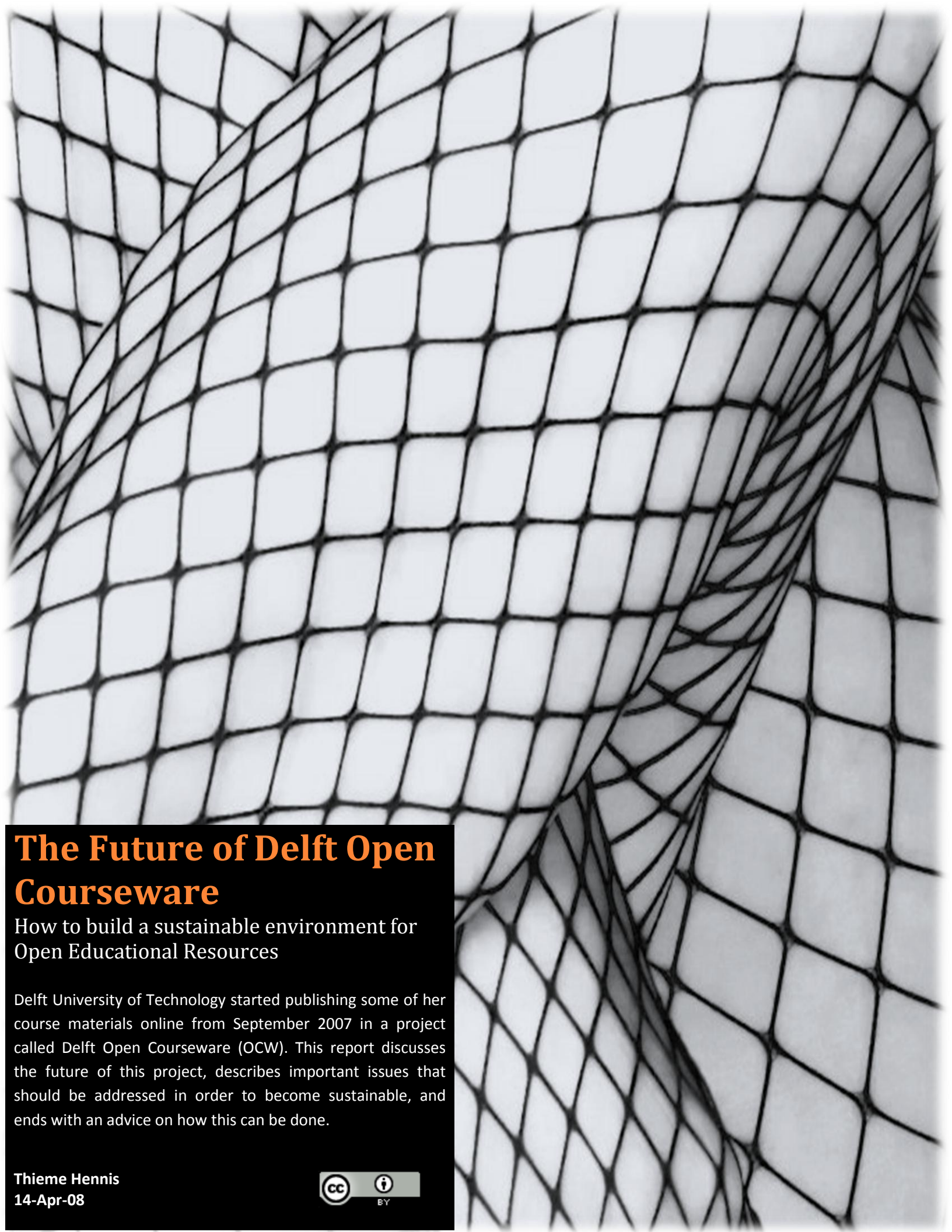


The Future of Delft Open Courseware

How to build a sustainable environment for Open Educational Resources

Delft University of Technology started publishing some of her course materials online from September 2007 in a project called Delft Open Courseware (OCW). This report discusses the future of this project, describes important issues that should be addressed in order to become sustainable, and ends with an advice on how this can be done.

Thieme Hennis
14-Apr-08

The picture on the cover page, called *"Network Solution"* is created by Russian artist Dmitry G. Pavlov and stumbled upon by me, Thieme Hennis, on DeviantArt.com.
A network solution can be sexy.

Preface

A number of years ago, I was studying in Barcelona, with plenty of time to contemplate about my position in the world, my future, my interests, my happiness, without any constraints imposed on me by my environment. It was during this time that I started thinking about the future of education, and got inspired by projects such as MIT Open Courseware[1], the $100 dollar laptop[2], and Wikipedia[3].

Back in Delft, I decided to change the course of my studies in order to be able to focus more on education and technology. This report treats the subject of educational resources that are freely available to anyone on the internet, an engaging and very relevant topic. It is not just another interesting domain to research, but also very rewarding because of the ability to contribute something positive.

Clearly, I have a number of people to thank. First of all, my supervisor, Professor Wim Veen, not just for sharing his knowledge and ideas with me, but most of all for inspiring me. Ellen Sjoer was the perfect person to assist me next to Professor Veen, because where he left me inspired, but a little dreaming about long-term implications, she put my feet on the ground. Her guidance and insightful comments have helped me enormously. Next to Ellen, I was enthusiastically assisted by two more persons of my faculty, Jaco Appelman and Jolien Ubacht. Other people who, actively or passively, have played a role in the research are Edzart Hoyng, David Wiley and other persons from the Intro to Open Education course (Fall 2007), the people I have interviewed for this research, and finally, my parents, for their support in many ways.

Thieme Hennis, 14 April 2008
http://hennis.nl

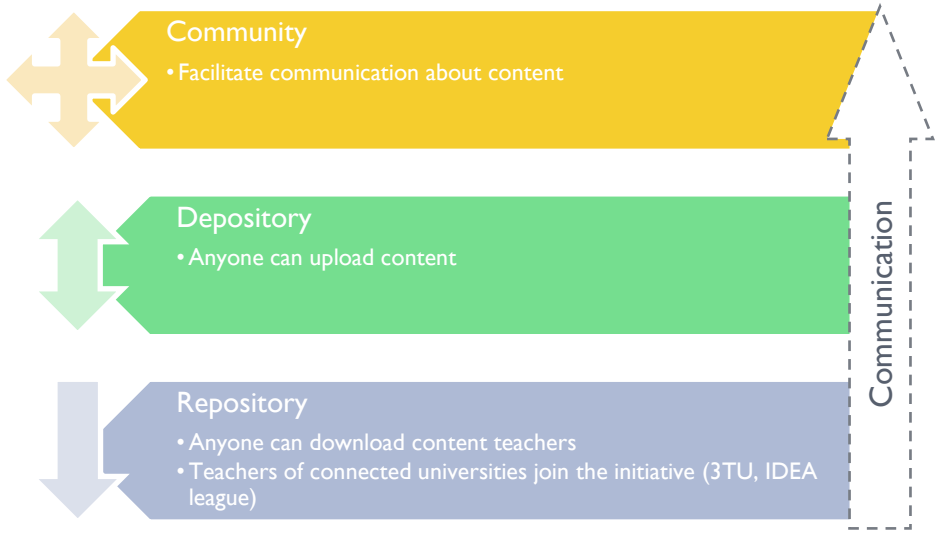
Table of Contents

List of tables and figures

Summary of findings

In 2007, Delft University of Technology, one of the leading Dutch technical universities, started a project called Delft Open Courseware (OCW). This project has the aim of publishing all university courses online, free for use, and builds on the worldwide trend and movement of opening up education. This young movement, commonly referred to as the Open Educational Resources (OER) Movement, has brought a number of interesting and diverging projects. The subject of sustainability of these projects is approached in different ways, bringing up lessons for sustaining new OER-projects, like Delft OCW.

Delft OCW has started off as a project similar to MIT Open Courseware, the initiative from the USA that is the original and first OCW project worldwide. Their model and workflow is copied for the first number of pilot projects of Delft OCW, and currently (2008), the courses published on http://ocw.tudelft.nl flow from this model of publication. In the project proposal for Delft OCW, this model, characterized by centralized control on publishing materials, has been described as forming only the first layer of three. A second and third layer, which address respectively decentralized publication and communication around content, will supplement this initial layer to become a sustainable, thriving, and attractive OCW website. The picture below shows the three-layer model.



The research

The goal of the investigation has been to provide the TU Delft with an advice about the sustainability of Delft OCW. Because it is a new project, in a relatively new domain, not much is known about the sustainability of such projects. The specific objectives, ideas and ambitions of the university are not known either. The recommendations address about the organization of the project, and accounts for external trends and future opportunities as well as ideas and fears from TU Delft stakeholders.

First, a literature analysis has been conducted on Open Educational Resources and specifically, the sustainability of OER projects. The sustainability of an OER project is influenced by a number of very important components. These components, which are used as a framework for analyzing both OER initiatives and TU Delft actors, are described as follows.

- **Organization.** This relates to the way different activities to sustain the production and management of OER is organized, whether centralized, decentralized, or navigating in the ocean of opportunities in between.
- **Motivation.** Specifically in decentralized organizations, finding non-monetary incentives that exist next to the regular monetary incentives of participants is crucial. These incentives may be built into the project with the intent that participants build communities, and in that way sustain activities within the environment. How can you engage volunteers in production, support, and management?
- **Types of resources.** The types of resources that will be offered concern the media formats in which these resources will be shared, the level of contextualization, and whether the resources support standalone or teacher centric learning.
- **Types of end-user reuse.** An organization starting an OER project should envision the way the published learning materials should be used. It can explicitly allow and support (through tools) *adaptation* of resources, meanwhile another choice can be to just let resources be reused *as-is*. What kinds of reuse will best contribute to the project objectives? How will support be offered to the end user in case of reuse of content? Will this be done centralized, or decentralized in a network of volunteers?
- **Funding and revenue models.** The above components merely concerns organizational, social and educational issues. This last component emphasizes the financial side of OER initiatives, describing ways in which a project can reduce its costs, and the ways in which a project can make money.

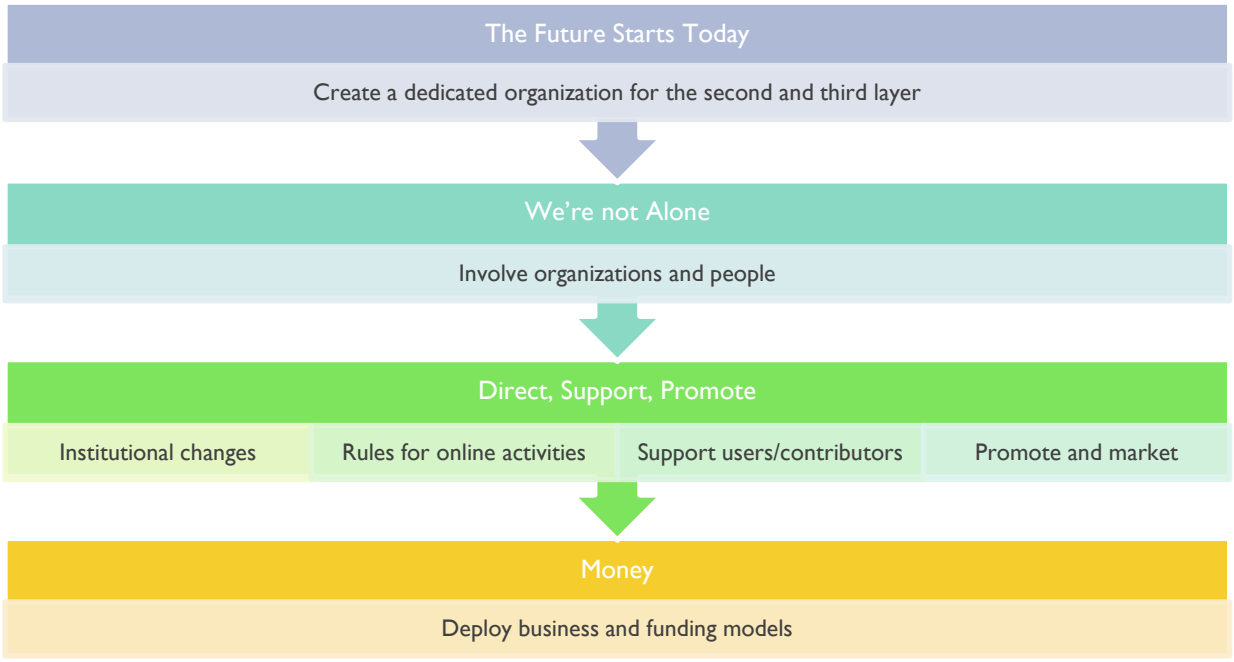
Using this framework, a number of distinct OER initiatives have been described. This resulted in an overview of how different initiatives approach sustainability. Also did it substantiate the mentioned components with real life examples and approaches.

Using external lessons and addressing technical opportunities is not enough: Delft OCW is a socio-technological system that will encompass and may become embedded in different layers of various organizations. The organization of Delft OCW has been investigated by interviewing important policymakers about their view on the project and its sustainability.

To form the advice, the findings are synthesized per component, prioritized, and put in a sequence. It is based on literature findings, the approaches of various OER initiatives, and the interview results.

The advice

After a synthesis of the results of the different research steps according the used framework, the most important elements of the advice were selected and put in a sequence. This is shown in the following illustration, which is a condensed overview of the advice. In order to fully understand the importance of each element, the reason why it is included, and how it can be implemented in the organization, the reader is advised to read at least the final chapter.



In short, the above illustration can be explained as follows.

- The current configuration of Delft OCW (the first layer) is not sustainable, because it is not able to continuously meet the objectives set by the stakeholders, such as *"becoming a hub in global knowledge networks"* and *"investing in the future of learning"*. The potential of the second and third layer should be recognized, resulting in the foundation of an organization that researches and develops these layers. This organization will form a comprehensive strategy about the role of OER in the future learning landscape. Concurrently, it develops a physical environment that includes the findings of the research.
- With a clear strategy, Delft OCW can more easily involve organizations and individuals. The TU Delft must not act solitary in the development and growth of the OCW environment, but must seek collaborators. These can contribute in a variety of ways, including creating materials, managing the site, providing business opportunities and funding, and sharing expertise and resources.
- Contributing content and site-managing by end-users and active participation by teachers and students do not happen without sufficient support and guidance. The TU Delft and participating organizations must be able to provide the necessary support and motivate sufficient individuals to contribute and add value to the site. Additionally, self-organizing principles, in combination with rules and protocols will guide and manage the distributed activities of end-users on the site.
- In an early stage, the potential business (and funding) opportunities must be considered, concurrently with the development of the future OCW system, so it will be able to develop business models and deploy them.

1 Introduction

Knowledge is the product of collective action; therefore we should make it a social property as well. This is the idea behind the numerous programs worldwide that give unrestricted online access to educational materials, commonly referred to as Open Educational Resources (OER). The projects that create, offer, and publish OER are relatively novel, but can be considered part of a much wider trend toward openness in and access to information online.

The Massachusetts Institute of Technology (MIT) shares free lecture notes, exams, and other resources from more than 1800 courses spanning MIT's entire curriculum. (http://ocw.mit.edu/)

In 2001, the Massachusetts Institute of Technology (MIT) in Cambridge (USA) announced its well-known Open Courseware (OCW) program, with the objective of making all their courseware available online.[4] This initiative has been followed by many, and is considered one of the most important projects in the world of open education. Anyone with internet access can look at MIT's educational resources, and use them for whatever (non-commercial) purpose, educational or personal.

As with any other educational institute, Delft University of Technology is facing enormous opportunities and threats in a rapidly changing, and increasingly globalizing world. Traditional structures and organizations are breaking down, learners and learning skills change, more and more information is becoming available online and educational institutes need to collaborate and compete on a globalized playing field (Downes, 2005).

TU Delft's objective is that the process of providing Open Educational Resources becomes embedded in the university's organization by 2010, and that open publishing becomes standard practice by faculty within the university.

Facing these challenges, Delft University of Technology (DUT) initiated Delft OCW in 2007. During several pilots with a number of faculties and departments the possibilities of providing Open Educational Resources are investigated. During the pilot phase, which will end in 2008, the objectives are;

- Designing the functionality, workflows, technical infrastructure, and organization. Sustainability and scalability are core issues.
- Publishing OER of different authoritative disciplines based on a specific functionality.
- Creating goodwill amongst participants to enable a university-wide dissemination of the initiative.
- Preparing a university-wide dissemination with additional functionality for the users. (Sjoer, 2007)

The reasons for "*opening up*" education are altruistic as well as commercial. By opening up, and showing best practices, the university expects to be better visible to the outside world, possibly attracting companies for collaboration and new students and Ph.D. students. Openly publishing of the university's educational resources can also improve the quality of education, because of transparency toward teachers and students, accountability, and feedback (TU Delft (a), 2007).

The following sections will define Open Educational Resources, describe the setting in which Delft OCW is established, explain the potential and projected future of Delft OCW, and introduce the research focus.

1.1 Defining OER

The concept of Open Educational Resources is difficult to define in exact terms. OER can be defined according to their function in learning, hence learning resources, resources to support teachers, and resources to assure the quality of education and educational practices (Johnstone, 2005). Downes argues that there should not be an a priori stipulation of what is or is not an educational resource, because it will limit the discussion unproductively. He argues that learning goes beyond the scope of formal learning, which means that resources used outside the formal boundaries of education may yet be considered instances of OER. (Downes, 2007).

The characteristic *"open"* is surrounded by just as many clouds as the term *"educational resource"*. Open does not by definition mean without constraints. The Creative Commons[5] license for example, commonly used in OER projects, can provide limitations for the use of the resources, such as the criteria of attribution or denying use for commercial purposes. More information about the Creative Commons license can be found in Appendix A. Tuomi explains openness on the basis of open source literature by distinguishing three different areas of openness: addressing social and technical characteristics, and the nature of the resource itself. Openness implies several ethical concerns, such as freedoms to *use, share, and contribute*. It also means interoperability on a technical level, and the use of open standards. The nature of a digital resource is that it is non-subtractive: anyone can use OER without affecting the amount available to others. If an educational resource is appropriated (with a restrictive license) this characteristic does not apply (Tuomi, 2006).

In conclusion, resources can be considered open when they *(i)* are non-rival goods that can be enjoyed without affecting the further use by others and possibly increase the value by using it, *(ii)* provide non-discriminatory access to the resource, and *(iii)* can be adjusted, improved, and shared.

The Hewlett foundation, one of the largest funders and supporters of Open Educational Resources worldwide, defines OER as follows;

> *OER are teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials or techniques used to support access to knowledge.*[6]

Hence, resources do not only refer to content, such as courses and articles, but also the software that can be used to develop, deliver, or manage these resources.

- **Tools.** Software (open source) to support the development, use, reuse and delivery of learning content, including searching and organization of content, content and learning management systems, content development tools, and online learning communities.
- **Learning content.** Courseware, content modules, learning objects, collections and journals.
- **Implementation resources.** Intellectual property licenses to promote open publishing of materials, design principles of best practice and tools to localize content (Hýlen, 2007).

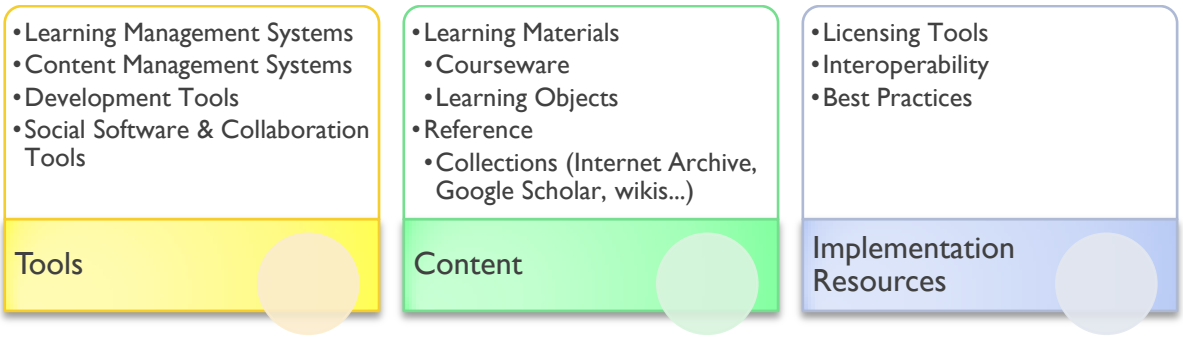


Figure 1-1 - Open Educational Resources, a conceptual map (Hýlen, 2007)

The following section explains some of the main challenges faced by universities in general, and connects them with the context of Delft Open Courseware.

1.2 Setting the Context

Global changes in population and workforce increase the need for lifelong learning. The skills needed to perform in our economy changes and will continually change, making it an imperative for knowledge workers to update our working skills throughout our working lives. This development is based on two important factors: globalization and the rise of a knowledge economy (Keeley, 2007). The coming decade will bring us a world where knowledge is readily available whenever and wherever we need it. Technology enables us to store and carry enormous quantities of information, and communications networks allows us to connect and coordinate activities, and process and apply knowledge space and time independent (Tuomi, 2007). E-Learning will become an important element of formal learning, and the way content is distributed and used by people may become more important than the way it is designed. Social software will play an increasingly important role in the dissemination of knowledge between learners (Chatti, Jarke, & Frosch-Wilke, 2007). Although universities and educational institutes have a particular role within society, which means that trends that emerge in society may not apply for universities, these developments cannot be disregarded and may form an inspiration for organizational changes.

Not only does Delft OCW provide an opportunity to connect and form a hub in worldwide knowledge networks, but Open Educational Resources have the potential to change education and make it cheaper.

Learning and learners change as well. Where teacher-centric approaches have been a standard and common practice in most educational institutes, the shift towards a more learner centric approach is emerging. Learners have direct access to various sources of information and instructional devices, and leads to the disintermediation of traditional classroom instructors and institutions. The learner becomes actively involved in his or her own learning (Siemens, 2006). These issues pose significant challenges to educational institutes, and Delft University of Technology (TU Delft) is no exception. Organizationally, things will change, but also the way research and education is conducted is bound to be transformed.

The TU Delft is a research university: her education is intrinsically linked with high quality research. Opening up her education offers many opportunities to disseminate their authority and name, but at the same time it may entail risks. The way Open Educational Resources (OER) will play a role in education in

the 21st century is still unknown. We are witnesses of only the start of a worldwide movement, whose foundations and structures, its value and potential, are still being formed. If openness plays a central role in the future of education and research, then Delft OCW can in fact become a crucial instrument to attain the core objectives of the TU Delft.

The following section portrays the future of Delft OCW, as described in the project proposal.

1.3 The Future of Delft OCW

The TU Delft is at the start of the project, which means that still many possible directions can be explored. It is important to know what the point of departure is, before conducting a long and interesting journey. Regarding the future of Delft OCW, the project proposal describes a three-level approach, illustrated with the picture below (TU Delft (a), 2007).

