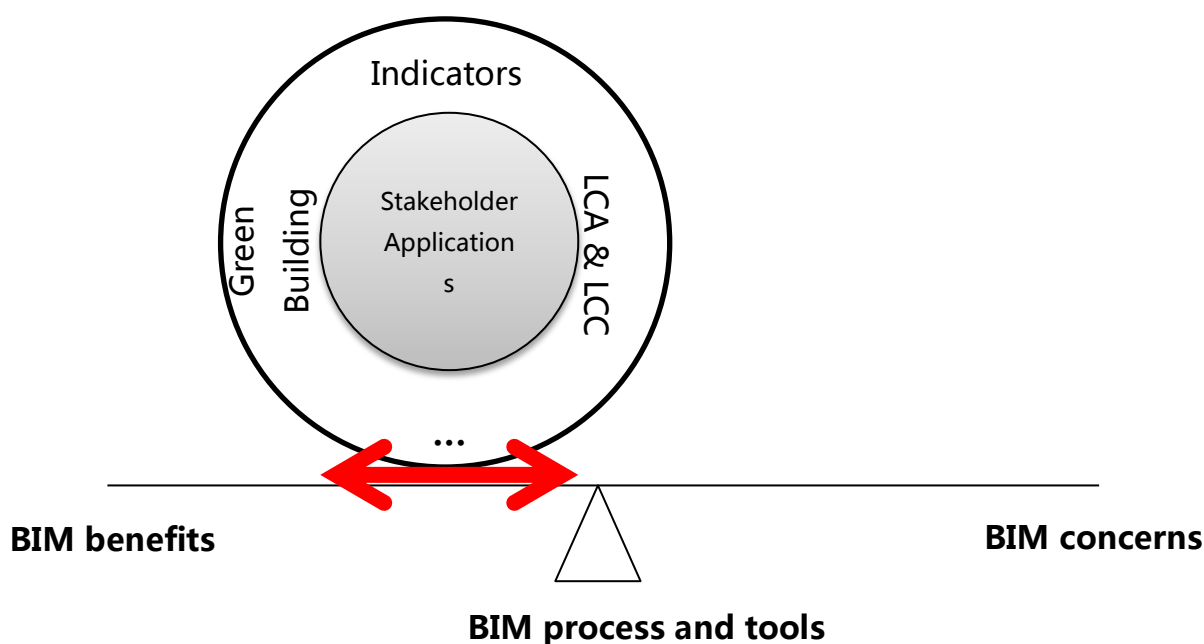


Figure 3: Concept of BIM leverage between BIM benefits and concerns with the affecting factors.