Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences
Graduation Plan: All tracks
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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<tr>
<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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<tr>
<td>The posed problem, research questions and</td>
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<td>design assignment in which these result.</td>
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Problem statement

The transition from linear to a circular economy has big consequences for the business models parties involved in the construction sector. A key principle of the circular economy is the transition from sales of products to sales of services (Stahel, 2006). This means that businesses change from a sales-based business model to a performance-based business model. In theory, the implementation of circular economy will cause a shift in ownership. Instead of selling their products the suppliers will remain responsible for the life time of the product. In the construction industry this means that manufacturers (suppliers) will sell services instead of products. This could be organized via various constructions:

1. Buy - buyback obligation
2. Buy - buyback right
3. Buy - takeback obligation
4. Buy - takeback right
5. Rent and/or lease constructions
6. Pay per use

For the suppliers financial, legal, social, mental and operational challenges arise (Kok et al, 2005); the business structure needs to change. However, empirical scientific research on the implementation of
circular economy, especially in the construction industry, is lacking and it seems to the author that the terminology is used rather diffused and incoherent when different sources are examined.

**Main question**

To what extent is a) the implementation of the circular economy theory in the construction industry of influence of the business models of building material providers and b) how should the financial aspects of the business model be designed in order to operate successful within the boundary conditions of the circular economy theory.

**Process**

**Method description**

This structure of this research is based on the main findings of literature reviews on the topic of circular economy. It appeared that a lot has been written on this topic. The circular economy concept has been boosted by the Ellen MacArthur Foundation in 2012 and since then the topic has gained a lot of popularity amongst companies, universities and governments on global scale. This has resulted in a significant amount of reports and papers on the one hand and initiatives such as the establishments of foundations to promote the topic on the other hand. Despite the amount of literature available, they all remain rather theoretical. It could be concluded that empirical scientific research on the implementation of circular economy, especially in the construction industry, is lacking and it seems to the author that the terminology is used rather diffused and incoherent when different sources are examined.

In short, there is not a solid ground theory to base this research on. Therefore it is chosen to use the building theory process designed by Eisenhardt (1989). She designed a roadmap for building theories from case study research. It synthesizes previous work on qualitative methods, the design of case study research, and ground theory building. According to Eisenhardt (1989) the case study is a research strategy which focuses on understanding the dynamics present within single settings. They typically combine data collection methods such as archives, interviews, questionnaires, and observations. The evidence could be twofold: qualitative, quantitative or both (Eisenhardt, 1989). This research will primarily be qualitative, since building projects involving circular economy are not available.

The following data collection methods will be used:

- Literature reviews
- Thought studies

Lack of empirical evidence on the practical implementation of circular economy in the construction industry

Because of the above mentioned argument on the lack of empirical evidence this method gains in importance. Since there is not a solid ground theory thought studies could give certain insights in the concept of circular economy which not yet have been acknowledged.
- Interviews

The interviews will be mainly explorative in nature. A interview protocol and a transcript of an already done interview can be found in the appendix. Interviewees could be of any nature, preferably in the construction industry, however certainly not necessary.

- Case studies

The main question to be answered in the case studies is: to what extent do the case meet the set circular economy boundary conditions? It is aimed to do four case studies, however this number can be raised if interesting cases are found. Again, the cases should preferably be within the built environment, however not necessary.

**Literature and general practical preference**


Theses in progress


Reflection

Relevance

Scientific relevance

Especially in the last years a lot has been written about ‘the circular economy’. It has been promoted by the Ellen MacArthur Foundation via various reports in corporation with McKinsey & Company and this has been picked up by various institutions (Ellen MacArthur Foundation, 2012). The foundation started The Circular Economy 100, a global platform bringing together leading companies, emerging innovators and regions to accelerate the transition to a circular economy.

Also on political level is interested in more research in the circular economy. The European Commission is aiming to present a new, more ambitious circular economy strategy late 2015, ‘to transform Europe into a more competitive resource-efficient economy, addressing a range of economic sectors, including waste’.

Not only in Europe is ‘the circular economy’ gaining popularity. Also in The Netherlands more and more initiatives are popping up in the field. Initiatives such as ‘The Green Deal’ tries to implement the circular economy in the building industry. The initiative is gaining interest and is already signed by more than 60 companies. Next to that there are foundations such as ‘Building the CE’ and ‘Stichting Circulaire Economie’ trying to gain more knowledge about the circular economy.

There are also examples to mention where it is claimed that the circular economy is used in practice. Carpet manufacturer DESSO says it has been working with the principle and it has gained them significant advantage. Recently it has been announced that Philips will use ‘circular lighting’ for the new lights at Schiphol Airport. Next to that, there is the town hall in Brummen, claimed to be the first circular building in the Netherlands.

Despite the significant amount of (questionable) reports that has been written about the circular economy and the increasing popularity of this ‘theory’, there is a lack of scientific reason about the practical implementation of the circular economy. After having done an extensive literature review, many brainstorm sessions and various interviews it can be concluded that there is a lack of a widely supported working definition of the circular economy. If 10 people are asked to give a definition, 10 different answers will be given.