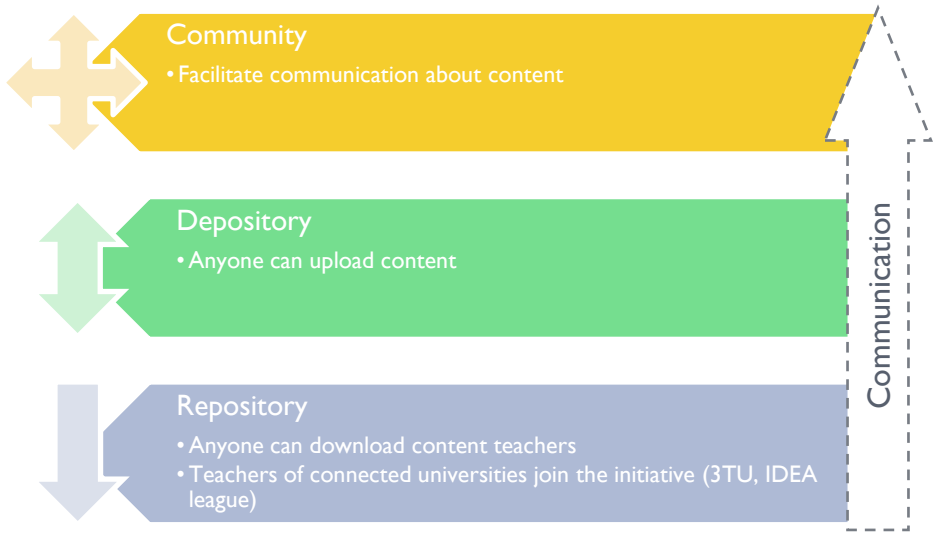


Figure 1-2 - Three layer model, Future of Delft OCW (TU Delft (a), 2007)

Repository. The first layer can be described as a repository, managed and controlled in a centralized fashion. In December 2007 a total of 10 courses were published in this repository and became accessible for anyone on the website.[7] It is expected that in the beginning of 2008 another 16 courses of three different departments will be published according to a rather centrally controlled workflow, expressed in Appendix B. All these courses are published voluntarily by teachers in an online repository that can be accessed by anyone. The objective for the TU Delft is that publishing educational materials becomes a standard process within the university. The TU Delft operates in collaboration with national and international universities, and it hopes that in the future, these will join in this project.

Depository. The second layer, the depository, allows any individual, not just teachers from connected universities, to add content to the website. These users do not necessarily belong to the TU Delft or one of its partner universities, but they can be anyone. Allowing contributions from anyone involves and engages the user of the site, and taps into the *"wisdom of crowds"*. This means that the university outsources functions once performed by employees to an undefined (and generally large) network of

people in the form of an open call (Howe, 2006).

Lab-environment. One small step further is the third layer, which is called a lab-environment, where users not only are able to contribute new and remixed content, but can in addition discuss and interact about it. This, supposedly, will lay the foundation for the formation of learning communities.

The following section introduces the research focus, which is further elaborated in chapter 3. The main research question is posed, followed by sub-questions.

1.4 Research focus and questions

My personal interest in the subject, in combination with TU Delft's need for clarity about these issues, made me decide to choose this project as the subject for my thesis. The department of Education & Student Affairs (ESA), responsible for financing and managing the project (Appendix C), is the problem owner.

The whole movement around Open Educational Resources is relatively young, and a proven method or model to follow lacks. A number of researchers have written about Open Educational Resources, sustainability, and future issues and their views will be covered in this report. Next to these ideas and theories there are organizational and technological issues and characteristics of TU Delft and its environment. This technological and institutional context of an educational institution is significant for the implementation, and should therefore be taken into account as well.

What will be the right configuration for Delft OCW? How can it be sustained and scaled? Are the second and third layer desirable, and how can they be implemented?

As described in the project proposal, and depicted in Figure 1-2, the objective is to go from a centralized organization around the production of educational content, toward a more decentralized, self organizing community based environment for open educational content. In the near future, the emphasis will be on the digitization and (online) publishing of TU Delft course materials in the depository (first layer). Many questions remain concerning the described second and third layer, their function, what the benefits and risks are, and how this corresponds with university's internal organization and direct environment. Finally, it is unknown whether and how these ideas match with trends in a quickly changing global learning landscape. There are many relevant issues that can be investigated, including the future of learning/education and its relation to OER, pedagogical effectiveness, copyright issues, etc. In dialogue with the problem owner, ESA, one of the more pressing issues, the *sustainability of the project*, is chosen as a focus of the research, because there are no clearly defined ideas on how the project should be developed to become sustainable.

There is not a *one size fits all* configuration for sustaining OER projects; both the context/environment and organization are very important. Sustainability of OER, as described in literature, must be investigated, and supplemented with lessons that can be learnt from other OER initiatives and their respective approaches toward sustainability. Finally, the technologies used, people, their sentiments and other social aspects of the university play a crucial role in sustaining such a project. By conducting

interviews with the most important stakeholders of OER, the investigated future possibilities can be fitted within the specific TU Delft context. This will then form the basis for the final advice that can be used as a design for a sustainable Delft OCW.

The goal of the research is to provide the university with a report that proposes a way (or ways) for Delft OCW to become sustainable. The result of the analysis will both address external trends and opportunities, and consider the internal difficulties and possibilities of the university. By addressing these issues the university will then be able to let this project evolve in something that is sustainable, meaning that it is *continuously able to meet its goals*, and *able to constantly produce and share reusable educational resources* (Wiley, 2007). This implies many different aspects, discussed in chapter 3 about sustainability of OER projects. The research question is formulated as follows:

How can Delft Open Courseware (OCW) become sustainable?

It is not the focus of this research to investigate educational and technological trends, and whether they are applicable within a university context. Still, this is significant, because in order to be sustainable, Delft OCW must operate successfully in the future learning environment.

The following operational research questions indicate both the setup of this report, as the setup of the research. For each of the questions the intended result is described.

Chapter	Research question(s)	Intended result
2	What research methodology applies best to formulating an advice for sustaining Delft OCW?	Description of research methodology and coupling research questions with instruments.
3	What does sustainability for Open Educational Resources (OER) mean? • Which factors are most relevant for the sustainability of OER projects?	Elaboration on sustainability of OER. • A conceptual framework for investigating sustainability of OER consisting of a number of relevant factors.
4	How do other OER initiatives approach sustainability? • What are relevant initiatives? • How should these be researched?	An overview of different initiatives and their means of being/becoming sustainable using the defined framework.
5	According to the most important actors, what are future concepts, ideas, and ambitions with respect to Delft OCW? • Who are relevant actors for Delft OCW? • How do they see the project from the perspective of sustainability?	This chapter has different results; • Overview of actors, their positions, roles and influence possibilities. • Ideas for the future and ambitions with regard to Delft OCW, according to important stakeholders at the university.
6	What are the most important issues for TU Delft to consider in order to make Delft OCW sustainable? • What are opportunities for making Delft OCW sustainable? • What are the most relevant opportunities, and how should the organization of Delft OCW address these?	The literature findings, the results from the initiatives, and the outcomes of the interviews are combined into an advice for sustaining Delft OCW. • An overview of possibilities, their priorities, and sequence to attain the educational objectives and international ambitions.

Table 1-1 - Sub-questions, methods, and intended results

1.5 Outline report

This chapter has introduced the project, mentioned the importance of the organizational aspect, and explained the view on the future of Delft OCW as represented in the project proposal.

The following chapter will describe the research methodology and instruments. Chapter 3 explains sustainability of OER according to literature. It will conclude with proposing and substantiating a framework for doing the research. The 4th chapter uses this framework to describe exemplary OER-initiatives and how these projects (intent to) attain sustainability. In this chapter different possibilities for attaining sustainability in OER-projects are described. The results of this chapter are used as an input for both the interviews and the advice in chapter 6. Then, the 5th chapter will describe the most important results of the interviews that have been conducted with the most important actors. This is preceded by an actor and network analysis, which analyzes the project by looking at the persons, groups, and organizations that are (potentially) affected by or have to deal with the project, now and in the future. The result of the actor and network analysis is to identify the most important actors to interview, and to provide an overview of the power balance, the importance of different (groups of) individuals, and the network surrounding the project. This can be used in further investigations. Chapter 6 offers an advice for sustaining Delft OCW. The advice is based on the findings of the literature research and the discussed initiatives, but configured specifically for the TU Delft, by using the findings of the interviews with the most important actors.

The figure on the next page depicts the outline of the report.

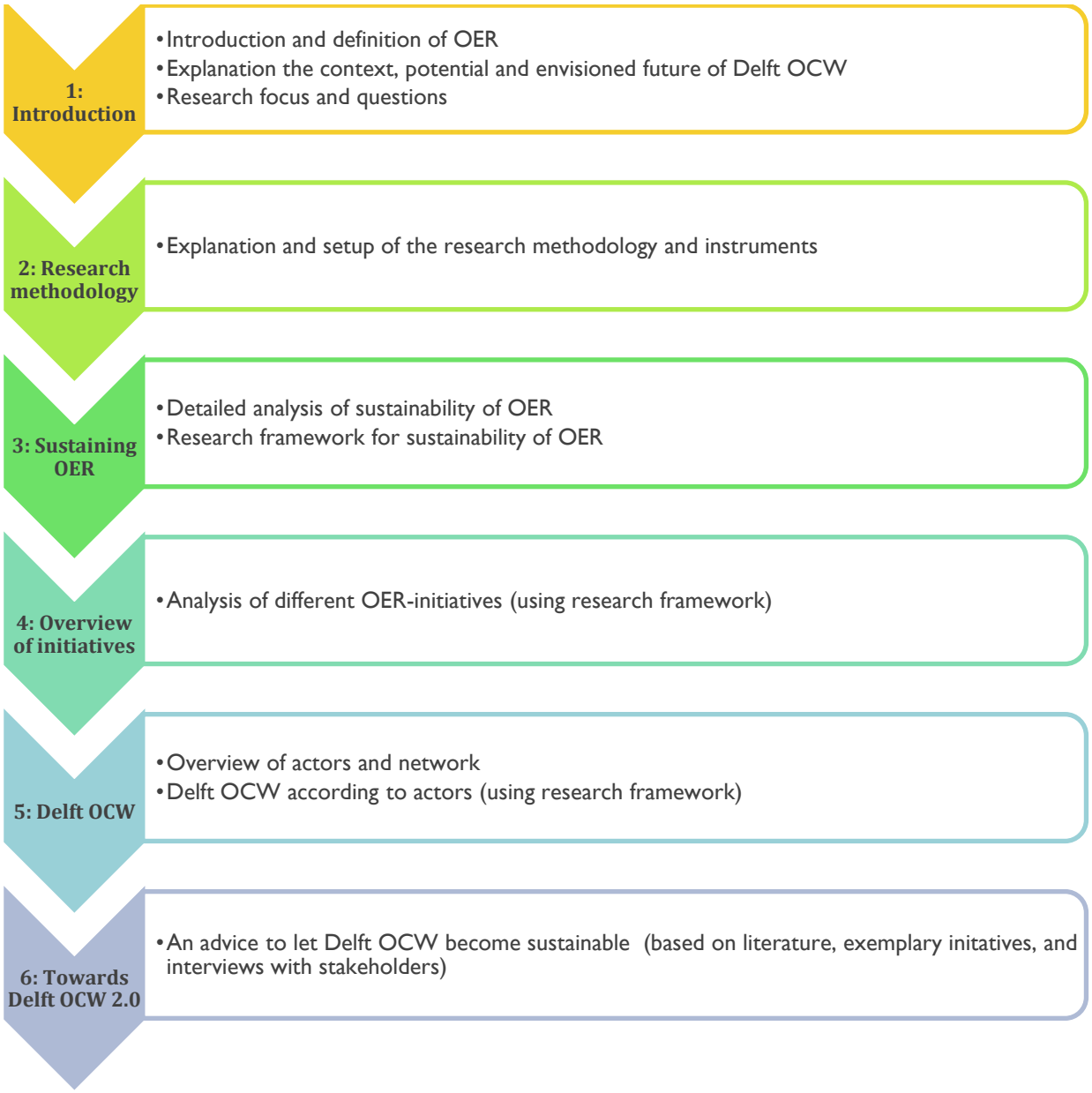


Figure 1-3 - Overview report

2 Research methodology: an embedded case study

This chapter will elaborate on the methodology and research instruments that are used to formulate the advice for the sustainability of Delft OCW.

Yin explains that the case study method is generally used when *"how"* or *"why"* questions are being posed, when the researcher has little control over events, and when the focus is on a contemporary phenomenon within some real-life context (Yin, 2002). Case studies are not used solely to explain certain phenomena, but can be used to describe, or to explore phenomena. They can bring greater understanding of a complex issue, by doing a detailed contextual analysis on a number of relevant conditions and their relationships. An embedded case study is a case study containing more than one sub-unit of analysis. The advantage of identifying sub-units for analysis is that it allows for a more detailed level of inquiry. The embedded case study design is an empirical form of inquiry appropriate for descriptive studies, where the goal is to describe the features, context, and process of a phenomenon (Scholz & Tietje, 2002). By studying information from a hypothetical or actual situation, a recommended policy can be formulated (Yin, 2002; Soy, 1997).

Flyvbjerg has argued that some common misconceptions about case study research are ill-founded, such as the misunderstanding that case studies may not be generalized (Flyvbjerg, 2006). Walton even claims that case studies are likely to produce the best theory (Walton, 1992). This means that although this specific case is focuses on the TU Delft, other (existing and future) OER initiatives may benefit from its results as well.

Case study research methodology relies on multiple sources of information, for instance documentation, archival records, interviews, direct observations, participant observation and physical artifacts. Relevant data are gathered, organized, evaluated, and generalized (Yin, 2002). Through *methodical triangulation*, i.e. using more than one method to gather data, the validity of the research is increased. This type of research is preferred when the boundaries between the environment and the phenomenon are not very clear. *Data triangulation* concerns the use of different data sources (Denzin, 1978). Because Delft OCW will be integrated in an international, national and local university setting, it is not wise to base a design for a sustainable online environment just on the available documentation, or just on the literature or exemplary initiatives. Therefore, using different methods to explore the same concept and applying different views on the case will lead to a more valid result of the research. It should be noted that the triangulation will explore, not test, a specific theory from different angles. It illuminates different perspectives in order to advance the understanding about sustaining Delft OCW. Figure 2-1 shows that both sources and methods are triangulated to attain a substantiated approach for sustaining Delft OCW.

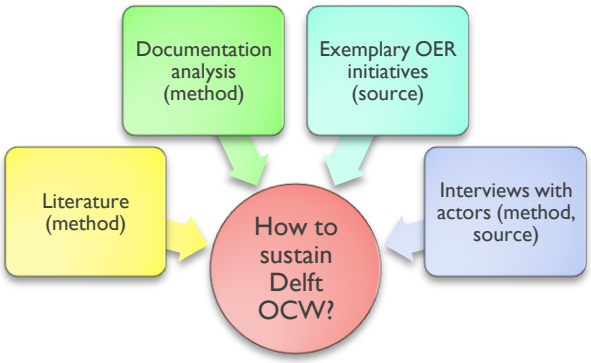


Figure 2-1 - Triangulation of the research

3 Open Educational Resources & Sustainability

This chapter explains sustainability and its relation with Open Educational Resources (OER) in more detail. After a short elaboration on the concept of sustainability in general, the section will specify its relation with OER. It does so by explaining the aspects that relate to the sustainability of OER projects, according to experts in the domain of (open) education. Then a conceptual framework is chosen that is used during the research to frame the analyses on exemplary initiatives and interviews. This framework grasps the most important aspects for sustainability in OER projects. The aspects are then substantiated with evidence from literature.

The following section holds an introduction to sustainability in general.

3.1 Sustainability in general

As defined in the main research question, this thesis will focus on sustainability with regard to the production and sharing of reusable OER, specifically for Delft University of Technology. The previous section has introduced the concept of open educational resources, and this section will focus on sustainability. So what exactly is sustainability? And how does it relate to open educational resources?

Although the definition of sustainability depends on the context in which it is used, some generic things can be said about it. The term is often used to refer to the ability of ecological systems to be usefully productive. Sustainability links present with future, because choices made now should not compromise the opportunities or possible benefits in the future (World Commission on Environment and Development, 1987). For example, the way we treat our oceans can be considered unsustainable. Although profits are being made nowadays, through overfishing large populations are driven to extinction, ruining ecosystems, and taking away opportunities for future generations.[8] Sustainability does not concern solely ecological and environmental systems, but relates to the continuity of economic, social, and institutional aspects of human society, as well as the non-human environment. Economic sustainability relates to the extent to which end-users rely on subsidies or financial inputs, institutional sustainability addresses the effect changes have on the social structures and institutions, and whether these changes are sustained by them (Ripamonti, De Cindio, & Benassi, 2005). Clearly, with regards to OER, there is no or little relation with nature, ecology, or environment. Hence, the focus of this thesis is on the economic and institutional sustainability, and sustainable development. An ICT environment needs financial support as well as social and institutional acceptance, making it a complex issue, where each aspect needs to be addressed. In formulating an advice for a sustainable Delft OCW, the various aspects relating to this concept should be investigated, such as costs and benefits, technical compatibility, social and institutional acceptance, and social gains.

Principles of sustainable development

Dealing cautiously with risk, uncertainty and irreversibility; integration of social and economic goals in policies and activities; equal opportunity and community participation; a commitment to best practice; the principle of continuous improvement; and the need for good governance. (Hargroves & Smith, 2005)

The next section discusses sustainability in perspective of OER projects.

3.2 Sustainability of OER projects

From an altruistic point of view, one could say that sustainability of an OER project means the ability to continuously support learning and the improvement of people's lives via freely available, adaptable, and redistributable resources. For the TU Delft, OER should create better visibility for her teachers and insight into education, improve the university's reputation, and advance the quality and efficiency of education (Delft University of Technology, 2007). The sustainability of the initiative depends on the costs of providing high-quality resources, but taken into account the positive consequences stated in the project goals. It is of course nearly impossible to define financial benefits OER have for the TU Delft: although you might be able to indicate the financial benefit of one extra student, it is impossible to do the same for a brilliant Ph.D. student. Or to estimate the benefits of future collaborations with companies, if a relation between OER and these collaborations can be made at all. It is sufficient to say that the project will contribute to the university's quality and sustainability if it has a positive effect on the reputation, educational quality, and visibility. It is, therefore, quite difficult to describe sustainability as something purely financial.

The following section describes two important challenges for sustaining an OER project. The section concludes with an argument in favor of decentralization as a means to attain sustainability in OER projects, according to different experts.

3.2.1 Two challenges

Wiley defines sustainability of an OER project as the ongoing ability to meet the goals of the project. This implies two important challenges, which are the ability *(i)* to continue the production and sharing of OER; and *(ii)* to sustain the use and reuse of their OER by end-users (Wiley, 2007; Hýlen, 2007).

- **The first challenge.** The creation of OER requires individuals to put time and effort in developing them, digitize material, checking for copyrights, and provide quality assurance. Additional costs concern those that are made for providing bandwidth and other expenses for the dissemination and sharing of resources.
- **The second challenge.** The provision of useful resources has to do with the format of materials, and consequently the ability to reuse the materials. Reusability of materials means the ability to contextualize, translate, adapt, and use educational resources. This is important, because the effectiveness of education depends not so much on the information itself as on the way the information is brought to students. There are two trade-offs to be made here;
    - Although reusability is an important objective in open education programs, many resources are published in formats that do not allow easy formatting and localization. Normally it involves much less effort and costs to produce materials in formats less easy to adapt or localize (such as PDF files), than in more flexible formats (such as XML). The reusability issue and the costs to transform materials into more flexible formats, such as costs for training, technology, and mechanisms, are part important when discussing sustainability, because it involves social acceptance as well as economic viability (d'Oliveira, 2006).
    - A similar paradox comes from learning objects literature, and is called the *"reusability paradox"*. In short, it describes the inverse relationship between reusability of a learning object and its pedagogical effectiveness, which applies to OER as well (Wiley, upcoming).

The illustration below gives an overview of the main sustainability challenges.

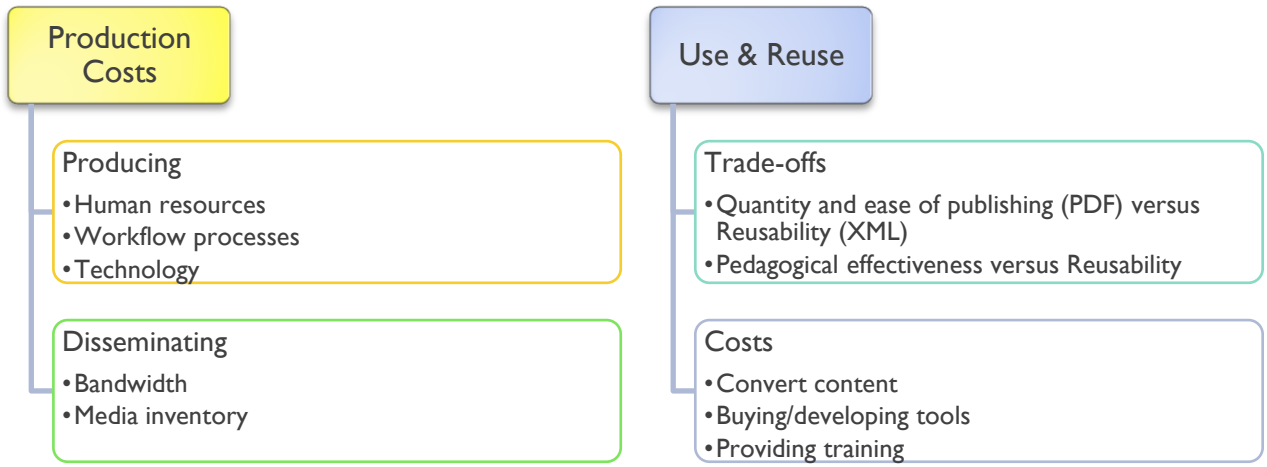


Figure 3-1 - Sustainability challenges (Hýlen, 2007)

Reflecting sustainability, or the *"ongoing ability to meet the goals of a project"*, on these challenges, it implies the ability to produce, share, localize, and learn from open educational resources. This can be attained through the reduction of friction and decentralization, capturing intrinsic motivation of individuals to contribute without financial recompense. Wiley states that decentralization means the active involvement of students (Wiley, 2007). In an earlier work, he posits it very clearly:

> *It seems to me that sustainability and scalability are problematic only when people rely on others to do things for them. Scalability and sustainability happen more readily when people do things for themselves. Centralizing open educational services is less scalable/sustainable. Wikipedia has two employees and well over a million articles in multiple languages. We need to learn this lesson if open education is really going to reach out and bless the lives of people. (Wiley, 2005)*

Other authors support this vision. Koohang & Harman describe OER communities of practice as a means for decentralization and better scalability (Koohang & Harman, 2007). The sustainability of Connexions, a project that almost entirely depends on the voluntary efforts of individuals worldwide for the production of OER, has been investigated as a case study. The case study focuses and describes issues regarding motivation and value propositions for end-users of the site (Dholakia, King, & Baraniuk, 2006). Benkler describes criteria for (decentralized) peer production of OER and its positive relation with sustainability (Benkler, 2005). Schmidt & Surman state that the focus should be much broader than just on content: the sustainability of OER depends on the thriving of a whole OER-ecosystem. For instance, the process of building and nurturing peer production communities should be taken more seriously. More focus should be on creating stronger communities of practice in open education (Schmidt & Surman, 2007). Stephen Downes follows the same argument, saying that the centralized model uses more resources, and is likely to cost more, but offers more control over quality and content (Downes, 2007). This, in fact, does not necessarily mean lower quality. We have seen that in Open Source Software, but in encyclopedias this phenomenon has proved itself successful as well. In a well-known, and well-debated, article in Nature results are described of a comparison between Encyclopedia Britannica (institutional)

and Wikipedia (community). More than 40 science related articles were compared using different criteria and the conclusion was that there was no significant difference in quality between the two encyclopedias (Giles, 2005). The quality review process and maintenance, as well as the production of information resources, is opened to a much larger group of people.

Generally speaking, the authors agree that decentralization, communities, and an overall bottom-up approach could improve sustainability and scalability.

The following section introduces the framework that will be used throughout the investigation. It consists of different aspects that relate to sustainability of OER projects. These aspects are explained and substantiated with literature findings.

3.3 A framework for investigating sustainability of OER

In order to be able to do the proposed investigation, i.e. analyze several exemplary OER initiatives and conducting interviews with important stakeholders, a conceptual framework is used. This framework should contain the most important factors that have to do with sustainability of OER projects. Literature research will substantiate these factors with more information. Addressing these substantiated factors in the analyses on sustainability of OER initiatives will produce a comprehensive account of their sustainability and approach toward this issue. In addition, by using the framework in the interviews with stakeholders, the internal approach toward sustainability of Delft OCW can be determined, and according the same format. This makes it easy to formulate an advice that is based both on the internal demands and ideas of stakeholders, and at the same time using proven methods and ideas of other initiatives and literature findings, because all is done with the same conceptual framework.

