Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

<table>
<thead>
<tr>
<th>Personal information</th>
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<tbody>
<tr>
<td>Name</td>
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<tr>
<td>Student number</td>
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<tr>
<td>Telephone number</td>
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<td>Private e-mail address</td>
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<th>Studio</th>
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<tr>
<td>Name / Theme</td>
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<td>Teachers / tutors</td>
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<td>Argumentation of choice of the studio</td>
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<tr>
<th>Graduation project</th>
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<td>Title of the graduation project</td>
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<th>Goal</th>
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<tr>
<td>Location:</td>
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<td>The posed problem,</td>
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<td>research questions and</td>
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<td>design assignment in which these result.</td>
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Problem statement

Although BIM seems to have a lot of potential, it is shown that this potential is still often not met, mainly because of a lack of good communication between actors and between building phases, with emphasis on the (data exchange between the) design and use/operation/maintenance phase.
The figure above shows the conceptual model of the research. To form the conceptual model, the IPO (Input-Process-Output) model is used. The model includes Input-Process-Output, and further the context of the project.

The conceptual first includes the context of the project, because in the interviews it became clear that project context can really be of influence. The context involves: what kind of project is it, which actors are involved... which project related factors can be of influence on the collaboration between the different actors with BIM.

Second, the input part of the model shows the factors that influence the communication and collaboration between stakeholders, such as interpersonal and technical factors. Interpersonal factors can be knowledge and competence of actors, but also factors that influence the team process, such as trust in eachother.

Third, the process involves the communication between the different actors: the design team, and the client/end-user of the project. The actors involved may differ per project. Questions related to this part are: is the process efficient and effective? And how is the functionality of the project evaluated, validated and verificated?

The fourth part of the model is the output of the process. This output involves the validated design, including design decisions, and which data is stored and transferred to the use phase. Questions that arise are: how do the different actors evaluate the design? Is the design according there wishes?

**Main research question**

In what way is the functionality of the building for the use (phase) evaluated in the design phase between the various stakeholders, while making use of BIM, and how is this data stored and transferred to the use phase?
The IPO (input-process-output) model, as implemented in the conceptual model is used to form the research questions.

**Research questions**

1. What is the context/input of the project
   a. What kind of project is it?
   b. Which actors are participating in the project? (project team/end users)
   c. What are the knowledge, skills and competences of actors – technical, interpersonal etc.?
   d. Use of BIM: how is the interoperability and usability of the software?

2. How is the process/information exchange between stakeholders?
   a. In what way is the information exchanged?
   b. Is the collaboration and information exchange efficient and effective?
   c. How is the functionality of the building validated and verificated?
   d. How is the process managed?
   e. How do the actors evaluate the (team) process (considering former).

3. How is the output of the process/project?
   a. What is the output of the validation of the use requirements? E.g. design decisions.
   b. How do the actors see the outcome of former – positive, negative, and why?
   c. Which data is being transferred to the use phase, in which way?

**Process**

**Method description**

**Case studies:**
- Case 1: A hospital case in Holland
- Case 2: A hospital case in another country, involving a Dutch subcontractor

For the case studies, the context will be described, as far as possible in terms of confidentiality. This will be: actors involved, how is BIM used... This information can partly come from project documents, and further from the observations and interviews.

**Observations**

Different project meetings of the two cases will be observed. This can be internal meetings (within the organisation) such as the before-mentioned “scrum meetings” at the Dutch subcontractor of the Foreign hospital case. These are also external meetings - inside or outside the Netherlands - with multiple actors from different companies.

**Interviews**
Interviews with professionals who are participating in the cases are held. This will be the client/end users and the design team, depending on what is possible in terms of which actors are willing to participate in an interview.

**Strategy design**

The observations and interviews will be elaborated in a proposal for improvements.

**Focus group(s)**

Further on in the research the results will be discussed with a focus group, if possible. This will be a meeting with multiple stakeholders, to discuss the outcome of the research: to evaluate the proposed strategy/ improvements for data exchange and communication with BIM between the different stakeholders and building phases. Otherwise interviews will be held with different actors that participate in the projects.

**Literature**

During the research, new themes may pop up, which require some extra literature research. This literature will be studied along the way.

**Research population**

The research population will be all actors that are participating in the cases and are observed during the meetings or are willing to participate in an interview. It is not a random sample because it are actors who work in two explicit cases.

**Literature and general practical preference**

Themes that are investigated already are:
- Complex Projects
- BIM
- Team process and performance
- Project results
- BIM as a communication and collaboration tool
- Changing roles and competences of actors
- Data exchange between project phases
- Successfactors for implementation BIM as a collaboration tool

Themes that can be investigated further are:
- Team process
- Involvement of end users
- Exchange of data between design phase and use/operation/maintenance phase

During the research more literature may be needed, this will be implemented if needed.

For the research that has been done already, see P2 report.

**Reflection**

**Relevance**
The value of the graduation project can be placed in the larger social and scientific framework. At first, the scientific relevance can be seen due to the fact that the different topics of the research proposal are seen as a critical aspects in literature: communication and collaboration with BIM in complex project such as hospitals, and the data exchange between the different phases, with emphasis on the design and use phase. Further, the social/practical relevance can be seen in the fact that various different actors who have been interviewed see the relevance of the research subject. The subject involves different parties who participate in the building projects. So multiple actors can benefit from the outcome of the graduation project.

**Time planning**
As I do not need any other ECTS anymore, other courses will not affect my graduation. I did not plan a vacation, I will take time off when I feel I can miss the time (or need some time off). Because I do not know yet when the observations and interviews can be planned exactly, I made a monthly (or two-weekly) planning. I will also take a reflection every week to see if my planning has to be adjusted.

**Planning:**

Januari: **23th: P2**, Last week of Januari: implement comments of P2, finalize protocol for interviews and observations, elaborate case context.

Februari: Case observations, Interviews, literature when needed, transcriptions.

March: Case observations, interviews, literature when needed, transcriptions. **P3: somewhere in march**

April: First two weeks: Work out improvements/recommendations/strategy, Last two weeks: focus group/new interviews

May: Work out strategy and proposal **P4: 22th or 29th of may**

June: Work out final proposal, **P5 = between 25th of june and 6th of July**