Next to that, the circular economy as promoted by the Ellen MacArthur foundation should not be accepted as it is without any critics. This research will also criticize the model. Furthermore A working definition is necessary in order to determine the conditions of the circular economy. Questions such as ‘what is it?’ and ‘when is a project fully implement the circular economy principles’ will be answered. Only if the boundary conditions are determined it can be said whether or not a project is implementing the circular economy.
Especially in the built environment there are some serious practical challenges to mention about the practical implementation. This research will discuss those issues and subsequently tries to design a business model in which building material suppliers can operate successfully within the set boundary conditions of the circular economy.

Societal relevance:

The economy has been dominated by a one-way or linear model of production and consumption. In this model goods are manufactured from raw materials, sold, used and thrown away (EMF, 2012). This has brought us a lot of prosperity and there is still room for this model to grow geographically. However, people more and more realize the need for productivity gains and resource efficiency. According to the Ellen MacArthur Foundation people are living on a ‘consumption time bomb’. Our resources are running out. On the contrary, the global middle class will more than double in size to nearly 5 billion in the 15 years which will result in an increase in the consumption and material intensity (EMF, 2012). By 2050, the population will grow over 9 billion people, most of them enjoying increasing wealth (Godfray et al., 2010). This will lead to an economy demanding three times the amount of resources we currently use (Planing, 2014). Other research shows even concludes that over 99% of the material flow generated in order to produce goods ends up in waste disposal after 6 months (Hawken, Lovins, & Lovins, 2013). It can be questioned if these figures are exact, however it describes the urgency of a fundamental change of our economy.

Looking at the construction industry the following figures can be mentioned. The built environment nowadays is responsible for using 40 to 50% of the natural resources, 30% of the primary energy demand in OECD-countries, 40% of the emissions of greenhouse gases and 10 to 30% of the waste flow in the European Union (Uihlein & Eder, 2009) (Schoolderman et al., 2014; OECD, 2008; Uihlein & Eder, 2009; APRICOD, 2006).

The circular economy theory is about designing out waste and optimize use of the resources. There is great potential in the theory since, at some point, our resources are depleted and the world has to use the resources available. The current linear economy has been here for more than 200 years. It has been sufficient for a long time, but at this point in time, a change is necessary.

This research aims to give more clearance about the concept and its challenges in order to accelerate the implementation of a sustainable economy.

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<td><strong>Year planning graduation Ruud Stigter</strong></td>
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- **Week 36** 31/08 -- 04/09
  - 1) research the change in business models, 2) further definition of case study criteria, 3) plan explorative interviews
  - Literature studies, thought exercises, brainstorm sessions

- **Week 37** 07/09 -- 11/09
  - 1) research the change in business models, 2) find at least four case studies, 3) plan explorative interviews
  - Literature studies, thought exercises, brainstorm sessions

- **Week 38** 14/09 -- 18/09
  - 1) finish chapter 3, 2) first examine case studies, 3) plan explorative interviews
  - Literature studies, thought exercises, brainstorm sessions

- **Week 39** 21/09 -- 25/09
  - 1) finish case study 1, 2) conduct interview(s)
  - Case studies, interview

- **Week 40** 28/09 -- 02/10
  - 1) finish case study 2, 2) conduct interview(s)
  - Case studies, interview

- **Week 41** 05/10 -- 09/10
  - 1) finish case study 3, 2) conduct interview(s)
  - Case studies, interview

- **Week 42** 12/10 -- 16/10
  - 1) finish case study 4, 2) conduct interview(s)
  - Case studies, interview

- **Week 43** 19/10 -- 23/10
  - 1) finish report for p3, 2) finish presentation
  - Case studies, interview

- **Week 44** 26/10 -- 30/10
  - P3

- **Week 45** 02/11 -- 06/11
  - 1) finish case studies, 2) conduct interview(s)
  - Case studies, interview

- **Week 46** 09/11 -- 13/11
  - 1) define the main challenges in designing the financial aspects of a business model
  - Literature review

- **Week 47** 16/11 -- 20/11
  - 1) design the financial aspects of the business model
  - Literature review

- **Week 48** 23/11 -- 27/11
  - 1) design the financial aspects of the business model
  - Literature review

- **Week 49** 30/11 -- 04/12
  - 1) design the financial aspects of the business model
  - Literature review

- **Week 50** 07/12 -- 11/12
  - 1) finish draft chapter five, 2) plan interview(s)

- **Week 51** 14/12 -- 18/12
  - 1) try to define the viability of the designed model in practice
  - Interviews

- **Week 52** 21/12 -- 25/12
  - 1) try to define the viability of the designed model in practice
  - Interviews

- **Week 1** 28/12 -- 01/01
  - 1) finish report for p4, 2) finish presentation

- **Week 2** 04/01 -- 08/01
  - P4

- **Week 3** 11/01 -- 15/01
  - 1) improve report for p5, 2) draft presentation p5

- **Week 4** 18/01 -- 22/01
  - 1) finish report for p5, 2) finish presentation p5

- **Week 5** 25/01 -- 29/01
  - P5