An expert in issues concerning open education, David Wiley, has proposed a model containing five factors that address sustainability of OER projects. These five factors form the framework that has been used in this research for the mentioned objectives. The framework is described in Hýlen (2007), a recent publication of the OECD (Organization for Economic Co-operation and Development), which gives an account of the worldwide OER movement.

Sustainability has been earlier described as the ongoing ability to meet the goals of a project, which means that the following components must be seen from that perspective as well.

- **Organization.** The configuration or organization model for the project forms one of the most important aspects of an OER initiative. It merely relates to the level of decentralization and the way different activities for sustaining the production, support, and reuse of OER is organized.
- **Motivation.** Another interesting topic regarding sustainability is finding non-monetary incentives of participants. These incentives may be built into the project with the intent that participants build communities, and in that way sustain activities within the environment. This component focuses specifically on finding and utilizing incentives that exist next to the regular monetary incentives. How can you engage volunteers in production, support, and management?
- **Types of resources.** The types of resources that will be offered, and the media formats in which these resources will be shared are important considerations, because there are many instances when a certain format inhibits the reuse. For instance, video lectures and PDF files are rather difficult to edit or reuse. Other considerations regard the level of contextualization and

whether the resource supports standalone learning or is more focused on teacher centric education.

- **Types of end-user reuse.** An organization starting an OER project should envision the way their Open Educational Resources should be used. In an earlier section the example of Connexions shows that the organization can explicitly allow and support (through tools) *adaptation* of resources, meanwhile another choice can be to just let resources be reused *as-is*. What kinds of reuse will best contribute to the project objectives? How will support be offered to the end user in case of reuse of content? Will this be done centralized, or decentralized in a network of volunteers?
- **Funding or revenue model.** The above components really have to do with the organizational, social and the educational issues of OER. This final component addresses the financial component, meaning the ways in which a project can reduce its costs, and the ways in which a project can make money. How will the project be funded, now and in the future? What are ways to reduce costs? What revenue models are there and can they be applied in the context of the OER project?

The above factors need further elaboration, which is done in the following sections. Each of the factors forms a separate section containing literature findings that relate to the specific factor.

3.3.1 Organization

One of the most difficult issues faced by institutions that want to share their educational resources online, but potentially most important one, concerns the level of (de)centralization of production and management of an OER initiative. This is explained in detail in the following paragraphs.

MIT was not the first institution to support the open publication of educational resources, but they were the first large scale initiative worldwide. The future of education is in openness, was and is their vision (Vest, 2008; Goldberg, 2001). For their groundbreaking initiative, enormous grants were donated and other types of support were received from several foundations and organizations. They have developed technologies, workflows and organizational models that have been copied worldwide by many institutes in the OER movement. Their model, which adopts a centralized approach toward publishing OER, sources the contributions of MIT teachers and faculty, but makes it impossible for any user (such as students) to contribute resources or personalize the environment.

In several recently published reports on OER (Hýlen, 2007; Geser,

Delft OCW, the beginning…

MIT started the first Open Courseware Initiative worldwide in 2001. TU Delft's vice-chancellor, Jacob Fokkema, was inspired by this initiative and brought it to his university. Initially, TU Delft chooses to follow the footsteps of MIT, with a centralized support and management model. Teachers get physical and technical support in bringing their courseware online. A workflow has been designed focusing on the easy publication of materials, and the clearing of copyright. This centralized model is a standard for the different Open Courseware initiatives worldwide.

Different authors argue that a centralized organizational model is not sustainable, and suggest a model that makes better use of the voluntary efforts of many individuals distributed in a network. This has been described in the project proposal for Delft OCW as well (TU Delft (a), 2007).

2007; Atkins, Brown, & Hammond, 2007; Wiley, 2007; Downes, 2007) it is argued that, because of sustainability and scalability issues, a centralized model should not be adopted by each university. MIT has been able to publish all their courses, because of the substantial grants they have received. Now, years later, there are hundreds of Open Courseware initiatives, and the funds available for individual institutions for OCW projects have decreased considerably. Describing different factors that influence the sustainability of an OER project, these experts argue that decentralized models (of producing and managing OER) are available and better able to sustain a project, especially for institutions that do not want to rely on constant funding. Being dependent mainly on large investments and funds is less sustainable than a project where the same (or similar) results are reached in a decentralized network of volunteers. On the other hand, in a centralized environment, the contributions and management do not depend on volunteers distributed in networks or communities. More control on the content and management of the site is possible in that case, which is an advantage (Downes, 2007).

On a more generic level, different authors describe the potential of newer communication technologies to decentralize production, knowledge generation, and management. Technology allows many to contribute information and cultural goods, and at the same time it enables the finding and collaborative evaluation of it. The infrastructure to share resources and communicate in networks becomes better, faster and available for more and more people. This powerful development represents a global trend toward more openness, sharing, and peer production (Benkler, 2005; Benkler, 2006; Tapscott & Williams, 2006; Anderson, 2006). Others have a more critical approach toward the empowerment of users, increased amateurism, the disintermediation and loss of gatekeepers, and resulting demise of culture and quality online (Keen, 2007; McHenry, 2005). The translation of societal trends to an educational context is important, but not easily done. The particular characteristics of higher education should be kept in mind in case educational institutes intend to adopt and respond to societal trends, including decentralization and empowering end-users.

With regards to the component "Organization", the following sub-section will focus more on the subject of centralization versus decentralization. It discusses the community and institutional model, two organizational models that both cover one end of a spectrum.

Community versus Institutional model

There are various ways to organize OER, create them, and manage their quality and reliability. This section will focus on the way the organizations differ that support or create OER, which means that the structure and the organizational model are discussed.

Next to the size of a project, OER initiatives differ in the type of provider. The OER provider is the organization responsible for managing and sustaining the project. An important difference can be seen between OER organizations that are top-down organized and financed *(institutional model)*, and organizations that depend more on the voluntary efforts of many in a distributed network *(community model)*. Although a combinational approach is possible, most initiatives follow either an institutional model (most of them), or a community model, explained below (Wiley, 2007). The following list contains a number of exemplary initiatives, which are specified in the next chapter.

- **Institutional model.** The production, maintenance, quality review, control, management, and any other workflow activity happen in a centralized, hierarchical organization. MIT is one of the institutions applying this model, but Wiley states that this model is difficult to replicate, mainly because of the costs implied by the approach. MIT spends approximately $10.000 US to produce one course (Wiley, 2007). The advantage of this model is that an institution controls the quality of the resources, and can be more decisive in putting resources online and in support of people who need help. The model needs constant funding in order to be sustainable in the future.
- **Community model.** This approach assumes the (distributed) social production of educational resources, and the OER initiatives Connexions[9] and MERLOT[10] have adopted this model. This model enables the users to contribute and self-organize materials, to provide feedback, and in the case of MERLOT, to peer review materials. MERLOT, unlike Connexions, is a referatory, meaning that the website links to educational resources, rather than hosts them. Because the technical and pedagogical support is distributed here as well, it may be less reliable or controllable than the centralized model, but the costs of producing and maintaining materials is close to zero. Besides, extensive is documentation available on these sites that the user to contribute in different ways.

The space of possibilities of organizing OER is marked by the centralized "institutional" on one side, and the distributed "community" model on the other. This typology only depicts two points in a wide spectrum, in which many different possibilities exist, and different configurations can be adopted, sometimes combining the two extremes.

Utah State University for example, uses the centralized model in combination with a number of (student) volunteers to maintain and coordinate activities for their OCW organization (Wiley, 2007).[11] The Open University UK has an interesting configuration adopting both models by using two different websites with their OpenLearn initiative.[12] They have published their resources following a rather centralized model. Nevertheless, they have made a separate website, which uses the same resources, but includes tools that enable and encourage users to improve the materials or contribute own materials.[13] Interestingly, the Open University offers materials are specifically made for self study, while the OER of most other initiatives are resources used in some classroom or teacher context. The next chapter describes these and other exemplary initiatives in more detail to find out different approaches toward sustaining OER.

The community model

Mankind has always formed communities. Historically, these communities operate in certain geographical boundaries. Since the evolution of communication technologies, some communities tend to become more and more distributed, especially those where information is glue that keeps it together. A special kind of community can be found in open source software development, earlier described as a community with the freedoms to use, share, and contribute information.

Wikipedia co-founder Terry Foote describes two configurations in these distributed volunteer-driven open resource communities. (Foote, 2005) This difference should not be overestimated; it should be acknowledged that motivation and reputation can be addressed in different ways.

- One way to organize communities is around a select group of (distributed) volunteers, who probably know each other, and make up for the larger part of contributions. Within these communities, reputation is the result of interactions between these individuals, and these reputations are respected and influential.
- Another type of community concerns a more emergent organizational model, where individual users are less powerful. Numerous users all contribute a little bit to the whole, out of which a large coherent body of work is created. Normally, mechanisms are used to indicate the added value of a person and promote activity.

After this extensive elaboration on the main issues that concern the organization of an OER project, the following section will discuss motivation, which, specifically in decentralized organizations, plays a crucial role.

3.3.2 Motivation

Motivation is crucial in sustaining a decentralized environment. Non-monetary incentives are at the core of the social (or peer) production of educational resources and they will be crucial in order to create thriving communities where educational resources are reused and remixed constantly. Larsen & Vincent-Lancrin say that contributors are motivated to make OER material available because of their contributions might be adopted, modified or improved (Larsen & Vincent-Lancrin, 2006). Professors and researchers freely reveal their work to build recognition and promotion or receive tenure (Kansa & Ashley, 2005). These intrinsic (recognition) and extrinsic (promotion, tenure) motivations for sharing resources show that the sharing itself happens in a community. Without an existing culture there might be no motivation to share, because potential contributors do not feel *'obliged'* to share, or have not experienced the value of sharing (Fox & Manduca, 2005).

The design of the website and the organization influence the possibilities of utilizing possible sources of intrinsic motivation. An organization that depends on volunteers needs clear overall vision, strategy, and roles for participants (Horton, 2005). Stephen Downes makes the comparison with the way the Apache Foundation is organized. Being a *'meritocracy'*, it organizes its volunteer staff to serve more or less enviable roles depending on the value of their contributions (Downes, 2007).

Another important issue concern open licenses. Creative Commons, a set of open licenses for cultural and informational goods, plays an important role: contributors of original resources can stay owner of the resource, while freely distributing it.

The types of resources, in the next section, concern the original purpose of the materials, the flexibility of them, and type of media used.

3.3.3 Types of resources

OER differ in the way they are presented and the way they are published. They differ in quality, in subject, in size, in media format, and much more. The first distinction to be made regarding the Types of resources, concerns the purpose of the resource. Is the resource made to support classroom teaching, or does it allow stand-alone learning? One could say that educational resources fall in a spectrum where one extreme is denoted as typical teaching resources, and the other as typical learning resources.

- The teaching resources are designed on the assumption of existing knowledge of the domain. Experts are better able to understand and use these resources than a person unfamiliar with the subject.
- Resources used for learning must be richer, go into more detail, and are more expensive to produce than resources used for teaching (Wiley, 2007).

The project report states that it will not focus on learning resources, because this will be a greater barrier for getting teachers and other contributors involved (TU Delft (a), 2007). Still, high quality instructional design (inclusion of sound and appropriate learning theories into digital contents) and

presentation (user interface) of OER produce learning, which in its turn increase sustainability (Koohang & Harman, 2007).

Wiley explains further that a careful consideration should be made between the following two sometimes contrasting goals: *(i)* Publishing OER as efficiently as possible; and *(ii)* Supporting and allowing end-user reuse (and remix) of OER (Wiley, 2007). For example, it is quite easy to record a lecture on video and post it on the internet, but to reuse this type of material is almost impossible. To convert materials in highly flexible XML-documents may be very difficult, but it enhances the possibility to adapt and remix the resources. With regard to the first few pilots, the position of the TU Delft is very clear: publish OER as quick and efficient as possible. About the second and third phase, where users are able to publish materials themselves, the contrast between these goals (easy publishing versus reuse) is very relevant (see the textbox about the reusability paradox). Reusability and adaptability of OER could contribute to shorter lifecycles of materials, and increased quality maintenance.

Another issue here concerns the types of media used, such as online videos, websites, podcasts, weblogs, and more. Extensive research has shown that the medium of delivery (text, video, audio, etc.) does not significantly relate to the effectiveness of the resource.[14]

Different media types, as explained above, allow different types of reuse. The most important types of end-user reuse are explained in the next section.

3.3.4 Types of end-user reuse

End-user reuse indicates the way users will be reusing the offered OER. Earlier in the report, reuse and remix has been described as follows, quoting from the LabSpace website:

"Reuse could take the form of using our materials in the classroom, directing other individuals toward the freely available materials and tools, drawing on the content in your own writing, study or research. Remixing could take the form of reworking, rewriting, and translating units."[15]

The most relevant types of reuse are listed below.

- **As-Is.** Users do not have the rights or possibility to edit educational materials, and are able to use them without any modification or alternation. This means without special software or plugins.

The Reusability Paradox

Learning happens when people connect new information with knowledge they already possess. This means that the meaningfulness of an Open Educational Resource (or any learning resource) is a function of its context. This context is usually extensively elaborated in the resource (course or module) itself, making it easier to understand the information contained in it. In clearer terms: a learner can understand a highly contextualized resource more easily than one that lacks context.

Reusing learning resources means placing the resource in another context than the original. This replacement in a new context is easier with resources that contain little or no context.

In conclusion, it can be argued that reusability and pedagogical effectiveness are contrasting objectives. This can be seen in the picture below.

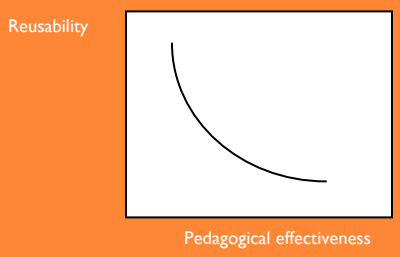


Figure 3-2 - Reusability paradox

- **Technical adaptation.** Resources are changed, but only in technical format. The content stays the same, but a website can be adapted with a certain style sheet, for example.
- **Remixing.** The most relevant type of reuse (for this thesis) concerns the ability of a user to access the source code. Users will be able to change the content of the resource according to their own wishes. The type of resource influences this possibility, because not all file types enable the user to access the source code, which is necessary to be able to change it. Because most users will not be skilled in reusing and adapting digital resources, it is crucial to have tools that make it easy to remix and adapt educational materials. An example is a WYSIWYG editor, rather than someone editing in XML, the latter being necessary to change modules in LabSpace.

Other common reuse possibilities are translations of resources, adaptation of resources according to some cultural aspects, which includes company-cultures or cultures within academic disciplines, pedagogical adaptation to resemble better a certain pedagogical style, and annotation, which means altering mostly physical materials for better recollection or overview (using colored highlighters, notes in the margin, etc.) (Wiley, 2007).

Downes takes a simpler approach and describes two broad models: either resources are used and compiled *'as is'*, so without modification, or OER are downloaded and adapted to the user's needs, and subsequently uploaded to the system again for potential use of other users. The latter model may require some sort of user registration (Downes, 2007). Walker further argues that sustainable implicitly means reusable, in the way that the content types are flexible enough to be adapted to local needs and conditions (Walker, 2005). This relates to the previous component, types of resources, because only a number of formats enable remixing of content.

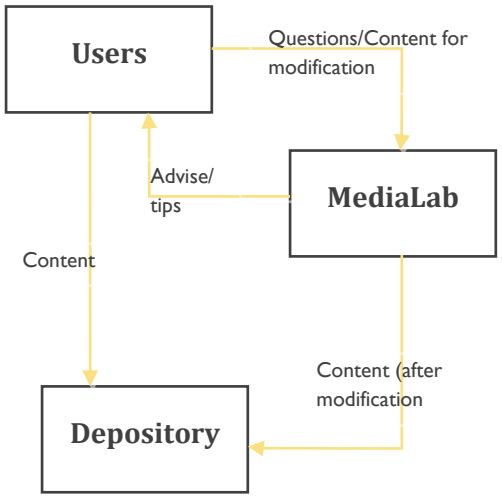


Figure 3-3 - Support by MediaLab

The way support is offered to users who want to contribute or reuse material should be considered. The project plan contains the diagram depicted in Figure 3-3, explaining the support for users (in fact: teachers) in uploading resources. As can be seen, the adopted approach is a rather centralized one, but with the extra comment that extensive use of student assistants is projected. It can be questioned whether this approach is scalable, because it does not addresses the potential benefits of tapping into the many small contributions of volunteers in a decentralized and global network (crowdsourcing). Tools should be considered to take away some of the need for support. For example, a WYSIWYG (What You See Is What You Get) editor enables individuals without technical knowledge to edit content originally written in XML-code. The editor converts the original XML-code to normal text, and vice versa. Also, online support in the form of manuals, FAQ's, and forums are possible instruments to support the reuse, remix, and re-contextualization of OER.

Money issues, in terms of cost reduction, revenue and funding, are discussed in the next section.

3.3.5 Funding and revenue models

Most large OER projects start with external funding. The William and Flora Hewlett Foundation is one of the most important organizations supporting the OER-movement, investing millions of dollars in numerous projects around the world.[16] MIT received millions in funds to set up their project, and this project may become sustainable in the long run, because of the enormous funds received. Some experts on OER (Downes, 2007; Dholakia, King, & Baraniuk, 2006; Koohang & Harman, 2007; Benkler, 2005; Wiley, 2007) have argued that (for other institutes) the MIT model might not be sustainable in the long run, because it needs constant funding to sustain the centralized support model. Besides arguing that decentralization can increase sustainability of OER-projects, a number of relevant funding and revenue models are described (Dholakia, King, & Baraniuk, 2006; Downes, 2007). Because there are similarities between the described models, I have specified and aggregated them below into a smaller set of models.

- **Endowment/foundation/donation model.** A project is set up and maintained through funds or large donations. This start-up capital can create sustainability in the long run, because interest rates cover the exploitation costs, but if not, the project needs to find alternative methods to create sustainability. A government-support model is another alternative falling in the same category. The voluntary support model is a model based on fund-raising campaigns. Companies and individuals are approached to donate, once or annually. The membership model relates to this: a group of interested parties join resources which are sufficient for the covering the operating costs of a project. Sakai, an open source collaboration and learning environment, uses this model to fund the development.[17]
- **Sponsorship/advertisement model.** The free access to resources involves a marketing strategy. 'Free' radio and television is an example, but in several OER initiatives the commercialization is much less explicit.
- **Segmentation model.** Open educational resources are provided for free next to value-added services, such as Ask-an-Expert, print-on-demand, training and user support, assessment, customization, etc. The conversion model represents a widely used model of giving away something for free, and by doing that, creating a *'customer base'* for other, related services. This model is adopted by Linux distributors Red Hat and SuSe.[18]
- **Contributor-Pay model.** Several open-access magazines, such as the *"Public Library of Science"*, have adopted a model where creators of articles pay for the peer-review and production. In return, their articles may be published, receiving recognition. The advantages of this model are the openness and quickness of publication. Other than that, it functions more or less in the same way as traditional peer-review model.
- **Replacement model.** Open content or software makes current systems or resources superfluous, which results in cost savings. A new OER-environment could, for instance, result in the replacement of Blackboard as learning environment.
- **Partnerships and Exchanges** can play an important role in the (collaborative) funding of large OER initiatives as well. Delft OCW has the objective, after a successful university-wide implementation, to connect not only with the other technical universities in the Netherlands, but possibly also with others in the IDEA league. Partnerships could address redundancy in for example software or course development.

3.4 Concluding this chapter

This chapter contained an introduction to sustainability, and what it means in OER projects. It further elaborated on two important challenges of sustaining an OER project. Sustaining an OER project means the ability to produce, share, localize, and learn from open educational resources. The role of decentralizing the organization of OER initiatives has been explicated, as well as other factors that influence the sustainability. Together, these factors form a framework that is used during the investigation. All of the components have been described in detail in this chapter, and are summarized in the table below.

	Summarizing findings on component
Organization	Experts argue that (partial) decentralization in OER projects, i.e. the creation and sharing of reusable OER is done by volunteers, is needed for sustainability, although it offers less control on the output. They describe two models: an institutional model, with a centralized organization that controls and manages the OER project top-down, and a community model that decentralizes a number or all of the activities needed to sustain the project.
Motivation	Motivation is crucial in OER projects. Even in a rather centralized initiative like MIT OCW, the teachers must be motivated to share their educational materials. The more a project relies on volunteers, the more it needs to find and utilize the intrinsic, non-monetary incentives to become sustainable. Open licenses that allow easy attribution or partial restriction of use increase the motivation to share. Other motivational factors include *"giving something back to community"*, recognition, tenure, and more.
Types of resources	There are different types of resources. The most important distinctions can be made between • The flexibility of the format of a resource influences the way the resource can be reused. • Granularity of task size and modularity of resources affect the possibility for peer producing OER. • The level of contextualization has a positive relation with the pedagogical effectiveness, and negative relation with reusability. • Relating to this: learning versus teaching resources. The former are intended for stand-alone learning, whereas the latter supports teacher-centric or classroom based learning.
Types of reuse	The most important types of reuse are *(i)* as-is reuse, *(ii)* remixing, adaptation, repurposing; and *(iii)* contextualizing and placing content in other (technical) environments.
Funding & Revenue	Several models have been described in literature. These models address "regular" funding by foundations, marketing and advertisement models, partnerships, and the ability to create revenue through value added services and other business opportunities.

Table 3-1 - Advancing the framework components (literature)

The following chapter includes an overview of exemplary OER initiatives. These initiatives give insight in their particular approaches toward sustainability. The mentioned framework is used to investigate the sustainability of the different initiatives.

4 Analyzing the sustainability of exemplary OER initiatives

This section will explain and describe OER-initiatives and their respective approaches toward sustainability. The initiatives have been chosen for their relevancy for the case, and availability of sufficient information. All information has been retrieved on their websites, unless stated otherwise.[19] I have tried to include initiatives that are similar to Delft OCW as it currently is (first layer), and initiatives that correspond with the proposed future OCW environment, depicted with the second and third layer in Figure 1-2. In addition, initiatives that share e-learning resources (allowing stand-alone learning) have been included. The objective of analyzing the sustainability of various initiatives is to form a basic understanding of possibilities to configure Delft OCW and make it sustainable, and to investigate the relations between the different components.

After analyzing the initiatives, they have been grouped into three categories with the mentioned characteristics, in order to generalize approaches toward sustainability. Clearly, although such a generalization is useful for having a common understanding of different possibilities for approaching sustainability, it must be acknowledged that many different configurations are possible.

I. **Centralized, as-is reuse, teaching materials.** The first group concerns the traditional OCW initiative, such as MIT OCW and USU OCW. They are organized and managed in a centralized manner, and are depending on the motivation of contributing teachers and students. Motivation is increased through *(i)* acknowledgement of original creator (also when resource is changed/adapted); *(ii)* a quality review of the resource; *(iii)* being rewarded personally for contributions (non-financial); and *(iv)* showing information about use and users. The courseware offers an overview of the classroom based course, and are not specifically made for self-learning. They include materials for face-to-face teaching, used in a course, such as recorded lectures, lecture notes, syllabi, exams, and articles, and are usually published in a format that does not allow easy remixing. The courseware can be read, but does not allow online adaptation by end-users. These projects are usually financed with grants and through partnerships.

II. **Centralized, as-is reuse, learning materials.** This group is similar to the first one (regarding *Organization, Motivation,* and *Types of End-user Reuse*), but it offers resources (usually full courses) that are specifically designed for self-learning, including assessments, multimedia, instructional design, and even cognitive tutoring and virtual laboratories. Examples include OU OpenLearn Initiative (LearningSpace), Carnegie Mellon's (CMU) Open Learning Initiative, and National Repository of Online Courses (NROC). Regarding sustainability, the most interesting characteristic concern the various business models that can be applied. Besides grants and partnerships, these initiatives are sustained financially through customization and personalization, support and value added services, such as tutoring, assessing, and endorsing certification. CMU has shown pedagogical successes with its project as well (Thille & Lovett, 2007).

III. **Decentralized, various kinds of reuse and resources.** This grouping concerns initiatives that have bottom-up characteristics, and end-users are able to contribute to the project in a variety of ways. Quality maintenance, OER production, change, re-contextualization, and management are facilitated with tools and online support, and done by end-users, but it does not necessarily mean that the initiative is 100% decentralized. Motivation is improved through different non-monetary incentives, such as attribution of resources, connecting with peers, and forming learning networks & communities, in combination with low barriers (easy-to-use technology). The offered OER include adaptable (text-based) learning modules and referrals to external resources. The revenue models of these initiatives are based on grants, partnerships, and value added services (on-demand printing,

Rent-an-Expert, etc.). In addition, through decentralization, costs are significantly lower than the other initiatives.

The above introduces the approaches of different initiatives toward sustainability. It is clear that the configuration of an OER project influences the options to make it sustainable. The first group (traditional OCW) depends on external funding and the motivation of teachers to sustain the project. The second group of OER projects, creating materials intended for self-learning, has more sources for revenue at their disposal, such as course customization, online tutoring, and support. The third group shows that through decentralization end-users are capable of sustaining projects themselves, because valuable contributions are facilitated and engagement is increased.

The following sections will explain how these initiatives are sustained in more detail, by describing the specific characteristics according to the mentioned framework.

4.1 I: USU & MIT

This group of initiatives resembles the original idea of putting courseware online following a rather centralized workflow. The two discussed examples come from Utah State University, and the original OCW project at Massachusetts Institute of Technology.

MIT OCW is the first and largest OCW project. It is exemplary for almost every OCW project around the world, and is translated into many languages. The website offers information on how to design the workflow, the technical architecture, and more issues. Faculty and teachers provide the resources of their courses online and are, after being checked by a central committee, published on the course website. Other than sending formal feedback or starting a discussion on an external site, called Open Learn Support, there is no possibility for interaction.[20] USU adopts a slightly more decentralized approach by allocating university students in the creation and maintenance of the educational resources.

How these projects become sustainable over time remains an important issue. The objectives of both initiatives are pretty abstract and range from *"advancing education around the world"* (MIT) to *"providing people around the world with an opportunity to access high quality learning opportunities"* (USU). Contributing to the *"shared intellectual commons"* in academia is important, which fosters collaboration across universities and among scholars across disciplines and around the world. Finding out role OER will occupy in the future learning environment is an inherent goal of each project as well. Reviewed according the framework, the initiatives are described as follows:

- **Organization.** All support and maintenance happens within the walls of the university, in a rather centralized manner. USU involves volunteer students in their project, whereas MIT depends less on voluntary efforts of students. People using the site, cannot easily adapt, remix, and reuse the materials online and are therefore not able to take part in the organization.
- **Motivation.** Motivation is needed from teachers and students. For teachers and contributors apply a number of important motivational aspects, such as being acknowledged as the creator (also when resource is changed/adapted); having a quality review of the resource; knowing the changes made to the resource; knowing how the resource is used and by whom; being rewarded personally for contributions, not financially (Hýlen, 2007).
- **Type of resources.** The type of resources concern courseware that supports traditional

teacher-centered educational practices. There is little or no instructional design or interactive assessment integrated in the resources, and some multimedia (such as video lectures). Most resources are presented in formats that do not allow easy change or flexible reuse.

- **Types of end-user reuse.** Reuse is possible only in two ways: by downloading the whole course, or downloading separate parts, such as video lectures, or PDF files. Remixing is hardly possible because of the inflexible formats of the resources (PDF, video lectures), and no tools to support remix. Users are not given tools or support to communicate, discuss resources, or add or change resources.
- **Funding & Revenue.** Both projects were initially funded by the Hewlett foundation. MIT, being a prestigious and world-famous university with contacts everywhere, will have no difficulty in finding partners for sustaining their project, or initiating new open education projects. USU, being a smaller university and less prestigious, will have to find other ways to sustain the development of open educational resources.

The costs for publishing one course online for MIT is around $10.000 and for USU around $5.000. The reason behind this is the smaller organization of USU and more distributed development. MIT can exert a little more power on the publication progress and process, whereas USU depends more on students and teachers to do that (Wiley, 2007).

4.2 II: OU OpenLearn LearningSpace, CMU OLI, NROC

The following group of OER initiatives is characterized by the fact that they offer true learning resources. Unlike teaching resources, which support classroom teaching, these resources are specifically designed to enable the learner to learn without the need of a teacher, and usually include instructional design, repetitive assessment, multimedia, interactive tests, etc. Obviously, these resources are much more time-consuming and costly to build.

The NROC intends to increase access to quality education for everyone, especially underserved populations. The published OER are contributed by a community of leading online learning programs from across the country, and must meet very high standards of scholarship, instructional value, and presentational impact. Carnegie Mellon University (CMU) and the Open University (OU) started with the objective of *exploring the landscape of open education*. CMU researches the use and effectiveness of its online resources to improve and advance knowledge about practices in online learning environments. It also hopes to build communities of use that will play an important role in course development. For the OU, the project contributes to their mission of being open to people, places, ideas, and methods, and explores new models and technologies that will give them a leading position in the learning revolution. The OU hopes to achieve the following:

- Enhanced learning experiences for users of open content delivery;
- Greater involvement in higher education by under-represented groups and empowerment of the various support networks that work with them;
- Enhanced knowledge and understanding of open content delivery, how it can be effective, and the contribution it can make to the further development of e-learning; and
- Enhanced understanding of sustainable and scalable models of open content delivery.[21]

OpenLearn consists of two different sites: LearningSpace and LabSpace. The latter is more experimental:

users can author materials, and add new ones as well, whereas the LearningSpace does not empower the user to take control over the resources. LabSpace is discussed in the next section.

Although there are some differences between the initiatives, I will elaborate on the aspects of sustainability and mention the most interesting things that can be learned.

- **Organization.** The initiatives have a rather top-down approach for making and managing resources. Since the effort needed to make these resources is high and quality must be guaranteed, it is quite understandable that a top-down control and financial rewards are needed. Still, an interesting aspect is how different initiatives approach the creation of these resources. Although individuals cannot create or contribute any resource, the level of distributed development is different for the initiatives. Carnegie Mellon, for example, tries to create communities that in the end will be partly responsible for the development of the resources. These are, therefore, created in a modular fashion to enhance the reusability. NROC facilitates collaboration among a community of content developers to reach students and teachers worldwide. Most resources are made and maintained by developers of online-learning programs across the USA (in collaboration with NROC), and have to meet certain standards of scholarship, instructional value and quality criteria to be published in the repository.
- **Motivation.** It is not clear how intrinsic motivation is found and utilized within these initiatives. Probably, the individuals that are responsible for the resources are specifically paid to make them, and put them online, which means that little intrinsic motivation is needed to do this.
- **Types of resources.** As mentioned, a true learning experience is offered with full courses or single units, including video-material, animation, still graphics, simulations, text and audio. Carnegie Mellon even includes innovative features, such as cognitive tutors, virtual laboratories, and group experiments in the resources. As said, most materials can be understood without recourse to a teacher, unlike teacher-centric OER. Carnegie Mellon specifically strives for reuse of material, by making it in modules, because it is part of their business model.
- **Types of reuse.** The user is able to use the material as-is, or download it for personal reuse. Remixing by end-users is difficult, such as with Connexions (next section), because this requires the ability to adapt OER online or upload new materials.
- **Funding & Revenue.** First of all, all initiatives receive substantial funding, not only by the Hewlett foundation, but others as well. Carnegie Mellon has specific sponsors for specific courses that relate to the sponsors. It also offers created content, and user data, for a small price to institutions and instructors to include (customized) content in their own environment, meanwhile offering free access to the content to individual students on their own website. Both Carnegie Mellon and the Open University UK have additional services for subscribed students. The NROC offers different membership based services, such as social authoring, customizable courses, and access to webinars, papers, and people. The initiative also addresses marketing possibilities for publishers of textbooks.

4.3 III: OU OpenLearn LabSpace, Connexions, and others

Chapter 3.2 explains that sustainability of OER projects can be increased through decentralization. This section explains how different OER projects approach decentralization. The goal of including this section is to show these approaches, and learn from them.

The two initiatives that are described in detail, Connexions and LabSpace, have one thing in common: the initiative supports explicitly, through tools and online support, the remixing of the offered content by

the end-user. The format and license used for the resources allow them to reuse, remix, and recombine them in any way they would like. It means that anyone with a little knowledge about a particular subject is able to contribute new resources, or add value to existing ones (commenting, suggesting, making changes, reapplying).

4.3.1 LabSpace

LabSpace is the *"playing ground"* of LearningSpace (the OU initiative discussed in the previous section). By being a more experimental site, and allowing different types of reuse and remix, it contributes to its objectives of exploring the future of open education and advancing the understanding about it.

- **Organization.** Interestingly, the LearningSpace is organized rather top-down and centralized, and resources are added by OU teachers, who are supported by the university. LabSpace, in contrast, enables users to change and add units, and maintain overall quality. Both sites offer different tools, such as Instant Messaging, knowledge mapping, discussion forum, Flash-meeting, and personal learning journal. You can also rate each unit.
- **Motivation.** The motivation needed for the success of the sites differ as well. LabSpace depends on the content of LearningSpace, because all courses are published on LabSpace as well. So initially teachers have to be motivated to put their content online, but they are supported by the university to do that. More intrinsic motivation is needed for the development of resources on LabSpace, since the users are not given any specific support or reward for their contributions.
- **Types of resources.** As mentioned, a true learning experience is offered with full courses or single units, which sometimes include video-material. The materials are rich enough to be understood without needing a teacher, unlike Open Courseware materials. To enable remixing, the content can be downloaded in different formats, including Moodle, XML, Print, and Zip.
- **Types of reuse.** The user is intended to be able to use the material as-is, or download it for personal use/adaptation. On the LabSpace site users can contribute derivative works, and get a teacher status. Software is available that supports this, but physical support is only given to OU individuals. Some knowledge about Moodle, which is the Learning Management System used for the project, is needed to be able to work with it. Reuse and remix are described as follows:[22]
    - Re-use could take the form of
        - Using some of our materials in the classroom
        - Directing your students toward OpenLearn
        - Encouraging use of the tools and content for interaction
        - Drawing on the content in your own writing, study or research
    - Remixing could take the form of
        - Reworking, rewriting, translating OpenLearn units
        - Remixing knowledge maps using the Compendium tool
- **Funding & Revenue.** In total, a substantive grant of about $7 million (US) was given by the Hewlett foundation for the whole project. Clearly, in the longer run, the OU hopes to interest users, so they will subscribe to a paid course of their interest. The initiative caused quite a bit of media attention, and new users (potential new students) worldwide. Value added services may include assessment, tutoring, certification, and support for collaborative partners (McAndrew, 2007).

An important notion is that content of the LabSpace website does not specifically rely on the contributions of many. All learning resources of its sister site LearningSpace (explained in a later section) are automatically put on LabSpace. These resources are open to be used, re-used, and remixed by any

person. The collaborative authoring possibility is not intended as a route to lower costs or to replace the creation of learning resources as is done currently (in a top-down fashion). (McAndrew, 2007)

4.3.2 Connexions

Connexions has the objective of providing and maintaining a commons where individuals and communities worldwide can create and freely share knowledge. It is comparable to LabSpace in the sense that it also provides the end-user with the opportunity to author materials. It dates back to 1999, so even before the MIT OCW initiative. The design of the project is based on the following intuitions:

1. Knowledge should be free and open for use and re-use;
2. Collaboration should be easier, not harder;
3. People should get credit and kudos for contributing to research and education;
4. Concepts and ideas are linked in unusual and surprising ways and not the simple linear forms that textbooks present (Dholakia, King, & Baraniuk, 2006).

Connexions is a place to view and share educational material made of small knowledge chunks that can be organized as courses, books, reports, etc. Connexions allows anyone to create, rip, mix, and burn:

- **Authors** create new materials and rip (copy and adapt) existing, sometimes in collaboration with others;
- **Instructors** rapidly build and mix materials into shared custom collections, possibly burning it into new non-/digital materials; and
- **Learners** find and explore content.

Their *"Content Commons"* contains educational materials for everyone — from children to college students to professionals — organized in small modules that are easily connected into larger collections or courses. Modularity and non-linearity is an essential quality, enabling learners and teachers to flexibly connect and aggregate learning resources. The software, the content, and the whole philosophy are open. Collaboration happens in workgroups, and by co-authorship and maintenance. Users can suggest changes to modules, or derive a copy and start a differentiated module. Uploading from different formats is easy, and translated into the XML language that enables flexible reuse and remix of content. The content is licensed under the Creative Commons Attribution 2.0 (CC-By) license. This is unlike most OER initiatives that apply CC-By-NC-SA licenses to their OER, which means that OER have to be attributed (By), cannot be used for commercial purposes (NC) and has to be shared with using same license (SA), offering less freedom to the user. The reasons for using a license that offers more freedoms to the end-user are explained in more detail on the site.[23]

The website enables users to make connections between granular chunks of knowledge, and combine them into some personalized learning experience. It also empowers users to contribute in an easy and intuitive way. In addition, institutions and individual users can *create lenses* that enable them to maintain a certain quality level on resources. For example, an institution as the TU Delft can create a lens, adding only the modules and courses that are approved by the university. When applying this lens, a site visitor is guaranteed that the content he or she encounters has been approved by the TU Delft. The most important thing is that the user is (or can be) contributor and responsible for organizing, creating, and sequencing knowledge according to his/her own wishes. The project therefore only relies on a small

official organization dealing with legal and technological issues.

- **Organization.** Connexions is organized 100% bottom-up. Anyone can contribute, and the support is all online. Tools are in place to improve and adapt resources, and to support users.
- **Motivation.** The CC Attribution license is chosen so authors are attributed for their works. Primary motive for the majority authors that contribute their original content to Connexions is not to earn royalties; rather, it is to have the greatest possible impact on scholars, practitioners, and students within their disciplines. Contributors of open content are merely motivated by the use and improvement by others, and altruistic reasons. In addition, the barriers of participation and contribution are quite low, because of modularity and easy-to-use editing tools (Dholakia, King, & Baraniuk, 2006).
- **Types of resources.** Modules can be aggregated into courses, and allow stand-alone learning. Still, because quality control happens after publication, and there is not a specific minimum quality level required, lower quality resources are part of the commons. This can be resolved by using quality *lenses*, explain in the text above. The tools empower users to contribute mainly text-based content.
- **Types of reuse.** Reuse and remix is the foundation on which this initiative builds. People can derive copies, suggest changes, and make their own content. Users can also sequence different modules into a certain learning path, course, report, book or something else.
- **Funding & Revenue.** Besides initial funding from the Hewlett foundation, Connexions shows particular interest in relations and partnerships with non- and for-profit institutions and universities. Little money (close to nothing) is needed to create and publish educational materials. The software is open source, and maintained in a similar fashion as the Content Commons. The money is spent on technological infrastructure, improving access, R&D, and marketing.

4.3.3 Additional examples of decentralization

There are a number of initiatives that try to adopt open source philosophies of peer production and distributed management to OER. It is not useful explaining them in detail as LabSpace and Connexions, but it can be helpful to mention different activities that can be done in a decentralized fashion.

- **Referring to OER.** Instead, or on top of having resources in similar format in a repository, some initiatives offer the possibility to add external resources. Curriki[24], OER Commons[25], and MERLOT[26] are examples of OER-projects that include external resources. If the resources on the website consist of just external resources, it is called a referatory.
- **Reviewing.** Some initiatives try to improve the overall quality, and find the high-quality resources through more official (peer-)reviewing methods. Curriki involves volunteer and paid (professional) reviewers, and MERLOT uses a more social approach to involve people to add value and review materials. On that site you can be part of a community, and your status, which includes your contributions, is shown. In addition, professionals in a certain domain get the opportunity to be hired through the Virtual Speaker Bureau. Through reviewing activities and other activities you can add value to your status.
- **Rating & Commenting.** MERLOT, Curriki, and OER Commons, and numerous other websites, offer the user the opportunity to rate material and comment on it. Also, most initiatives enable the user to make personal collections of materials.
- **Adding metadata.** OER Commons, a site that aggregates OER from well-known initiatives, and LabSpace empower the user to add tags to resources. Tags are personal labels that express

information about the resources.

- **Connecting.** Some initiatives enable the user to connect to others directly. LabSpace provides this possibility with an online Instant Messaging service that shows users online. Other possibilities include discussion forums (most initiatives), teams/workgroups/collaborations (OER Commons/Connexions/LabSpace), communities (MERLOT), and searching people (MERLOT). I have not discovered an OER-website with an integrated social networking application.

4.4 Sustainability of OER initiatives

The above sections describe in detail three different directions an OER initiative can go. As has been explained in the introduction of this chapter, this picture of sustainability is not intended to give an overview of all possibilities. In fact, by reading the previous sections, it can be concluded that there are many configurations possible. For example, the Open University UK *OpenLearn* initiative consists of two websites, mentioned in two different sections, which allow different types of reuse. It should be acknowledged that each organization can address each component in a specific way, but that elements are highly interrelated, making the number of possibilities finite. For instance, organizing the creation of high-quality, media rich, pedagogically advanced resources (Types of resources) for a specific subject in a highly decentralized way depending on volunteers (Organization) is not so plausible, since it requires significant efforts by specialized experts to do this. The continuous updating of the textual content of the same resource, on the other hand, could be outsourced to a large amount of volunteers on the Web (Types of reuse & Organization).

This chapter has shown three main configurations, which help in forming an idea about sustaining an OER project. Additionally, for this specific research, it has contributed to substantiate the conceptual framework. The most important aspects in the OER-spectrum, as shown in the initiatives, are summarized below.

- **Organization.** Clearly, there are different organizational configurations. MIT OCW and most other OCW initiatives are rather top-down organized, and need a rather large organization to support (internal) contributors and maintain the development of the OER site. USU OCW involves more volunteers and students, making the speed of contributions a little slower. Still, resources follow an internal workflow and individual end-users are not empowered to contribute material or information. Another closed approach, but more distributed, is adopted by the NROC and Carnegie Mellon. They involve a number of (paid) professionals, distributed across the USA, to create high-quality learning resources. On the other side of the spectrum we have a bottom-up or emergent approach where individuals are able to contribute, review, comment on, rate, and add metadata to resources themselves. On these sites, such as LabSpace, Connexions, OER Commons and MERLOT end-users are given tools and explanation on how to do this, but no or little centralized support.
- **Motivation.** Motivation to contribute or add value to an OER environment depends mainly on the size of the task to be done. If the task is large, quite a bit of motivation is needed. Initiatives that depend on volunteers for the creation and management of OER require lower barriers than others that do not. Even with centralized initiatives such as MIT OCW, intrinsic motivation of teachers is needed, because they are not obliged to put their content online. Still, extrinsic support is given and in that way the barriers are quite low. Different possibilities for finding and utilizing intrinsic motivation are possible, which include having a personal profile and status,

customizable licenses that attribute the author, and being part of a community. Altruism and the feeling of *"giving something back to community"* seem important motivational factors as well.

- **Types of resources.** An important distinction can be made between courseware (lecture notes, lecture videos, syllabi, etc.) and learning materials that include instructional design, multimedia, and more elaborate features (repetitive assessment, cognitive tutoring, etc.) and are specifically made for stand-alone, online learning. Other differences are the type of media, flexibility of format, and the modularity (or decomposability), which influence the way the resource can be reused.
- **Types of reuse.** The intended end-user reuse by different initiatives ranges from as-is use, download and local reuse, download-remix-upload, suggesting/commenting, derive copies and remix on-site. The ones that empower the user to remix materials and upload it, usually have the most flexible media format and offer wiki-like tools that overcome the technological barrier of editing or creating content in this format.
- **Funding & Revenue.** There are many different and interesting options that can be discussed. There is of course the standard foundation model, where external funds support and sustain the OER project. This is the least sustainable as well, since competition for funds for OER-projects increases, especially for Open Courseware projects. A number of interesting options include
    - providing content for free to individual users, meanwhile offering institution packages for a certain price;
    - offering added value, such as assessment, tutoring, certification, and support for students;
    - offering added value, extra services and support for institutions or companies through fee, per-use, or membership models;
    - commercial offerings for relevant companies.

To make the whole discussion a bit comprehensible and well-ordered, a matrix is made providing an overview of the OER initiatives and how they are sustained. The matrix explains the different initiatives according to the so-called sustainability factors.

	I Centralized, as-is reuse, teaching materials	II Centralized, as-is reuse, learning materials	III Decentralized, various types of reuse & resources
Organization	• Contributors include campus teachers and students. • Pre-publication reviewing. • Centralized support, (quality) maintenance, and responsibility.	• Top-down control on OER, including quality standards and other criteria. • Production of OER is organized both centralized and decentralized. • Pre-publication reviewing.	• Anyone can be a contributor. • No or post-publication reviewing. • Mostly decentralized: end-users are empowered with tools and tutorials to sustain the environment.

	I Centralized, as-is reuse, teaching materials	II Centralized, as-is reuse, learning materials	III Decentralized, various types of reuse & resources
Motivation	Motivation can be addressed with • "Open" licenses that acknowledge the creator (also when resource is changed/adapted); • having a quality review of the resource; • being rewarded personally for contributions (not financial); • and showing information about use and users.	Contributors are explicitly paid for their contributions, so finding and utilizing intrinsic motivation is not applicable.	Intrinsic motivation of end-users to contribute is crucial for these sites, specifically if content creation and management relies on volunteers. • Recognition (through attribution); • low barriers for contributing. Although possibly motivating, few sites offer the possibility to connect to peers, form networks or communities.
Types of resources	• Teaching materials, used in a course, such as recorded lectures, lecture notes, syllabi, exams, and articles; • most materials in a format that does not allow easy remixing.	• High quality learning resources that include instructional design, multimedia, and sometimes additional features (cognitive tutoring, assessments, virtual laboratories).	• Learning resources, but mainly text-based; • modular and flexible format allow adaptation; • referrals to (already existing) external resource.
Types of reuse	• As-is reuse; • some remixing and translations happens, but not on the OCW sites: end-users are not empowered with tools to remix or contribute content.	• As-is reuse of content by individuals; • additional possibilities (including social authoring, localization) are available for paying users.	• Reuse includes adaptation, remixing, and sharing new content; • continuous improvement and/or localization are made easy with tools and manuals.
Funding & Revenue	• Grants & partnerships	• Grants; • partnerships (support for development of specific content) • value added, customization, and support services; • attract new students for tutoring, assessment, support, and certification; • advertisements.	• Grants; • partnerships (universities, companies); • offering value added services.

Table 4-1 - Sustainability of different OER initiatives

The analysis in this chapter has improved the used conceptual framework significantly with real-life examples. Table 4-2 summarizes the information retrieved per component, and is used in the following steps of the research.

Summarizing findings on component	
Organization	The organization component concerns the activities to sustain an OER website, and the way they are organized, in specific the level of (de)centralization. These activities include • Creating content, including high quality, media-rich learning resources, granular, mainly text-based learning objects, and courseware materials; • Arranging and sequencing OER; • Uploading and linking new and existing OER; • Communicating around OER; • Adding metadata to information objects; • Software development; • Quality maintenance, centralized as well as decentralized; • Pre-publication and post-publication reviewing; • Checking for inappropriate, illegal & copyrighted materials; • Supporting teachers, students, and end-users (physical and online).
Motivation	Motivation is especially important when the sustainability of an initiative depends on the efforts of volunteers. Motivation can be increased through • Recognition, attribution and acknowledgement (both by users and institutions); • Community engagement; • Providing use and user statistics; • Lowering barriers for participation.
Types of resources	There are different types of resources. The most important distinctions can be made between • Flexible and inflexible format: allowing easy adaptation or *as-is* reuse; • Finely-grained versus coarse-grained resources: small task size to make/change resource or a large effort to make/change; • Modularity concerns the extent to which a resource is composed of different elements: allowing easy or hard re-contextualization; • Level of contextualization: a high level means that the resource is pedagogically effective, but not easily reusable; • Learning and teaching resources: intended for stand-alone or teacher-supported learning; • Internally and externally made resources.
Types of reuse	The initiatives allow and support different types of reuse. The most important are • As-is reuse; • Remixing, adaptation, repurposing; • Contextualizing and placing content in other (technical) environments.
Funding & Revenue	Different interesting models can be seen at other initiatives. • Endowment, foundation, donation models involve external parties to donate grants; • Segmentation and value-added services models search and utilize business opportunities to sustain the project; • Sponsorship and advertisement for specific courses or domains; • Partnerships and exchanges to create software or educational content.

Table 4-2 - Advancing the framework components (initiatives)

This chapter has resulted in an overview of different initiatives, and their specific approaches toward sustainability. It has also contributed to an expanded conceptual framework, which has been used to construct the interview schemes as well as generated ideas for the eventual advice.

The following chapter uses the framework to investigate the sustainability of Delft OCW according to important stakeholders. These stakeholders have been chosen after an actor and network analysis, which shows the field of actors of this project in more detail.

5 The Case of Delft Open Courseware (OCW)

In the previous chapters we have seen an introduction to Open Educational Resources (OER), with specific interest toward the concept of sustainability in chapter three. This chapter concludes with a conceptual framework for the research, consisting of five elements that influence the sustainability of an OER project. This has been used to investigate different OER initiatives in the previous chapter, which concluded with two tables. Table 4-1 describes the approaches toward sustainability of different OER (using the framework), and Table 4-2 extends the framework's components with the results of the chapter.

This chapter focuses on internal characteristics that concern Delft OCW. It does so by interviewing important stakeholders, and analyzing their view on sustainability, using the (improved) framework. The importance of stakeholders is analyzed by doing an actor and network analysis, in the following section. This section results in the choice of several actors that will be interviewed. Section 5.2 describes the results of the interviews with these actors, which are combined with findings from (internal) documentation analysis. These results, in combination with literature findings and the results of the analysis of different OER initiatives, form the basis for the advice in the next chapter.

5.1 Actor and network analysis

This thesis research aims for creating an advice for a sustainable environment for Open Educational Resources at the TU Delft. This cannot be done without an analysis of relevant actors. An actor and network analysis will come up with information about relations, objectives, and power of different actors and stakeholders. This is relevant, because the eventual success of such an environment depends on the cooperation of many different actors, and the permission or authorization by a small number of decision makers within the university. An actor and network analysis contributes to the overall research in different ways:

- A qualitative better problem analysis, because it is based on information, knowledge, insights, and interests of different stakeholders. In the end, this will result in better solutions;
- Better insight into opportunities and threats faced by the actors in approaching the problem;
- A normative better and more legitimate problem analysis, because the analysis will decrease the chance that important social values and risks are forgotten; and
- A problem analysis that is recognized by different parties, which will increase their willingness to cooperate (Enserink, Koppenjan, Thissen, Kamps, & Bekebrede, 2003).

An actor and network analysis can also be used to research feasibility of certain options and to evaluate the effects of measures. It consists of the following steps:

1. Formulation of a problem as starting point;
2. List the involved actors;
3. Depicting the formal map: formal tasks, authority, and relation of actors and the operational legislation;
4. Establish interests, objectives and problem perceptions of actors;
5. Mapping dependencies between actors; and
6. Determine the consequences of these findings for the formulation of the problem (Enserink, Koppenjan, Thissen, Kamps, & Bekebrede, 2003, p. 105).

The execution of such an analysis is done by reviewing all relevant documents and other material. Also, the results of the interviews form a substantive source of information. The results are a picture of a situation at a certain moment in time. Objectives change, new relations form and old ones disappear, and balances of power are always shifting. This dynamic should not be overlooked when making decisions based on the findings.

5.1.1 Step 1 – Problem formulation

As we have seen, a problem formulation can be used as a starting point for the research. The problem has been formulated in chapter 1:

> How can Delft Open Courseware (OCW) become sustainable?

5.1.2 Steps 2-4 – Listing of involved actors, their authorities, objectives, and interests

This section will describe the relevant actors, seen from the perspective of the problem stated above. In short, the following questions are used to come up with relevant actors:

- Which actors are actively concerned with the problem?
- Which actors possess the authority that is relevant for potential solutions?
- Which actors possess other resources (money, knowledge, people) relevant for the problem?
- Of which actors can you expect that they want to be involved in the project?
- Which actors will not participate actively, but are affected by the problem or the approach to solve the problem?

These questions can be answered first and foremost by rational thinking and looking into the available information online and in project documentation. In addition, some questions have been discussed with the problem owner (Education & Student Affairs) and with other actors.

Formal structure - Project organization

The first thing to look at is the current formal organization of Delft OCW. On the website, an up-to-date overview of this organization is shown.[27] The organization behind the project can be categorized into steering committee, project team, and participating academics. Besides this formal categorization, other groups of users and relevant actors can be described. The following diagram depicts the formal organization behind Delft OCW. The following sections will elaborate a little more on it, and describe other actors that are, or will be, involved in the project.

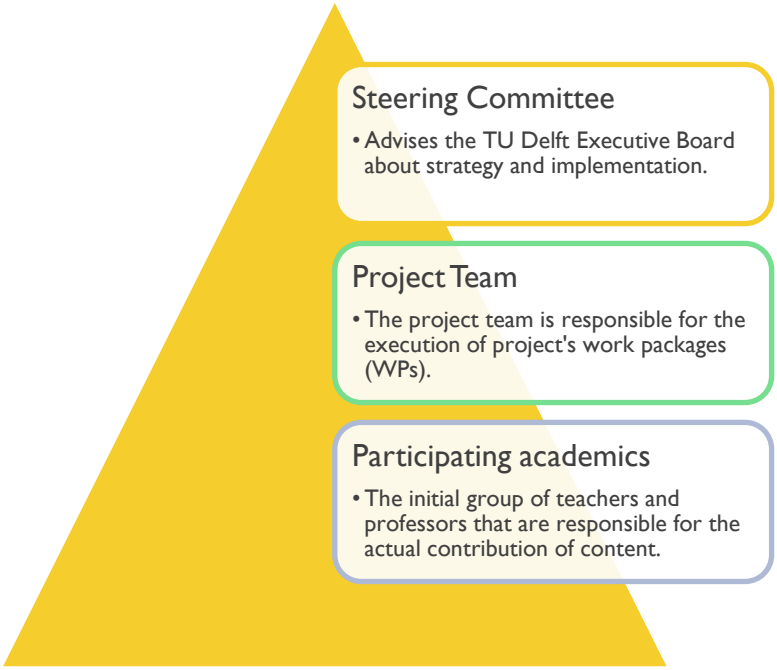


Figure 5-1 - Formal representation of the organization behind Delft OCW

Steering committee

The steering committee advises the TU Delft Board of Directors about the follow-up after the pilot phase, concerning both the strategy as the embedding of the project in the TU Delft organization. It consists of the vice-chancellor of the TU Delft, two participating professors, 3 persons from ESA (Education & Student Affairs), and the director of the TU Delft library. The department of ESA carries the financial responsibility for the project, and is the project initiator.

Project team

The project team is responsible for the execution of project's work packages (WPs). Besides 2 rounds of pilots (Work packages B and C), there is a number of work packages, addressing different organizational and technical issues. These are depicted in the following diagram.

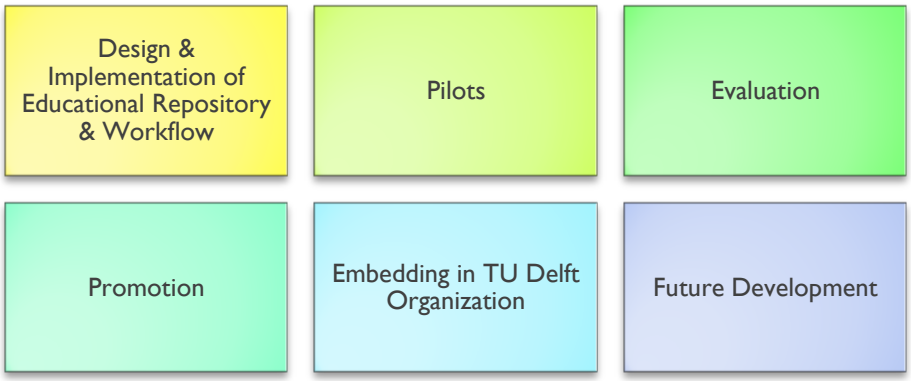


Figure 5-2 - Project team and work packages

Participating academics

Work packages B and C are pilot projects, and participating academics post their content online in the OER-repository. The first round of pilots (2007) is executed with the following departments: CiTG: Drinking Water, 3mE: Offshore Engineering, and EWI: Micro-electronics. The second round of pilots is undertaken with TBM: Sustainable Development, 3mE: Biomedical Engineering, TNW: NanoScience.

The following list gives an overview of actors according to the formal structure, and describes their tasks, interests, and influence.

Actor	Task/contribution	Interests/objectives	Influence
Steering Committee	Advise about embedding in TU organization, strategy, and follow-up.	Financial responsibility for the project (ESA). Sustainable exploitation. Reaching (short-term) objectives concerning TU Delft brand name, attraction students, usability site, ease of use for teachers, scalability.	Influence the TU Delft Executive Board (represented in this Committee), which makes important financial and strategic decisions.
Project Team	The execution of different work packages (WPs).	Design and implement technology, repository, workflow, copyright policies, promotion, evaluation, future development.	The persons implementing the WPs work independently and possess a lot of specific knowledge about processes and technologies, so their influence is rather high. They make decisions about the technology, workflow, presentation etc.
Participating academics	Delivering content for Delft OCW during pilot phase.	Visibility department, faculty, and materials. Acknowledgement of work. Good representation of education and research will increase reputation. Transparency of education (for students) and altruistic motives play a role as well.	Without content no OCW: teachers can back out the project, and stop delivering or updating content. Their support is crucial.

Table 5-1 - Analysis of formal actors

The table shows a summary of the most important stakeholders and their roles and objectives in the project. Some extra notes should be added to the above. These findings are the result of an email sent to the persons that are part of the formal structure of the project, discussions with professor Wim Veen, and an actor analysis done by Peter de Moel, who was the project leader from the start of the project until December 2007 (de Moel, 2007).

Some notes about the formal actors

The steering committee, as described, will report to the TU Delft Executive Board about the project's continuance, strategic embedding in the organization, the scaling, and all other aspects that concern strategic decisions that need to be made by the Executive Board. Jacob Fokkema, TU Delft's vice-chancellor, has a seat in the steering committee, where he propagates the wishes, ideas, and needs of the Executive Board. Another important stakeholder in the steering committee is Anka Mulder, who is the director of ESA. The main concerns for the steering committee include the sustainable exploitation and implementation of this project, which will have to contribute to the quality of the education, the visibility and brand name of the TU Delft, and the attraction of (inter)national students, experts, and industry.

The project team, consisting of people from ESA, the library, EduTec (Education & Technology Department), and the IT Department, and the participating academics have more practical concerns. Still, some departments, such as the IT department, have the information, knowledge, and position to take strategic decisions. Before describing the possible issues that may follow from these decisions, a short elaboration on the main interests and objectives of the project team:

- The realization of the technical infrastructure and a functional workflow, which is consistent with TU Delft technologies, other IT projects, and processes. In addition, decisions have to be in line with exploitation and financial management at the IT department.
- Scalability, both organizational and technical, is considered very important.
- The workflow, which includes adding metadata and clearing copyright, should not pose barriers for teachers. It has clear overlap with the workflow used in the publishing industry: *"submission, peer review & tracking"*.
- The library, having links with the publishing industry, intends to design a relevant copyright policy.
- For participating academics, the objectives (or reasons) include alignment with other (IT) projects, embracing innovation in education, better visibility and stronger international relations, better and more use of technology and multimedia, and the improvement of materials.
    - Teachers enjoy a large degree of freedom and self-responsibility, which they consider as an obtained right. They want to control their materials and worldview, and copyright is not considered that important (de Moel, 2007).

Other actors

The project organization is responsible for the initial setup of Delft OCW, and its implementation. This thesis is not about the initial setup of Delft OCW, rather about the future. In the near and more distant future, more people and organizations will be involved in it. Their influence may be significant, and their support or input can be crucial for the sustainability of the project.

I have discussed the relevancy of different actors with professor Wim Veen, who is responsible for the future development and strategy of the project, and with Ellen Sjoer, responsible for the evaluation of the project.

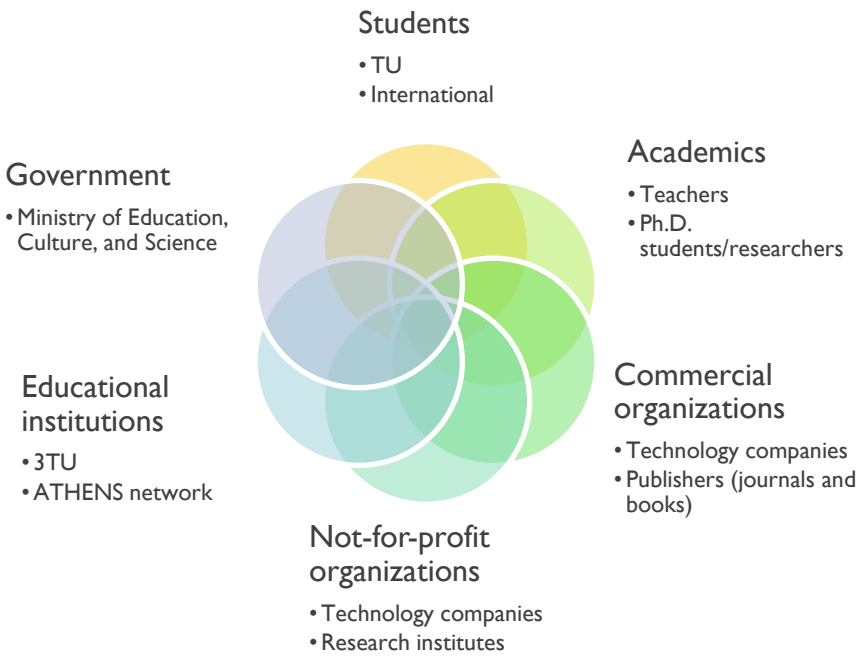


Figure 5-3 - Other actors

The picture above shows a number of important actors that are, or will be, in some way relevant for Delft OCW. These actors will become important in a near future, when the project scales up to a TU-wide initiative, and in a more distant future an international initiative that involves different universities and people around the world. They are listed below, and described in the same manner as the formal actors previously.

Actor	Task/contribution	Interests/objectives	Influence
Students (3TU, international)	Use the available OER, improve them, be active on the site.	Learn something, become engaged and motivated.	Students will form a powerful group that is able to contribute significantly to both the content, as the liveliness of the OCW site. Participating in the creation and remixing of OER may become a part of the learning process. They may form an important group for other students around the world, and possibly for companies and experts.
Academics (teachers, Ph.D. students, researchers)	Upload and improve content to Delft OCW, providing expertise.	Not be bothered too much, having enough freedom to do what they think is right, improving their authority and their (professional) network. Being recognized for their work. Having quality time with students.	Academics form the expert and knowledge backbone of the site. They are a very important group, since they will have to *"fill"* the site with valuable content, which may subsequently be improved by a MediaLab. In addition, they form an attractive group for experts and people from industry worldwide.

Actor	Task/contribution	Interests/objectives	Influence
Commercial organizations (such as technology companies)	Use the available OER, provide practical expertise, being a source for money and new (Ph.D. & part-time) students.	People from industry and lifelong learners want to stay updated, and learn new and relevant things. They are less interested in doing a full-time education than flexible training and education. They are interested in improving their (academic) network by connecting with experts.	People from industry can affect the project in different ways. First of all, they can be a source of revenue, by providing new students, sponsorship, joint ventures, collaboration, etc. Besides, they can possess practical knowledge that is very relevant for experts and students. In sharing their knowledge, one should be aware that they act in a competitive environment, where shielding off information still is an important criterion for making money. Their position within society offers other opportunities as well, such as employment or research assignments.
Commercial organizations (publishing industry)	No specific role or active contribution for the site itself.	Make money, maintaining the copyright and control over published materials. Possibly they see Delft OCW as a way to connect with many students and researchers to *"sell"* books and other publications. The content may be interesting to use, since it is free. Still, since the NC (Non-Commercial) clause is usually used for OCW, they cannot profit from it.	The publishing industry is not helped by total openness of educational materials and articles: it is their source of revenue and having dominion over the publication is a core aspect of their business models. Their influence over copyrighted materials and the project (especially in its infant stages) may be large. Still, Delft OCW may be a source of revenue, even for them (free information, selling books, printing books, online peer reviewers, larger audience, etc.). This can become a source of revenue for Delft OCW in its turn.
Not-for-profit organizations (technology companies & research institutes, foundations)	Use the available OER, provide practical expertise, being a source for money and new (Ph.D. & part-time) students.	Similar to *"normal"* industry, people from non-profit organizations want to stay updated, and learn new and relevant things. They also demand flexibility. They are also interested in improving their (academic) network by connecting with experts. In addition, there may be altruistic motives for sustaining these kinds of projects.	Non-profit organizations may be interested in funding the sharing and developing of high quality OER. In addition, through connections on the website, they may contribute to the sustainability of the project by providing/improving resources, and offering research or collaboration opportunities.
Educational institutes (3TU, ATHENS, etc.)	Offering high-quality education and research. Reusing OER, creating, remixing and sharing OER.	Educational institutions want to provide high quality education in a cost-efficient way, attract new students, and be recognized by experts (for research activities for example). Like companies, they are subject to (national and international) competition.	Other universities, both national as international, may become very important in the future of Delft OCW. When collaboration between universities intensifies, contributions in terms of finance and expertise will increase sustainability. Their support for the project increases the number of users, who can be allocated to sustain the project.

Actor	Task/contribution	Interests/objectives	Influence
Government (Ministry of Education, Culture, and Science)	Providing funds for education.	Good training in academic disciplines, independent pursuit of scholarship, and application of scholarly knowledge in the context of a profession. Furthermore improving understanding of the phenomena studied in the various disciplines and the generation of new knowledge.[28] Finally, contributing to the goals set in the Lisbon treaty.[1]	Governmental agencies do not have an active role in the project. Still, they can influence the project with donations, or playing a role in the collaboration between universities.

Table 5-2 - Analysis of the other actors

Although the above description is partly an assumption, it is quite useful to get an idea of the playing field. The assumptions concern relative common statements, such as the objective of a student to learn and be motivated, or the ability to contribute expertise and knowledge by academics.

Some notes about the other actors

The most important fact that should be recognized when discussing these actors is that almost none of the mentioned actors can be *"forced"* to join, collaborate, and be active on the OCW site. Possibly, TU Delft and affiliated universities could implement policies that include the sharing of OER by teachers. Still, we have seen that experts on OER agree that sustainability depends on the distributed efforts of volunteers. It is therefore important to understand the motivations of these volunteers, and act upon it. Regarding the position toward the actors that are currently not directly involved, and on whose influence Delft OCW depends to create sustainability, two generic rules apply:

- Be attractive for people and industry that increase sustainability for Delft OCW. This means offering online services and promote the ability to improve one's life, education, professional opportunities, network, cash flow, income, and more.
- Offering alternatives for people and industry that might be hurt by the project or get anxious of the concepts of openness and sharing such as the publishing industry or private companies.

In both cases, communicating the main drawbacks, solutions, and opportunities is very important. Students must be motivated to be active and contribute, companies must be shown their opportunities, the ability to increase authority and recognition, and build up a network must be clear to any participant, publishing companies should know that Delft OCW does not necessarily threaten businesses and that there are some great business opportunities, Delft OCW should welcome other educational institutes, and offer possibilities for that. Finally, the value of the project, its uniqueness, and its relevance for the future of education in the Netherlands should attract private investors and public funders, including the government. An active attitude is demanded for this.

[1] The treaty has the objective make the EU *"the most dynamic and competitive knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion, and respect for the environment by 2010"* (Kok, 2004)

5.1.3 Step 5 – Mapping dependencies between actors

In the previous section an overview is made of the most important actors, their respective roles or tasks in the project, their objectives, and main concerns and influence possibilities. This section focuses more on the relations between the actors: the network analysis. This step results in a description of the problem owner's dependency of other actors. Three issues are to be investigated:

- The importance of other actors' resources needed for the project (like money, expertise, information, people, authority, etc.);
- The commitment of actors toward Delft OCW; and
- The degree to which problem perceptions, goals, and interests correspond.

The first step in the network analysis is determining the critical actors. This investigation concerns the sustainability of Delft OCW, so *"critical"* means critical toward the sustainability of Delft OCW. Two factors determine the criticality of an actor: the level of influence or the dependence on the actor's resources for the sustenance or change of the problem situation, and the exchangeability of the actor with other, similar actors. (Hanf & Scharpf, 1978)

Appendix D shows that there are a number of critical actors for the sustainability of Delft OCW. It does not mean that the other actors are not important, or even crucial for the sustainability; rather, it means that they can be replaced, or that their influence is not as significant as the critical ones. The following list shows the critical actors, and describes their role, influence, and objectives. Also, it describes the problem perceptions of different actors, and how that matters in the sustainability of Delft OCW.

- **Steering Committee.** The steering committee decides whether the project continues, and makes other important strategic decisions. Although the members of the committee, because of their position within the TU Delft, are not as dedicated to the problem as the project team, they do form a group that should be accounted for. Their perceptions toward certain solutions or ideas can be crucial for the follow-up of the project. This, obviously, works in both directions: positively and negatively.
- **Project team.** The project team may be an even more important group to consider than the steering committee, because of its direct involvement in the creation and design of Delft OCW. People within the project team, such as IT experts, have a lot of expertise on certain subjects and authority over people and resources, and operate rather autonomously. The IT department has the largest influence, since they possess technical expertise, people, and other resources.
- **Students.** As has been described in literature (chapter 3), are students crucial for sustaining an OER initiative. TU Delft students, as students from other universities, will form the basis for sustainability of Delft OCW. Their voluntary efforts will improve the site's content and their activities will attract new people and companies to the site. Still, their influence in how Delft OCW is set up, and how it will be scaled to a university-wide, 3TU, and possibly international initiative, is rather low. They are not capable of making strategic decisions. In addition, they are not dedicated to the project: if they do not like it, they will not use it.
- **Academics.** Academics form a similar group as the students. If they are not engaged, and motivated to be involved in the project, then their potential contribution, such as expertise, contacts, and authority, gets lost. Especially in the first few years of the project, it is crucial to engage and involve academics.
- **Educational institutions (3TU, Athens network).** The objective of Delft OCW is to scale

the project up to other institutions and universities. Initially, the focus is on involving the other polytechnic universities in the Netherlands; University of Twente and University of Technology Eindhoven.[29] Subsequently the initiative should spread to other institutions worldwide, possibly including the European university network Athens.[30] These institutions are crucial because they do not only form a potential source for financing and co-developing the project, but their academics and students can contribute in other forms that may be much more valuable.

So what is the relevance of the above exploration of actors and their network? Most importantly, it provides insight in the situation, and how individuals, groups, and organizations can contribute to, or frustrate the sustainability of Delft OCW. The following section will draw conclusions and describe what these results mean for the research, and explain which actors will be interviewed.

5.1.4 Step 6 – Consequences of findings for the formulation of the problem

This final step summarizes the findings, and links them with the problem definition. So, addressing the research question regarding the sustainability of Delft OCW, what do these results mean? First I will sum up a number of threats and opportunities that can be derived from the actor and network analysis, and how these should be addressed in order to address the problem situation. Then an explanation follows about the choice for interviewees, which is done in consultation with Professor Wim Veen.

The actor and network analysis has shown that there are numerous actors that should be accounted for when designing Delft OCW. These actors, in different levels of involvement, all have some kind of relation with the project, which can be expressed positively and negatively. In order to make sure that important actors and potential contributors are addressed in the right way, the relevant opportunities and threats are discussed that concern these actors.

- **Influence of involved stakeholders.** The steering committee and the TU Delft Executive Board are not the only authorities that take strategic decisions. Some of the decisions, including decisions about the configuration of Delft OCW, are made by actors on a lower level, such as the IT department. It is therefore important to know what their ideas, opinions, and policies are. On a higher level, it is important to know what is considered the most important in any configuration of Delft OCW, and how the project should (not) affect to Delft University of Technology.
- **Activity and motivation.** One of the most important features of sustainability of an online environment is the activity that happens on it. Students and academics worldwide form an incredible resource, and can make this activity happen by contributing ideas, content, questions, answers, manpower, and overall liveliness. Still, Delft OCW must engage these individuals, by clearly showing them its value.
- **External interest.** Delft OCW is able to attract interest from companies and other universities through its project. Their contribution to the project can be crucial for the sustainability, contributing expertise, human and financial resources, and a network, which in return could be important incentive for academics and students.
- **Copyright issues.** The publishing industry, and organizations that hold copyright on educational materials, should not be neglected, because they could either frustrate the process, or help it.

This list, even though it is a static representation and not complete, illustrates some important opportunities and threats for Delft OCW. If time was not an issue, I would have investigated every of

the points mentioned above. I have chosen to interview the stakeholders that are most influential in the project. The reason is that, especially during this phase of the project, it is very important to know what the starting point is, and what the possibilities are, before jumping to solutions.

Clearly, the other issues are very important as well, and should not be overlooked. For example, it is very interesting to know why academics would contribute, and when students will be motivated to be active on the website. Likewise, an investigation toward the potential of collaborations and networking with other universities, institutes, and commercial and non-profit organizations is of extreme importance. Still, these issues, opportunities, and threats should be seen from the objectives stated by the influential people who are involved in the project at this moment, because one can imagine that a great ideas are not possible, just because it does not fit in TU Delft policy, or that something is only possible under certain circumstances that are considered very important by an influential actor.

The following section will explore the ideas, the policies, the ambitions of the most important and influential stakeholders. They follow from the above analysis, and the choice has been discussed with professor Wim Veen.

5.2 Interview results

This section will describe in detail the ideas, ambitions, and demands of certain influential Delft OCW stakeholders in the sustainability spectrum. This is done by using the different components that address sustainability in OER-projects (Wiley's conceptual framework: chapter 3.3, p.23). The components are repeated here:

- Organization
- Motivation
- Types of resources
- Types of end-user reuse
- Funding/revenue model

Besides these components, the objectives of TU Delft and Delft OCW are discussed, the ideas and concerns about the second and third layer (explained in chapter 1.3, p. 14), and opportunities and threats that relate to the future of Delft OCW. The interview protocol can be found in Appendix E. The following stakeholders have been chosen to be interviewed, because of their influence in this stage of the project.

- **EduTec.** First of all, Wim Veen himself was interviewed because of his expertise and insight in the future learning environments and activities. He is professor at the department of EduTec, an abbreviation of Education and Technology, at the TU Delft. His role within the project is to deliver an advice about the future of Delft Open Courseware, from the perspective of what is needed, and possible in future learning landscapes.
- **TU Delft Executive Board.** Secondly, Jacob Fokkema and Paul Rullmann of the TU Delft Executive Board have been interviewed, because they have a large influence toward the members of the steering committee and project team, carry end responsibility over the project and its consequences, and their specific ideas and policies about how the university should evolve in the future.

- **IT Department.** Cock Huizer and Willem van Valkenburg are both actively involved in the project, and have a high position within the IT department of the TU Delft. They are responsible for designing and implementing the workflow and the related technology. Because of their specific expertise about the technology and current workflows within the university, and the relative autonomy they enjoy, it is crucial to know how they see the project, and what their own objectives, ideas, and policies are. In addition, certain (existing) ideas can be deliberated to see whether they are possible for Delft OCW.
- **Education & Student Affairs.** Finally, Education & Student Affairs (ESA, Appendix C), being the problem owner and responsible department for Delft OCW, is an important actor to consider. Anka Mulder, Director of ESA, and Joost Groot Kormelink were interviewed to discuss their ideas, confer possibilities, and to discuss criteria for a future Delft OCW.

By adopting an open and closed approach in the interview, the interviewees were able to explore ideas and give their opinion about existing possibilities and ideas. Each interview was conducted along the same components, but was different in terms of focus. For example, Wim Veen showed more his view on learning and the role of OER in it, and was focused more on the future than other interviews. Jacob Fokkema and Paul Rullmann showed their strategic interest in the interviews, and stressed the importance of quality, authority, and name of the university, similar to the way ESA was interviewed. The interview with Cock Huizer and Willem van Valkenburg of the IT Department clearly had a more technical focus, and explored technical possibilities within the existing structures and technologies of the TU Delft.

The following sections describe the results of the interviews. As can be read in Appendix E, the interview protocol starts with questions about sustainability in general and the objectives of Delft OCW. These introductory questions are intended to get to a mutual understanding of the concept of sustainability of Delft OCW. The objectives are important, because sustainability of each initiative is seen from the perspective of its objectives. After discussing the ideas about sustainability and the project's objectives, it continues with elaborating the different components of the conceptual framework, and ends with some concluding questions on future threats and opportunities of the project.

5.2.1 Sustainability

The sustainability of an OER initiative is not determined by the content that is placed on it, but by the community that is engaged in it.

Wim Veen, EduTec

To introduce and get a mutual understanding of the subject, the interviews started with an exploration of the concept sustainability and discussing the potential and thoughts about the described second and third layer. The table below contains the most important issues that came along during the interviews, when discussing the sustainability of OER and Delft OCW in particular.

Actor (TU Delft)	Thoughts on sustainability, second, and third layer
EduTec	Both social value and cash flow are important elements of sustainability. With regards to social value, Wim Veen argues that the value of the OCW site will not be determined by the content that is placed on it, but by the community that is engaged in it. The site has to be meaningful to a lot of people. The lab environment is an online environment with a *"wiki spirit"*: anyone can contribute, use, and discuss resources, and people can easily form communities. This should be motivated, supported, and fostered. Initially, the focus is on the TU Delft, followed by 3TU, and IDEA league. In the end any interested person can be involved.
Executive Board	Sustainability refers to durability and exploitability. The brand of TU Delft, which is propagated through Delft OCW, should not degenerate. A format or a formula should be found that expenditures are maintained, and the quality is guaranteed. Connectivity is very important, but this cannot be seen without the content. High quality content is needed to form an online attraction. But indeed, social involvement and personal contact in a domain remains crucial and high quality connectivity can contribute to that. The lab-environment is a research and learning environment, improving existing and generating new connections.
IT Department	We see sustainability in terms of scalability, security, feasibility, and compatibility with the technologies and standards we have at the TU Delft (web-oriented, SOA, etc.). We see two models for OCW: • The centralized MIT model; • A more decentralized model where you depend more on the teachers to take care of IP issues and content, like we have now at the TU Delft. The model we use can only be sustainable if these processes are truly integrated with the normal processes of the teachers at the TU Delft. Regarding connectivity: focus on content becomes less relevant, and the focus on the connections between people more.
Education & Student Affairs	Sustainability means that the project has some kind of continuity: technology is in place, and that there is sufficient support and motivation. This can be created through incentive or allocation models. Through uploading and communication possibilities (second and third layer) richer and more information will be part of the site, and knowledge networks will emerge. The model of Open University, where there are two separate sites, LearningSpace and LabSpace, is interesting.

Table 5-3 - Interviews: Thoughts about sustainability

So what can we conclude from these thoughts? At the end of this chapter, a more comprehensive account will be given of all the different points of view, ideas, and policies, but for this particular subject, some things must be recognized:

- The brand TU Delft should not degenerate because of the project.
- Value toward users of the site is at least as important as being able to support it financially. The long-term value is considered important more in terms of connectivity, and less in terms of content.
- Integration of the OCW processes into TU Delft's *normal* processes and technologies is crucial for sustainability.

5.2.2 Objectives

According to Wiley, the different components of his conceptual framework should be analyzed from the perspective of a project's objectives. This section defines the objectives and issues described in the project plan of Delft OCW, and by the most important stakeholders. The TU Delft wants to contribute to sustainable solutions for global challenges and develop pioneering scientific views that lead to technological breakthroughs. From the perspective of sustainability, the university focuses on first class

multidisciplinary research and design. She disseminates its knowledge through the education of highly qualified knowledge workers and the testing and developing of knowledge applications. Internationalization is considered very important in attracting and utilizing a diverse talent pool. Research and education are intrinsically linked and important criteria for knowledge valorization. In order to realize the above, she wants to be preferred partner in research for universities worldwide, preferred partner in education for (inter)national students, and preferred supplier of knowledge and graduates to multinationals, governmental institutes, small & medium enterprises, and start-ups (TU Delft (b), 2007). The Delft OCW project proposal describes the following objectives:

> *Giving away your content is does not mean that you give away everything, just the opposite: it creates an itch for learning. People become hungry for knowledge and have questions...*
>
> Jacob Fokkema, Executive Board

- Contribute to the development of open knowledge organizations in worldwide networks;
- show reputation to all relevant institutions, and confirm her leading position; and
- promote the quality of modern higher education, because feedback of the academic community is possible when resources are online (TU Delft (a), 2007).

The project plan adds to this that the project shows added value for lifelong learners, the international reputation, and the attraction of researchers. The report further mentions some implementation goals, but these are not relevant for this section.

Actor (TU Delft)	Thoughts about Delft OCW objectives
EduTec	The most important objective related to Delft OCW is that Delft should become a hub in global knowledge networks. Through Delft OCW and the content on the site, people will connect and form communities. The quality of this connection determines the value of the site; it forms the glue for forming networks. The lab-environment will have to facilitate processes that empower students, anywhere, to add content, communicate about content, and collaborate on making new TU-approved content. A kind of labeling system should be in place to define the TU-approved content.
Executive Board	In the university of tomorrow, it is unthinkable not to give away your content. Giving away content creates an *"itch"* for learning. Computers and IT can help by creating a context for learning. An important aspect is the internal and external visibility of research and quality of teachers. Who we are and what we do is visible for anyone. Investing in these kinds of projects is also a way to find out how we have to deal with all new technologies and trends influencing the university of tomorrow. What we are doing nowadays in separate institutions worldwide, should be done in collaboration with the rest of the world. OER contribute to that thought, by connecting 3TU to the rest of the world. Again, branding and visibility are extremely important: we should be recognized as a source of knowledge, as a creative pool. Experts should correspond with the content on the site, which should be of high quality.
IT Department	The primary objective is to publish as quickly as possible most educational content of the TU Delft, integrated into one database. For the future, the 3TU[31] may be integrated. Still, the TU Brand will remain extremely important, and individuals still want to have a TU diploma. Education will still be linked directly to our high-quality research.

Actor (TU Delft)	Thoughts about Delft OCW objectives
Education & Student Affairs	Objectives concern • Reputation/marketing; internationalization, promoting unique OER, forming knowledge networks, attracting Ph.D. students, joint ventures, etc. • Quality of education; better equipped for learning in the future (tools, networking), more granularity in learning objects. • Openness about education opportunities; better able to prepare or gain insight in education. • Altruistic motives; making OER available worldwide. Practical goals include making open publication of educational materials an intrinsic part of the university, and to raise the level of participation. For that, we need low barriers and institutional changes that reward participating teachers for their efforts. Because reputation is extremely important, and part of the project's principle reasons, we need to ensure high quality and good design.

Table 5-4 - Interviews: Delft OCW Objectives

The objectives the different actors describe range from operational objectives to criteria, to more long-term ideals. The long-term objectives of the project include the following;

- Marketing and economic purposes
  - Attracting new students and researchers;
  - More efficient to collaborate worldwide in the creation of educational materials;
  - Instrument or platform to let departments and faculty become part of knowledge networks.
- Educational and research purposes
  - Creating insight (visibility) in education for ourselves as for the external world;
  - Creating an itch for learning;
  - Opening up for valuable contributions and connections worldwide;
  - Investing in future learning and education methods and environments.

Again, reputation is being mentioned several times: quality and good design is crucial, because visibility does not just mean visibility of beautiful materials, but possibly also of rotten apples. Following the introduction about sustainability and the layers on top of the repository, and the objectives in this section, the focus of the interview turned toward organizational issues, and deepened out the problems and criteria that come along. The literature that concerns this important component has been discussed in detail in chapter 3.3.1, page 24. Below the interview results are described.

What we are doing separately nowadays, should be done in collaboration with the rest of the world. Open educational resources contribute to that, by connecting to the rest of the world...

Paul Rullmann, Executive Board

5.2.3 Organization

As described in the introduction, the first layer of the project resembles a traditional Open Courseware project, such as MIT OCW. A number of educational resources from leading disciplines are put online, followed by a university wide implementation. The project report describes a number of issues that become important in the future.

- ICTs enable students to study more place and time independent in the future. Especially important is the participation in the IDEA League (a group of cooperating European technical universities), and the cooperation between the different institutions in providing learning spaces

and creating and executing of educational programs collaboratively.

- The report refers to the developments in the field of research, where more and more researchers post their articles on online platforms and form *open research centers*. Besides research, the university strives for online presence of all educational content (TU Delft (a), 2007).

> *Content is not that important in the future; if connections are great between people, good content will find its way to the right persons. How much time will pass until uploaded content becomes irrelevant?*
>
> Willem van Valkenburg, IT-Dept.

Although the project has adopted a rather centralized model initially, a shift has been described toward a more open environment where individuals have more opportunities to contribute (Figure 1-2 - Three layer model, Future of Delft OCW). Starting of as a repository of educational resources, where teachers can publish their materials, the project has to evolve in something much more interactive, where anyone can contribute and communicate about resources. The project report refers to this second and third layer as a *lab-environment*, and the comparison is made with the LabSpace environment of the Open University UK, described earlier in section 4.2. The formation of communities around content (third layer) is an element of the initiative MERLOT and, to a lesser extent, Connexions. Allowing people to add and create content, to connect and discuss online, implies a level of decentralization and influences the organization of Delft OCW. This section describes the different perspectives on this important issue.

Actor (TU Delft)	Thoughts about the organization & level of decentralization
EduTec	Students are the largest social capital of a university: we should enable them to contribute. They should participate in creating and improving the Delft OCW environment. In addition, this, in itself, is learning. This requires marketing toward teachers to enable this behavior, a rating system, and *"TU-approved"* labeling system. Regarding activities, the following can be said; • Support by MediaLab; specifically for multimedia applications. Per faculty a number of students will support teachers in creating high quality materials. • Production & Quality; anyone can contribute (bottom-up), but quality can be seen through certain *lenses* representing a certain quality (top-down). TU content must be of high quality (teams of course designers with instructional design, human interface, and content experts involved). Metadata about OER will be automatically generated. • Assembly of resources for courses is still the domain of teacher: control of teachers is crucial.
Executive Board	Protocols, recognizability, homogeneity; • *Decentralization works when it is subject to rules and protocols.* TU Delft and its employees are recognized through the Delft OCW platform, and experts should be able to identify themselves with (parts of) it. • Recognizability means that people adding value to the network, should be recognized as having done that. • Homogeneity means that the quality on the site is comparable with other content. A pool with all kinds of different resources is not attractive, so anyone uploading or creating resources must know that there are certain criteria that should be addressed. There are different reasons for people to participate. Research and education will be more and more intertwined. A marketplace for ideas and problems is an example of decentralization. We need a new division of labor; experts/teachers focus on content, and can handle the basic IT interfaces (for disseminating their expertise), and IT support teams enhance the learning materials, putting it in a kind of format.

Actor (TU Delft)	Thoughts about the organization & level of decentralization
IT Department	The different layers (see Figure 1-2 - Three layer model, Future of Delft OCW, p. 14) build on top of each other. We do not see the value in uploading content by non-3TU people. We would rather lay the focus on connecting people. Supporting the connectivity can happen in different ways, for example; • Social (networking) tools; • Technologies as RSS and Google's OpenSocial API allow information of other networks (also personal) to be embedded in Delft OCW; • Metadata about OER will be automatically generated. We will not create or own technologies, rather make use of all the technology that is already out there. Technical feasibility is not the problem, rather the organizational; should we allow people to add content (and tools) to Delft OCW? The TU Delft brand should always be clearly visible. You can allow people to tag, rate, comment, favorite content, and make profiles. Still, the willingness of teachers is rather important in allowing this.
Education & Student Affairs	We propose the model that the Open University UK has adopted: a separate OCW website where people can add and change content. With the right feedback loop this can work its way back to the original *"TU-approved"* site. Any interested person can contribute, comment, rate, and discuss content on the site. It is interesting to link the initiative with other (research) projects, such as C'MM'N, and offer modules (OER) that correspond with these projects. For our own teachers there should be sufficient support, both for technical and pedagogical issues. Currently a central office is being set up.

Table 5-5 - Interviews: Thoughts about organization & level of decentralization

Important organizational aspects being mentioned by different stakeholders include:

- Support by a MediaLab; it consists of teams of student assistants and experts in course, human interface, and instructional design and enhances teaching and learning materials to high quality OER. This implicitly means a new division of labor: experts/teachers for their expertise, MediaLab for enhancement of materials.
- Bottom-up rating, discussing, and commenting on resources is found acceptable, but these processes should also be acknowledged and support by the teachers/experts. Possible marketing and incentives toward teachers is needed to get this supported.
- Again, the reputation of the TU Delft, by making its processes and education transparent, is at stake. Protocols, rules and lenses should increase TU Delft's brand and (online) recognition. These are imposed top-down, and experts and teachers play an important role in it.
- There are few technological barriers for supporting communication around content, uploading materials, making profiles, and enabling crowdsourcing.[32]
- The intertwinement of research and education is an interesting notion that should be taken into account in the design of the lab-environment.

An example for communication around content is C'MM'N, an initiative that applies open source principles for the development of the car of the future. It would be great to offer educational content for this community.

Joost Groot-Kormelink, ESA

5.2.4 Motivation

The interviewees were asked about possibilities and ideas for finding and utilizing non-monetary incentives of potential contributors. Other, more extrinsic motivational issues, such as institutional changes and rewards were discussed as well.

Actor (TU Delft)	Thoughts about motivation
EduTec	Motivation is the principle motive for learning. Engagement in the learning process increases learning. The lab-environment shows more opportunities to engage and be engaged. Important are richness (in functionalities offered) and the usability of the functionalities.
Executive Board	Users, such as students and teachers, are motivated to be involved because they can easily gain knowledge, develop ideas, and building recognition.
IT Department	Rating, starring, profiling and creating reputations online, exchanging ideas and solving problems collaboratively are all options that can be integrated in the OCW site.
Education & Student Affairs	Teachers and experts should be rewarded for open publication. This should be integrated in the internal allocation model and in the employee assessment criteria. Reputation is an incentive only when the network to which this reputation applies is active and valuable in itself. Having sufficient (technical, organizational, pedagogical) support for experts and teachers will lower barriers and enable motivation.

Table 5-6 - Interviews: Motivation

The stakeholders have expressed the following issues with regard to intrinsic and extrinsic motivation.

- Recognition is very important. Contributors and activities should be visible and rewarded, intrinsically and extrinsically.
- There has to be clarity about goals, roles, and strategy within communities. In addition, there should be also a certain culture of sharing, and the community itself should be active and valuable, otherwise the incentive of building recognition or reputation is not valid.
- Sufficient and easy to use tools, offered on the website, lower barriers to share and engage learners. These are easy to implement in the OCW environment.
- Support for pedagogical, organizational, and technical issues will lower the barriers for participants. Also, including open publication in the internal allocation model and employee assessments increases motivation to share. Still, this applies just for individuals affiliated with the university.

> *Reputation can be an important incentive for people to participate, but it really depends on the value of the (online knowledge) network they will participate in.*
>
> Anka Mulder, Director ESA

5.2.5 Types of resources

The types of resources concern the media used, use of external resources, the flexibility of the format OER are published in, the granularity and modularity of the resource, and the intended way of reuse (either support classroom or teacher-centric settings, or allowing stand-alone learning). The discussions with stakeholders focused on these aspects and related issues, such as investing in e-learning, support for teachers and their role in a future learning landscape, tools, and more.

Actor (TU Delft)	Thoughts about the types of resources
EduTec	Competition between international universities will increase. E-learning possibilities attract new students. The number of new students will depend on the quality of the resources we put online. The time online, in conversation, increases, and that the face2face meetings will be less. This means that the learning resources are of at least such significance as the face2face (f2f) meetings. Both high-quality: • OER highly interactive with ID (instructional design) integrated; they enable stand-alone learning. A recognizable TU format for ID is needed, which can be used by anyone (possibly integrated in a tool). • Tools that enable the creation of personal learning tracks or curricula could become more important. • f2f meetings inspirational and on a meta-level; expert for expertise and discussing with/ inspiring people. • Multimedia, gaming, and other technologies become more embedded in people's lives, and will have to play a role in the environment as well. Interactivity should be stimulated. The quality of the resources propagates the quality of the university: inflexible, text-only resources, without any interaction affect the brand of the university negatively. On the other hand, a rich environment with high-quality resources improves the brand name. Focus on visualization: human-computer interaction. The increasing demand for flexible and personalized education requires flexible and granular resources. External resources are very important, but the teacher/expert decides which ones to include in *"his/her"* personal environment, and also decides in what manner he or she is affected by *"new"* resources.
Executive Board	More focus on creating and supporting new ways of learning materials that include ID, assessments, etc. Efficaciousness of learning contexts and materials is very important. Studio Classroom is a good example of a learning environment that has proven itself valuable.[33] The new labor division, where teachers and experts are supported in creating beautiful materials, is in line with this idea.
IT Department	Delft OCW is not a platform aimed for our own students. Furthermore; • Resources are published in a modular format. The regular Faculty → Department → Course division can easily be changed then. ○ A lens model can enable different views on resources. • Resources will be published in more flexible media (less PDF). Still it should be investigated whether teachers/experts want others to change/ contribute to their resources. • Including external resources does not pose any technical problems, but the TU brand and copyright issues are important factors to address.
Education & Student Affairs	Delft OCW, and the resources on it, can be used to offer blended learning. • E-learning increases, specifically in collaboration with other universities. ○ Endorsement and assessment should be considered then. • It will be difficult to offer both teaching as learning resources on the site.

Table 5-7 - Interviews: Types of Resources

There is clearly a significant difference between the opinion of professor Veen and the IT Department about whether TU Delft students form a specific user group of Delft OCW. The Executive Board gives the example of Studio Classroom, which is for TU Delft students, and repeats the idea of a new division of labor. This makes it clear that TU Delft students form an important user group, because they can both profit from new and interesting learning resources and contribute value to Delft OCW. They form a large part of the social capital of the university; it would be a waste not to use this in order to improve the environment. This statement by Wim Veen (EduTec) shows that OCW should not just be seen as an educational content-repository, but emphasizes the integration and use of new and innovative tools

We need a new of division of labor. Teachers focus and are hired for expertise. Support will enhance the learning materials, making it smooth and putting it in a kind of format...

Paul Rullmann. Executive Board

for learning and connecting on OCW as well. This may include gaming and simulation environments, multimedia, and more.

Blended learning will be possible: learning resources are of such quality, that individuals can learn from it without recourse to a teacher. We have seen that there is quite some backing with stakeholders to support the production of these resources. This requires

- Good support: a new division of labor, as been discussed in the previous section.
- A clear protocol and format for learning resources, so that they are recognizable as TU Delft resources. This format can be used by anyone to create resources and can be integrated in tools.
- Collaboration with other universities to create good learning resources.

Flexibility and granularity of resources enables reuse and personalized learning.

Regarding external resources important issues include copyright, quality, and the disturbance for an expert or teacher. The latter can be explained in a broader sense: users and contributors of the website do not want to be disturbed with irrelevant or bad materials.

5.2.6 Types of end-user reuse

The types of end-user reuse regards the intended way end-users will reuse the OER offered on the website, and how this is supported. End-users can reuse materials *as-is*, or adapt and re-contextualize OER. The interviewees were asked to define the different end-users, their value propositions, and the main types of reuse.

Actor (TU Delft)	Thoughts about the types of end-user reuse
EduTec	Regarding the different users and their respective propositions: • Students: Quality and visualization of content to follow education online. • Teachers: With a minimum of effort beautiful content is created. Self-explaining materials allow teachers to focus on quality time with students. • Companies: Flexible education offered at the university. The value will be in the flexibility to pick out pieces in which they are interested. Being able to put problems or case studies on the website is attractive, possibly solving problems, and having contact with students and experts. • Alumni: The ability to stay up-to-date within the domain of work, lifelong learning. The main types of end-user reuse are using content for learning, commenting on it, and remixing. Remixing requires that learning materials are made in a flexible format, and preferably, tools should enable on-site editing.
Executive Board	Regarding the different users and their respective propositions: • A student is able to learn efficiently and more direct, and place and time independent. • The expert or teacher can increase his/her own visibility and reputation. On the other hand, he/she can gain information/knowledge and create and participate in communities. • Industry can gain knowledge and contacts. We should entice people from industry to give something back to the community as well. Because of competition, we should offer closed community spaces, or *"Dark Rooms"*, to our users. Another way for industry to bring something is to offer places for students to work and do internships, or pay for Ph.D. research positions. This environment is a big knowledge hub, enabling more flexible ways of learning, also for lifelong learners. An important issue is the way people are certified and accredited. Certification is crucial to TU Delft: people are willing to pay for a TU Delft education if that is clearly identifiable with quality. Possibly, new ways need to be investigated.

Actor (TU Delft)	Thoughts about the types of end-user reuse
IT Department	Regarding the different users and their respective propositions: • TU Delft/3TU teachers & experts: better ways to connect to the world and build a reputation. • Self-learners, who are interested in the online content professionally or intrinsically. • Industry, being able to keep up with developments, sharing expertise, and involving alumni with the TU Delft. As has been mentioned before, we do not focus specifically on our own students. They do not form a target group and will probably not contribute to the environment. Regarding reuse, more elaborate types of reuse, such as tagging, commenting, ranking, and making profiles are easy to implement. Problems are not technical, but rather organizational. Teachers are rather conservative people, and their willingness to allow or use new technologies is crucial. An important issue will be profiling on the OCW site: we must make the profiles of people very transparent. Ranking will play an important role in it.
Education & Student Affairs	Regarding the ability to add and change content: it should be very clear which content is endorsed by TU Delft (or affiliates), and which content is not *"TU-approved"*. There are different user groups and reasons to visit the site; • Have an overview of the university's education, or of a specific domain; • Insight in the work and research of other educators; • Learn, ask questions and get answers; • Look for formal education opportunities; • Expand or create a network; • Increase reputation/marketing. Crowdsourcing and a controlled *"TU-approved"* environment can co-exist.

Table 5-8 - Interviews: Types of end-user reuse

Regarding the ability of remixing OER, there is not much clarity. Of the interviewed actors, only professor Veen mentioned that this should be an integrated option of the site. Individuals will be interested to add, change or remix content, to personalize the content or the environment. Technically, implementing tools that allow these kinds of reuse are not hard to implement. Whether these technologies are used, depends on the willingness of teachers and experts to allow or use them. Regarding companies, it should be acknowledged that people from industry operate in a competitive environment. This may require online spaces where people from industry can share or contribute materials that cannot be seen by anyone, total openness may scare away some potential contributors.

> *Branding is crucial. The university should be aware that putting static PDF documents rather than high quality interactive and flexible content online, might hurt her brand value….*
>
> Wim Veen, EduTec

E-learning will increasingly play a role in processes of the university. It enables students to learn more efficiently and time/place independent. For people in industry this flexibility is a great advantage as well. Again, technically, there are not so many issues. Rather, these are organizational and cultural, such as accreditation and certification. These issues need further research.

E-learning will become more important and *"our"* students will be distributed around the world. Agreements about support for creation of e-learning materials should be made with universities around the world. In section 5.2.4, the ESA (Education & Student Affairs) director Anka Mulder mentions the explicit support by a MediaLab for people who want to upload or edit content. This is only for people who are affiliated with the university; others have to make use of the available on-site tools (currently not available). These should be sufficiently self-explaining and easy to use. Better and more intuitive tools

lower the level of support that is needed for the creation and enhancement of OER.

Again the *"TU-approved"* issue was mentioned. It should be clear what resources are endorsed by the TU Delft (or affiliates), and what not.

5.2.7 Funding & Revenue models

Sections 3.3.5 & 4.4 describe various ways of sustaining an OER project with funding and revenue models. These possibilities, including business models and ideas, have been discussed with the stakeholders.

Actor (TU Delft)	Thoughts about funding & revenue models

EduTec	First of all, not one single model will create sustainability: a hybrid form will be taken to create sustainability.
	• Advertisement and sponsorship should be considered, possibly with preferred partners and large multinationals with a good brand name.
	• Offering services around the content on the site can be one of the core sources of revenue for Delft OCW. This depends on the quality of the content and the traffic on the site. Many, still unknown, services can be offered when students, teachers, and people from industry come together in an online vibrating community where interesting things happen.
	  ○ E-learning programs: both normal and international students as people from industry. A higher level of granularity and flexibility is needed to attract people from industry and lifelong learners.
	  ○ Rent-A-Student or Rent-an-Expert can be an interesting option, because may trigger students and experts to behave positively on the site and contribute high quality materials. For industry it can be an interesting way to hire people flexibly.
	  ○ Delft OCW as crowdsourcing platform. Technical problems and solutions can be posted online to form a kind of *"ideagora"*, a marketplace for ideas (Tapscott & Williams, 2006).
	• If Blackboard remains the closed and hierarchical environment as it has been the last years, Delft OCW might replace it as being the main learning environment. This future environment should address the learning skills and needs of future generation better. Also the trend toward 3D should be monitored closely, until some kind of standard emerges.
	• Regarding collaboration with other universities, there must be a 3TU OCW environment within 5 years. In 7 years the foundations must be built for a collaborative space for the IDEA league. Social (trust in technology and people) and technical (creating standards) factors play an important role in the success of these initiatives. Organizing (social) events together will help overcome these issues (such as a 3TU conference).

Executive Board	Funding, revenue, and advertisement models should be clearly described, so faculty themselves can search for it and use it according to certain guidelines. Offering value-added services is possible, such as Rent-A-Student or Expert, but we must not forget that education and research are highly intertwined. A marketplace for ideas and problems is a good example. Still, we must acknowledge that ownership and intellectual property is important.

Actor (TU Delft)	Thoughts about funding & revenue models
IT Department	The options that are mentioned, such as the marketplace for ideas and people/employment, are not difficult to implement. The latter needs clear and transparent profiling. Blackboard is independent of OCW, and we do not see that change in the future. OCW will not be a second BB. You can say that the formal learning happens on BB, and the informal learning on Delft OCW. The two environments are connected: • They are both connected to the same database; and • when uploading content to BB, teachers can easily indicate that they want it for OCW as well. The workflow is designed to do exactly this. OCW is different from BB, because • BB can host materials that are copyrighted; and • BB has options for keeping track of grades etc., which we will definitely not develop for OCW. Collaboration with other universities is still on a low level. The other 3TU universities (Eindhoven: TUe & Twente: UT) want to hitchhike on our efforts. In the future, we will probably use separate websites, but with the same backbone and database. This will be difficult to implement.
Education & Student Affairs	We do not see Delft OCW as a source of revenue. We see revenues mainly in terms of reputation and name. Regarding sponsorship and advertisement, some generic sponsorship may be possible, but the independent character of the university should not be harmed. The segmentation model can be interesting. Offering printed material as a value added service, or customized learning for industry people can be a viable way to get some financial return. The Rent-A-Student or Expert model might not work, because a university does not work as a company. The financial incentive for people at the university should not be over-estimated. It is important to consider other universities, but we should not forget our competitive position.

Table 5-9 - Interviews: Funding and revenue models

This section has described different models that can lead to either cost reductions, or bring revenues. It is clear that a combination of models will be the best way to sustain OER initiatives. Besides addressing important factors as organization, motivation, types of resources and end-user reuse, we should not forget that Delft OCW can also be sustained if it is acknowledged as a potential source of revenue. Having discussed different options, the most important issues that emerged are the following:

In 5 years there should be a 3TU environment. In 7 years the most important foundation should be built for a collaborative lab environment for the IDEA league.

Wim Veen, EduTec

- Advertisement, funding, donating, and sponsoring are all viable ways to receive money to sustain the project. Regarding advertisement, it should be carefully watched that it does not hurt the university's independent character and brand.
- Offering value-added services alongside the high quality content is a very interesting option to make the project both sustainable as attractive for users. There are some important criteria for being able to offer services (mentioned in this section) and make money. These criteria include the quality of the content, the attractiveness of the community or site, and transparent and clear profiling of users/producers.
- Blackboard and Delft OCW might have some overlapping functions in the future. Students could prefer to learn and be active on the Delft OCW site, and neglect the BB site. Still, BB offers functionalities and services that will not be developed for the Delft OCW site. BB cannot be replaced with Delft OCW, because it concerns a totally different environment. In creating a future Delft OCW environment, it should be monitored carefully how learning trends and technologies, including 3D worlds, should be connected.
- Collaboration with other universities might contribute to the sustainability of the environment,

but we should also acknowledge that they are also competitors. Social and technical issues may pose problems for collaboration.

5.2.8 Some final considerations

This final section describes different concluding thoughts of the persons interviewed, and discusses opportunities and challenges for Delft OCW, and internal strengths and weaknesses of the project and the TU Delft (a so-called SWOT analysis). Unfortunately, because of time restraints, some actors have not been able to share their thoughts on these topics.

Actor	SWOT and final considerations
EduTec	SWOT; • Strengths are the policy of the board of the TU Delft, the enthusiasm of a group of teachers to cooperate and contribute to the project. This at the same time forms a weakness, since they think in terms of content and in the old-fashioned open courseware pattern. Another weakness is the lack of information about the largest group of contributors (rest of the teachers) on their willingness to cooperate. It is expected that this group is rather reluctant to cooperate. Another weakness is the use of BB. OER, as said, will be integrated in the learning of TU Delft and used by our own students as well. • Opportunities include more international competition between universities, more interactive and social students, lifelong learning and the need of industry for flexible training and education. Threats are thinking in too limited terms, and too much focus on content and forgetting the importance of creating communities and activity on the site between people (and business). Technological (standards etc.), and social (trust, bureaucratic behavior) issues form other threats. A crucial factor is the acceptation of ICT in the private life of the users, especially teachers: if they are sufficiently IT-savvy, the lab environment, if set up well, will function well. If they are not: the lab environment will not succeed. Teachers need to be part of online communities, also in their private life. Another critical factor is the support of the management, which is created with a vision they have. Our task is to give them this vision. If they believe in this vision, they are willing to invest time and resources in this vision, and defend this vision. Creating vision is very important.
Education & Student Affairs	The strengths of our Delft OCW and the TU Delft are • Our affinity with technology; • we are early adopters of open educational resources; • the initiative is not isolated; it is part of our IT policy. Some important issues on the horizon of the project are • Scaling up the project; • intrinsic incentives for teachers to participate.

Table 5-10 - Interviews: Final considerations

The final thoughts of the interviewed stakeholders showed that there are some important aspects to consider.

- First of all, there are great opportunities lying ahead, such as better possibilities to compete internationally with universities and schools, technology enhanced learning, more active and social students, lifelong learning and an increased demand for flexible learning.
- Threats include the lack of standards (technical), trust for collaboration (social), and too little focus on creating communities.
- Important strengths are our affinity with technology, the reasonable early adoption of OER in the university's practices, and the willingness of the Board of TU Delft and an initial group of teachers to support and contribute to the project.
- On the other hand, the support by teachers and others may cause some problems, since they think in old-fashioned terms of courseware and hierarchy. Other weaknesses include the lack of

information about the willingness of other teachers (an enormous group), and the use of Blackboard versus Delft OCW, in case Delft OCW becomes a learning space for students. Finally, scaling the project up, even to a TU-wide initiative, may cause problems.

Important aspects in the future of Delft OCW are the use and acceptability of ICTs in ordinary lives of teachers. Another important issue is the vision translated into the project, for which this report can be helpful.

5.3 Concluding this chapter

What we have seen in this chapter is an elaborate overview of the meanings, ideas, and policies that relate to Delft OCW. After an actor and network analysis, several stakeholders were interviewed to acquire an impression of the project's future according to them. The protocol used for the interviews was based on the framework that was introduced in chapter 3.3 and used in chapter 4 for the analysis of OER initiatives. By using the visions, ideas, and demands of important stakeholders, in the next chapter an advice can be generated that is in line with current external trends and developments, and customized to the wishes and demands of the internal organization of Delft OCW. Acceptance of the proposed actions and possible assimilation of ideas in implementation policies or strategies are more likely, because ideas and demands of the most important stakeholder have been accounted for.

The next chapter uses literature findings (chapter 3), results of analysis on exemplary OER initiatives (chapter 4), and the outcomes of the interviews (this chapter) to generate a substantiated advice that will be accepted by the most important stakeholders.

6 Delft OCW 2.0 and the Road Ahead

The previous chapters described the results of a number of research activities.

- First of all, I have elaborated the concept of sustainability of OER-projects in detail, and concluded with a framework that I used in the rest of the research. This framework addresses different factors that have to do with sustainability.
- Using this framework, I have analyzed different OER initiatives, and described their approach toward sustainability. This resulted in a better overview of possibilities, generated ideas for sustaining Delft OCW, and improved the conceptual framework.
- Subsequently, an actor and network analysis has brought forward the most important actors, their role in the project, their importance, power, and criticality.
- Following the factors of the sustainability framework, I have conducted interviews with a number of important actors. This has brought forward the internal view and ambitions on sustaining Delft OCW, and ideas about the future of the project.

By doing these different analyses, *'the solution'* for a sustainable Delft OCW, as presented in this chapter, is both externally valid and internally accepted by decision makers.

This chapter will explain the approach the organization of Delft OCW can take in order to ultimately become sustainable. In section 6.1, this advice described along the sustainability components (of the conceptual framework use throughout the investigation. For each of the components, the results of the different analyses are synthesized and translated into an advice. After the description of the advice according to the different components, a prioritized advice follows in section 6.2. Here the most important activities are selected and sequenced, and suggestions are made about ways to address these topics by the TU Delft.

6.1 Synthesis and Advice

This chapter presents a componentized design for a sustainable Delft OCW. This can be used by decision makers to adjust or direct their policies and implementation strategies. For each component of the framework, the advice will cover the following aspects, represented both in one column:

- A short explanation about the component itself, its place in the TU Delft context, its relation with sustainability and other relevant issues and policy considerations. This is based on Table 4-2, which improves the definition of the components, and ideas mentioned during interviews.
- An advice describing a possible approach by the Delft OCW organization.

6.1.1 Objectives

Sustainability of an OER-project is seen from the perspective of its objectives. Before synthesizing the results of the research, and forming an advice, one should consider the purpose of the project. During the analysis, this has been done with the different initiatives, and during the interviews, the actors were asked to state the goals of the project, and describe their perspective on sustainability.

Different OER initiatives show different objectives and purposes. Generally, reasons for opening up education relate to educational, financial, altruistic, and marketing concerns. Advancing education around the world is being mentioned and other humane reasons as providing the world with an opportunity to access to high quality learning opportunities and fighting social injustice. Other reasons include world

leadership in design, content, and delivery of supported open and distance learning through academic research, pedagogic innovation, and collaborative partnerships. Intrinsic motives and intuition that education will (and should) reform play a role as well.

The interviews results show quite similar motives for starting and maintaining Delft OCW, although intuitions and ideas about sustainability are not always in line. The main objectives can be divided into marketing/economical and educational/research purposes.

- Marketing and economical purposes include attracting new students and researchers, more efficiency through collaboration in the creation of educational materials, and the project as an instrument to form knowledge networks.
- Educational and research purposes include more internal and external transparency in education, creating an *"itch"* for learning, opening up for valuable contributions from outside, and general investing in educational practices of tomorrow's university.

Regarding the intuitions, and the significance of sustainability within the project, connectivity between users is mentioned as being vital. The content should be useful and attractive, and comes first, but finally the connectivity between users will become more important than the content on the site. The integration of technology and common (teacher) processes at the TU Delft (and collaborating institutions) into activities that add value to Delft OCW is an important aspect for sustainability. Finally, something that was repeatedly mentioned concerns reputation, name, authority, and its significance: *Delft OCW may not degenerate the TU Delft brand.* This concern is valid, specifically when we regard a future Delft OCW as an online space where anyone can contribute content, discuss, and connect. This concern should be respected and acknowledged, but at the same time the potential of true openness must not be ignored. Both sides of the coin should be exposed and addressed, which I have tried to do in describing the advice and policy recommendations that follow.

The following section concerns the organization component of an OER initiative, and specifically addresses the concern of openness and level of decentralization. It therefore is described in more detail than the other components.

6.1.2 Organization

The organization of Delft OCW concerns a crucial aspect of the advice, because it involves acceptance by actors, is highly interrelated with other components, and may be the trump card in the sustainability game. The organization of an OER initiative concerns all the activities needed to sustain the production of useful OER. In a decentralized organization, many activities are done by many people dispersed in a decentralized network, which is cheaper and some say, more sustainable. On the other hand, this decentralization implicitly means less control over the output. In a centralized organization, there is more control over the content that is put online. In the same train of thought, it is likely to be more expensive as well, because potential voluntary efforts of individuals outside the walls of the university are not sourced. Different authors argue that decentralization is crucial for sustaining an initiative, because it cannot always depend on funds and external resources. This advice, hence the explanation of different activities, and the resulting technological and institutional criteria and changes, is addressed at decision makers in the Delft OCW project. It intends to show different organizational policy considerations, and

suggests ways to deal with them.

Decentralization of Delft OCW has been described in the project report and depicted in Figure 1-2, and is specified in a more detailed advice below. Because of its relative importance, the results of different research activities (initiatives, literature, interviews) on this component are described in Appendix F.

The three activity groupings of the organization component are described in detail and divided into separate sub activities in the tables below. In the second column the level of decentralization is described, and its relevance toward sustainability. The third column shows the technological and institutional consequences for Delft OCW concerning the described activity.

Organization: The creation and management of OER

This first group of activities concern various types of OER creation or uploading (both educational content and software), and the management, which implies adding metadata, and arranging and sequencing OER online. In addition, the communication around content, which creates new information, is placed in this group. The table below structures suggestions and considerations per activity. It clearly shows that a hybrid form of both centralization and decentralization of different activities is preferred in order to both source collective intelligence and maintain control over quality and output.

Activities	Explanation & Sustainability	Technological & Institutional
Creating TU Learning Resources	There are learning resources that have a low granularity, and that cost a lot to make. These resources, such as rich, highly interactive learning materials, serious educational games, etc. are unlikely to be made in decentralized networks. Still, creating these resources, and making them available online contributes to sustainability: • **Richness.** Making Delft OCW richer, more attractive may draw attention of both new students and companies that want customized courses/learning resources. • **Efficiency and quality education.** Such resources allow stand-alone learning, and more efficient use of experts. More about the potential financial benefits in the advice on the component *"Financial/Revenue models"*.	These resources according a rather centralized model: experts request pedagogical or technical support for creating high quality materials. • **A TU format or framework** for new high quality learning resources. • **Support team** with pedagogical and technical experts for making good, educative, interactive and rich learning resources. This, in itself, forms a new division of labor, as proposed by the Executive Board. The offered support (and costs) should be equally distributed amongst the participating institutes and universities.

Activities	Explanation & Sustainability	Technological & Institutional
Creating Adaptable Learning Objects	This activity concerns the creation of more modular and granular learning chunks, and can be done by individuals distributed in decentralized networks, hence (partly) voluntarily. These learning chunks could be courseware, or standalone learning objects that can be reused in different contexts. This requires some kind of adaptation, that should be allowed by the way the LO is presented, formatted, and copyrighted. Allowing adaptation increases sustainability, because of • **Efficient (re)use** of resources; • **Low costs of creation**, because of decentralization. • **Engagement.** Creating educational resources and publishing them online can provide an incentive for people (internal and external), because in that way they proliferate themselves online in the right networks.	Creating and adapting online learning objects requires • **Profiling system** should be in place to give users and contributors a social online identity. • **Authoring tools and framework**, such as wikis and XML-editors, that allow easy, on-site creation and adaptation/making derivatives. • **A workflow** that supports decentralized publishing of OER. • **Flexible resource format**, such as XML, so resources can in fact be adapted online and offline. These technical consequences go hand in hand with some institutional, such as • **Marketing** toward teachers for allowing reuse, and motivating active reuse of materials. • **Support** (both physical and online) for using the authoring tools. These suggestions are supplemented with search and quality issues later in this table and the next.
Uploading & Linking Learning Materials	Learning is independent of the channel through which it is conveyed. Therefore, any type of resource, for instance websites, blogs, online videos, podcasts, virtual worlds, games, places (such as museums), and more can be used for learning. It is impossible for a small organization to find and judge this enormous amount of information available worldwide. Individuals decentralized in a network can and must do this, because it contributes to the sustainability of the project. • **Finding relevant information** in the enormous pool of information available online and offline. • **Engaging people.** People can add their own resources, and that can be an incentive for them to be active on the OCW environment. • **Low barriers.** This type of enhancing the OER-ecosystem has very low barriers.	There are a few issues that need to be addressed when you allow people to upload and link to content. Besides the search and quality issues, discussed a bit later, they include the following: • **Uploading and linking system.** This allows anyone to upload and link existing resources. • **Format or framework** for new resources makes the heap of new resources more transparent, easier to find and compare, and enhances the overall clarity of the site. • **Rules and protocols.**

Activities	Explanation & Sustainability	Technological & Institutional

Communication around OER	One of the most important and rewarding activities with respect to learning with/of OER, will be the ability to communicate and connect with peers. It also contributes to the sustainability, because communities not only form a fertile ground for learning, but the connections of people within the communities can become priceless over time.
	• **Engagement.** Being able to discuss with people that are experts in a certain field of knowledge attracts people.
	• **Expert communities.** Communicating forms the basis of networking and one of the objectives of TU Delft is participating in global knowledge networks. Experts can group around more specific issues, problems, and expertise, where new OER are created.
		Implementing social tools are not difficult. Important is the fact that conversations can be about the content, but also about social issues. These should be in separate spaces though (SitePoint, 2003).
		• **Communication tools**
		  ○ Annotation tools
		  ○ Discussion forums
		  ○ Comment boxes
		  ○ Online chat and conference tools
		  ○ Q&A section (i.e. OCW.Answers; social, with profiling and kudos)
		• **Social networking tools.** Technologies that enable people to form (open and closed) virtual networks, including the most common relevant services.
		• **Rules and principles**
		• **Guidelines and support** for creating and cultivating communities.

Posting Assignments & Challenges	An interesting option for sustaining the activity level and attraction of Delft OCW is implementing a space for organizations and individuals to post assignments and challenges, which can be considered as learning resources. • **Companies.** Attraction toward (among other things) companies for posting problems and challenges. • **Students.** Attraction toward students to solve problems.	Although it may be an attractive option to allow companies and individuals to post challenges, this should be monitored closely. The added value for companies for this "free" advice can be large, and their ability to connect with possible future employees. A number of considerations are crucial. • **Privacy issues** regarding companies and individuals. • **Business model: revenue and selling patents.** Companies might be willing to pay for pitching a challenge and experts (including our own) can post their ideas or make the connection with existing patents. • **Protocols** for challenges and assignments.
Arranging & Sequencing OER	How OER should be sequenced, depends on the context of the learner: he or she must be able to form personal collections. The same applies for teachers and experts that may want to share their collections with others (such as students). • **Flexibility of collections** addresses changing learning contexts. • **Decentralization & Efficiency.** Anyone can create and share collections and combinations of learning materials. In the end this will increase the amount of contextualized learning materials. If people can make and sequence their own resources and tracks, the content and representation of it on Delft OCW will become different than Blackboard, and will be different. Teachers will have the choice between using BB and OCW for sequencing and managing their resources. • **Alternative for Blackboard.** This method can provide an alternative for BB for presenting learning materials.	Allowing people to make resources and combine them into personal collections can be a key aspect of binding individuals to Delft OCW, because they put value in the environment themselves. • **Profile system that includes personal (sharable) collections** allows individuals, both TU people and independent online learners, to create learning tracks of available and new resources. • **Sequence & Collect software.** Obviously, it must be easy to sequence OER and make personal collections, customizable courses, books, reports, etc... • **Shared repository.** A shared repository allows teachers to include '*new*' OCW resources in BB, and/or to adapt and repurpose educational materials from BB in OCW.

Activities	Explanation & Sustainability	Technological & Institutional

Adding Metadata	OER cannot be reused and remixed if they cannot be found. The ability to find OER, people, information, and communities is a key aspect for sustainability. There is no active participation, if a community, or its resources, are invisible. The value of Delft OCW will degenerate if search produces useless or bad results. A good search and reference system and method are imperative.	If OER contain sufficient metadata, they can be found and (re)used by learners. Adding metadata can be done in several ways:
		• **Automatic metadata software** creates information about OER automatically;
		  ○ Content search
		  ○ Refer to similar content/OER
		  ○ Usage and popularity
		• **Tagging.** Anyone can add the labels that apply best to his/her use and context of the OER. This information can be used by others to access and reuse the materials.
		• **Predefined metadata schemes.** Contributors can be asked to fill in a small number of fields to describe the OER that they create, upload, or link to.

Software Development	TU Delft and affiliated universities and institutes should be responsible for the main development of the online environment and the technologies and tools supporting the workflow. This does not mean that others cannot contribute: for example, applications can be written by students or external people. • **Decentralization.** Similar to the creation of OER: making software applications and games that may be useful for learning or using the available OER can be done by anyone.	Allowing software applications and plugins on Delft OCW involves some security issues that need to be addressed. • **Clear rules and criteria** about the software that can be contributed. • **Support materials** online to help potential software or application developers in creating useful software. In addition, there are agreements that should be made between participating institutions (3TU, etc) • **OCW Technology Center.** Collaboration between universities.

Table 6-1 - Synthesis & Advice "Organization: Creation & Management of OER"

The above table shows many policy considerations, criteria, recommendations, and important issues that have to do specifically with the creation of content. This can happen through linking to resources, creating online and offline, discussing and communicating around content, posting challenges and more.

Organization: Reviewing & Quality Management

Although the presence of a large number of resources may increase the likeliness of available qualitative resources, it should be clear where these resources can be found, and which sources can be trusted. Another issue is the fact that quality is a relative notion, and quality may depend on the context in which a resource is used. Especially in the described decentralized situation, quality and review mechanisms should be in place to be able to find relevant, high quality resources that can be trusted. The following table focuses on these issues.

Activities	Explanation & Sustainability	Technological & Institutional
Quality Maintenance (centralized)	There are materials that, in a centralized, top-down fashion, are authorized, maintained and updated by the TU Delft, affiliated organizations and universities, and people or appointed experts. This *'official'* version should always meet certain criteria and TU standards, and should be visible as such as well. • **Visibility & Trust.** Delft OCW will itself become a brand, and homogeneity between materials (or rather: how they are presented) and trustworthiness are important aspects for attracting people to the site.	Several issues should be addressed to guarantee a certain homogeneous group of official OER. • **Standards** indicate the criteria for the *'official version'*. • **TU format or framework** and corresponding technologies for making and maintaining official, high quality OER. • **TU labeling system**, managed (rather top-down) by teachers and experts that are involved in OER communities. The *"Lenses concept"*, as used in the Connexions initiative is a relevant example. • **Support**, as discussed earlier

Quality Maintenance (decentralized)	End-users must be able to indicate the usefulness and overall quality of OER, for personal use and reference, but also for an overall decentralized quality review of specific OER.
	• **Quality & Feedback.** The judgments by users of OER may increase quality in different ways:
	  ○ Feedback on content can be used directly in updating content.
	  ○ Feedback about use can provide an incentive for teachers, experts, and other contributors.
	• **Engagement.** The ability to contribute to the whole, to have a voice, and to customize the environment to one's needs and context is important for engaging users.
		There are numerous ways to allow decentralized quality maintenance. Besides the mentioned authoring and discussion tools, the formats, and protocols, these include the following.
		• **Marketing.** Teachers and experts may be hesitant to contribute resources that can be judged by anyone. This issue should be investigated and addressed.
		• **Policy** that encourages teachers to share their materials in the most open way helps to increase the reuse and use of quality feedback mechanisms.
		• **Rating mechanisms** allow people to rate or favorite OER.
		• **Feedback, Review & Discussion tools** enable anyone to suggest changes, and review or discuss OER.
		• **Usage statistics and software.**

Checking for Inappropriate, Illegal & Copyrighted Materials	Anyone can indicate whether a specific resource is of bad quality, contains explicit material, is copyrighted, or in any other way should not belong to Delft OCW. This is a task for the TU Delft and participating universities, but should be in the hands of individuals online as well. • **Empowering users** is both good for engaging them, as for the overall quality.	Implementing a decentralized quality mechanism for inappropriate, illegal, and copyrighted materials should be approached from 2 sides: prevent & resolve. • **Preventing** disallowed materials can be done through information and an internal check. This internal check can be less sustainable if many resources are added continuously. Hence, this internal check may best apply to *'official'* OER. • **Resolving** the mentioned issues is best done with allowing users to indicate with one click whether something should not be allowed. • **Guidelines.** In addition, guidelines are needed, and a monitor/quality section that is responsible for allowing and disallowing content.

Table 6-2 - Synthesis & Advice "Organization: Reviewing & Quality Management"

Creating resources, managing them, propagating a high quality, and making sure that people are able to find the information they are looking for, is something quite difficult, and depends on many factors, as we have seen in the previous tables. One of those aspects is the availability of sufficient support.

Organization: Support

We have seen numerous instances where support, physical or through information and tools, is needed. The table below will describe in more detail the importance of support, and suggests ways of how to deal with it.

Activities	Explanation & Sustainability	Technological & Institutional
Supporting teachers (physical)	Teachers that are affiliated to the TU Delft and other participating universities should receive sufficient support in the creation of high quality resources. This benefits the projects in 3 ways: • **High quality resources.** According to the described change in division of labor, teachers and experts will be able to focus more on content, and support is given to them to create high quality learning resources. • **Lower barriers.** Teachers can use human resources for creating OER, which significantly lowers the barriers for participation. • **Expertise.** Finally, a possibly not so straight-forward consequence, is the availability of in-house experts (pedagogical, human interface, learning design, etc.) who can be hired by organizations.	The support issue should be considered with care. On the one hand, support represents a significant expenditure, especially the way as described in the advice. This impairs the sustainability. On the other hand, it causes lower barriers, better resources, and teams of experts that can be utilized in other, more profitable ways. Regarding Delft OCW, a number of issues should be addressed. • **Policy changes** (extrinsic), in the way that financial resources and credits are allocated for faculty and experts. • **Professional support teams** are set up (per faculty, using students), providing expertise to both internal and external clients. • **Rules for internal and external support** describing how support is given, how people and organizations can make use of them, and for what price.
Supporting contributors (online)	Another way of delivering support, which little exploitation costs, is to provide contributors and users with tools and information to help themselves. This type of decentralized support is clearly not just for individuals that do not have access to the mentioned physical support, but for anyone.	There are several ways to decentralize support. • **How to…** Manuals and tutorials indicate ways how to create good resources & software, assemble, review and judge the content of the site. • **Discussion forums and social software** allows people to connect and interact about problems and discuss issues. • **Tools and mechanisms** that ease certain activities, such as creating resources in XML, or reviewing.

Table 6-3 - Synthesis & Advice "Organization: Support"

The above tables explain and define the advice for the organization of Delft OCW in how to deal with organizational issues, specifically regarding centralization and/or decentralization of activities. These activities concern concerning production, quality control, maintenance, and support. Institutional changes are suggested, technical possibilities shown, and policy considerations that should be addressed.

When you rely on others to sustain a project, motivating them becomes very important. The results of analyses and an advice on the component "Motivation" follows next.

6.1.3 Motivation

As explained in the introduction, and in chapter 3, finding and utilizing non-monetary incentives to engage people, is crucial for sustaining activities that depend on volunteers. We have seen that Delft OCW will in fact try to source many activities in a decentralized fashion, thus depending on intrinsic motivations of Delft OCW users.

The report describes several issues and ideas concerning motivation. The table below has synthesized the different sources of information (literature, exemplary initiatives, and interviews) and put into one table representing the main issues. The first column explicates different issues that concern motivation, which are explained in the second, and the advice follows in the third column.

Issue	Explanation & Sustainability	Technological & Institutional
Recognition, Acknowledgment & Community Engagement	Creators of OER may act altruistically, but recognition online, within communities, and acknowledgement of their contributions by institutions is of paramount importance. • **Community.** Feeling of contributing something, having significance or an impact on scholars and students *within a community* are intrinsic incentives that must be used to sustain Delft OCW without the need for financial resources. ○ **Culture.** Sharing happens in a community of people, and without an existing culture, there will be no incentive to share. • **Clarity.** Policies about open publication provide transparency for employees, needed to involve and support their efforts.	Different ways to utilize intrinsic motivations and/or provide incentives to potential OER contributors. • **Customizable licenses.** Attribution of OER, which means that the OER creators are named as the authors, is crucial (even when resources are adapted). Creative Commons-licenses, currently used, allow this. • **Vision, strategy and roles** provide clarity to community members, and can improve the level of commitment. Certain prestigious roles can be given to persons who have contributed significantly. • **Open publication policy.** Recognition by institutions can be conceived with policies that include carrots (tenure, kudos, exposure) for open publication, or sticks (employment criteria) for not doing so.
Use	As said, the impact on scholars and students within one's discipline forms an important incentive to share. Other incentives that concern the use and reuse are: • **Reuse, modification & improvement.** Reasons to share include the fact that resources will be reused and improved by others. • **Feedback** on the shared resource is another motivation. • **Knowing** who, how, and when uses the shared OER increases the likelihood of sharing resources.	Concerning the use and reuse of OER, there are a number of issues that should be addressed. • **Authoring tools** to improve and author OER. • **Marketing, open licensing and support** to increase and improve the reuse. • **Feedback and quality tools** to provide feedback and quality reviews. • **Formats and protocols** to provide quality reviews of resources, centralized as well as decentralized. • **Clear statistics** to provide contributors with information about the usage of OER.
Barriers	Clearly, motivation to contribute is reversely proportional with the barriers that are faced with contributing. Therefore, the barriers to contribute must be as low as possible.	Several ways to lower barriers. • **Support**, as explained above and earlier. • **Technology and tools** must be easy to use, and address the specific needs of the user/contributor. • **Size of task.** Low granularity in tasks enables people to participate in small increments, and only a little motivation is needed to do that.

Table 6-4 - Synthesis & Advice "Motivation"

This short section has explained several issues that deal with motivation. Delft OCW policymakers must acknowledge that if, as described earlier, decentralization of activities is needed to sustain the project, motivation, and the utilization of non-monetary, intrinsic incentives, play a very crucial way. Other initiatives and literature have shown that these incentives can be used, and that money does not always play a significant role, specifically for academics. Support, acknowledgment, size of task, feedback and

usage information, and technologies and tools can play an important role in decentralizing certain activities.

The following section continues with a synthesis and advice on the component "Types of resources".

6.1.4 Types of resources

There are many aspects regarding the types of resources, such as flexibility of the technical format, which allows or inhibits remixing and reusing content. Another aspect is the level of contextualization of a resource, allowing standalone learning, versus teaching resources (supporting classroom teaching).

Issue	Explanation & Sustainability	Technological & Institutional
Flexibility format	If a resource is published in a flexible format, such as XML, meaning that it can be adapted and reused, allows customization and repurposing, and thus, contextualization of resources. Since context is very important in learning, flexibility of resources increases efficiency, because users can contextualize OER themselves. • **Flexible OER** allow reuse and remix, which increases participation, efficiency, and motivation. It is also required for more personalized and flexible education. • **Inflexible OER**, such as PDF files or video lectures, although less easy to reuse and remix, are usually more easy and cheaper to publish.	OER will be published partly in flexible format, and partly in inflexible format. Still, reuse must be stimulated, either through tools or support. • **Intuitive tools** for (re)authoring materials lower the barrier for participation. The Delft OCW online environment is important to this respect as well. • **Fine-grained and modular** resources allow easy and efficient reuse and customization. • **Support**, such as online manuals, or a physical help desk, may encourage individuals to publish or create in flexible formats. • **Marketing.** Teachers must know the possibilities and the advantages of publishing in a flexible format. • **Balance.** Finally, it should be considered under which circumstances flexibility is preferred, and when this would not be cost-effective.

Issue	Explanation & Sustainability	Technological & Institutional
Learning & Teaching Resources	The learning landscape becomes increasingly global and competitive, which is recognized by the TU Delft. High quality online resources can contribute to the sustainability in several ways. • **Brand.** Publishing these materials online may attract new (inter)national students • **Online education.** In addition to that, it enables individuals (from our own and other universities, including 3TU) to study online, opening up to a new market. • **Better education.** High quality resources and innovative learning environments can also improve education at TU Delft (and the world). • **Business model.** Creating high quality materials can be a source of revenue in different ways, even if they are published openly. This will be discussed later. It should not be forgotten that teaching resources, i.e. resources that support teaching and are used in classroom, will be used and published as OER as well. Publishing these resources is probably much cheaper, which is good for sustainability. There is another consideration to be made, which concerns the reusability paradox (Figure 3-2): highly contextualized resources are more difficult to reuse, but their pedagogical effectiveness is higher.	Creating high quality learning resources is something new to TU Delft, but should be considered. Concerning Delft OCW, the following should be addressed. • **Protocol.** A protocol and format for learning resources should be designed, making the resources visible, homogeneous, and easier to publish. • **Support** is mentioned as something the university should give to teachers. Another labor division, which is discussed earlier, plays a role in this. • **Online education** must be investigated, including relating issues as endorsement and assessment. These efforts must be done in collaboration with other universities that may become partners in creating resources. • **Representation.** It should be investigated how both teaching resources are represented alongside high quality learning resources. • **Explore new developments.** Not just resources, but new ways of learning and learning environments must be explored and supported. • **Balance teaching and learning resources.** Because both have advantages and disadvantages, a balance between creating and publishing learning and teaching resources must be found. • **Reusability paradox.** The pros and cons of making learning (→ contextualized) resources highly reusable (→ flexible, fine-grained, modular) and less reusable should be investigated.
Internal & External resources	Resources can be made by the TU Delft and in collaboration with other institutions, but this would cover only a tiny part of all potentially useful learning materials online. We have seen that allowing individuals distributed in online networks to add and review online resources contributes to sustainability. • **Crowdsourcing.** Allowing external resources is a way to tap into the collective wisdom and richness of the World Wide Web and its peoples. • **Quality** is an important issue when allowing external resources to be added by anyone.	External resources can be of any type, format, level, and overall quality. These resources can not only help the university, but can do damage as well. • **Protocols, (decentralized) quality mechanisms, and tools** should be used to maintain quality and filter good and bad resources.

Table 6-5 - Synthesis & Advice Types of Resources

The component "Types of resources" has some difficult issues. On the one hand, highly contextualized, interactive, and visual online learning resources can improve brand and attractiveness and education, meanwhile opening up for new markets and creating business opportunities. On the other hand, their

reusability may be low, and their costs high. These considerations are important must be addressed and described in detail.

The following part of the advice shows which types of reuse are possible, and desirable, based on the research.

6.1.5 Types of end-user reuse

This section discusses the findings and advice about types of end-user reuse and the way this is supported. These include not only reusing materials as is (reading, watching, doing), but also remixing and adapting the content or the technical format, so they can be used in another context or with another technology. The section below will elaborate on the different approaches by initiatives on allowing or disallowing reuse by end-users, and the ideas and opinions of experts and the interviewees.

Reuse can be either reusing the site and its content *"as-is"*, or *"remixing"* content or format, repurposing it for some other context. Context is very important for the pedagogical effectiveness of resources, and allowing re-contextualization therefore is considered an important element for sustaining an OER project. Content can be exported as well, and reused (and remixed) elsewhere online or offline.

Issue	Explanation & Sustainability	Technological & Institutional
***As-is* reuse**	Currently, most OCW projects offer content that can be reused *as-is*. Earlier, I have explained that reusability, in the form of remixing and adaptation is an important element of sustaining OER-projects. Still, *as-is* does not mean bad or useless: *as-is* OER can contain value for different users. • **E-Learning.** To increase the usefulness of these non-editable resources they must be engaging, contain visualization, etc. This allows home-study, which can improve education. • **Communication around content: better quality & more engagement.** The *third layer*, the so-called lab-environment, is part of the strategy of Delft OCW. Content can be reused *as-is*, and initiate conversations and innovation.	There will be different types of users visiting Delft OCW. For all important users, the environment has to contain value. These respective values are contained by the OER, but also by the functionalities offered. Disregarding the option of adapting and remixing OER (explained in 2nd row of this table), these include: • **Learning from high quality OER.** This means that the OER really have to be of high quality. • **Support policies & strategy** to create high quality OER (lowering barriers and involving teachers). • **Communication tools** (comments, suggestions, networking) allow communication around content and connecting to other people in a certain domain. ○ **Dark rooms.** Allowing companies, experts, and students communicate in online dark rooms, addresses the need for shielding off certain information, and attracting companies.

Issue	Explanation & Sustainability	Technological & Institutional
Remixing, adaptation, repurposing	Remixing can be described as changing the content or the technology of materials. It can happen in many forms, such as translating, adapting content, making mash-ups, etc. • **Quality of content.** Remixing content may improve its quality. • **Engagement through personalization.** Supporting remixing content allows users to personalize OER and engage them. • **Business model.** Remixing, or adapting the content, may be easier for the organization that created the original OER and this may become a source of revenue: selling customized OER. (more on this in the next component)	Several implications for the Delft OCW organization: • **Marketing** that encourages teachers to openly license their OER, so it can be remixed/adapted. Also encourage the remix (and reuse: commenting, making suggestions) by students. • **Physical support** for teachers and experts. • **Technologies and tools** (plus online manuals and guides) supporting remixing, adaptation, and creating collections of OER. This may include a log-in or a profiling system. • **Rules** about remixing content.
Contextualizing	Both adaptable and non-adaptable materials can be reused in different contexts. • **Modularity and granularity.** An article in the inflexible PDF format, which is difficult to edit, can for instance be used in different settings, inside and outside classrooms, because of its granularity. A whole course, if it cannot be split up into different fine grained learning objects, is less viable to be reused in other settings than the original one. • **Externalization of content.** It is important to realize that successful websites allow users to take content and place it in their own, personal environment.	Both institutional and technological considerations should be addressed. • **Support & Marketing.** Improve external (re)use of OER by encouraging the creation of modular and fine-grained OER. • **Tools and technologies.** Using technologies as RSS, allowing and encouraging mash-ups and data-mapping technologies, as Grazr.com or Dapper.net, and offering content in a granular and modular way, increases external reuse.

Table 6-6 - Synthesis & Advice Types of End-User Reuse

The above table shows a number of issues that are important for sustaining the reuse and remix of OER. Remixing of OER has its added value toward sustainability, but implies a number of issues, such as the need of specialized technology. Finding out which technologies are needed, and how they should be implemented, is not part of the research, and should be considered by specialized IT experts. Besides technical issues, it important to have sufficient support of teachers, encouraging them to allow reuse and remix of content, letting people comment and suggest changes, and letting their own students participate in the improvement of OER in their domain. Reuse of content will, obviously, increase if OER are attractive. Remixing content will, obviously, increase if it is allowed, promoted, and supported physically, through tools, and with online manuals. Both reuse and remix will increase if it can happen on people's own, personal web spaces, hence; if they can take content and information out of Delft OCW and put it in their own environment.

So how does reuse affect our business model? Although Delft OCW may have altruistic objectives, it clearly has to bring some positive consequences to the university as well. The next section focuses on the business side of Delft OCW: the revenue and funding models.

6.1.6 Funding and Revenue Models

Investing a lot of money in creating high quality content, and then spending even more to make it available to the rest of the world may not be sustainable, and could result in discontinuation of the project. In a world where competition is increasingly global, this seems counter-productive. Especially if you consider the possession of content one of the main factors influencing your competitiveness.

Delft University of Technology thinks that high quality content, although making a difference in the quality of education, and therefore market position, should not be shielded behind firewalls and hidden in Content Management Systems, but should be free. Motives include altruism, efficiency, and marketing. This section will elaborate on the last two mentioned motives for conducting such a vast and interesting project. I will describe different approaches for sustaining this project by focusing on ways to receive funding, or make revenue.

The original OCW projects were heavily funded by non-profit and for-profit organizations, and their sustainability and business models were based on these funds. Now, years later, we cannot rely on these funds, because competition between OER initiatives for grants from institutions like the Hewlett Foundation has become particularly stiff. OER-projects have to be unique if they want to receive donations from large institutions. In addition, as has been explained before, the sustainability of OER initiatives cannot depend on funds, but have to find a way to become sustainable in another way. This report has described ways that approach sustainability from a non-financial angle. Through decentralization of activities, and the development of online communities and networks, Delft OCW may become (partly) self-sustainable. Still, money is needed to keep the development at a certain pace. Besides, there are a number of activities that are unlikely to be done voluntarily by individuals in decentralized networks.

The research has come up with a number of opportunities create revenues for Delft OCW, without loosing the independent character of the university. The results of the research on this matter, plus a substantiated advice follow in the next table. The different models, as explained in section 3.3.5 and 4.4, are repeated.

Issue	Explanation & Sustainability	Technological & Institutional
Endowment, Foundation, Donation	Finding funds becomes increasingly difficult, with Open Education projects emerging everywhere. Still, this classical model of funding an OCW project is still viable for really innovative initiatives. • **External funding** cannot be the most important source for sustaining Delft OCW. Being innovative can increase the likelihood of getting funds. Government may be able to support the project, if it fits into their policies. • **Donations** can come from both large non-profit organizations, and from specific private organizations that benefit from the development of certain materials. Voluntary support, membership-based, and government support models are similar models.	Several potential instruments may be applied; • **Lobbying** is a means to involve organizations and governmental institutions toward investing in Delft OCW, and pressing for Open Education policies at the government. • **Tip-jar:** a ***Donate!*** button on the site. • **Clear description, guidelines and format** for faculty to approach possible foundations and companies. They may be better able to approach specific interest groups and organizations to donate. • **Innovative.** Be at the frontline of innovation in Open Education, and the initiative will gain significant attention, and possibly more funds.

Issue	Explanation & Sustainability	Technological & Institutional
Segmentation & Value-Added services	This model represents a great opportunity making Delft OCW a source of revenue. In the research, we have come along a large number of possible value-added services. These can be offered, since by offering free content, a large user-base is created, that may be converted into paying *customers*. • **Value added services** come in many forms, as explained in the advice (next column). Offering and selling services and products is a large opportunity to make revenues, because of the large user-base that can be targeted with specific products and services. When products and services are targeted well, the obtrusiveness and annoyance become less. • **Membership based services** can be interesting for corporate clients, with special features and privileges. • **Community marketing**. If a strong brand is built, and vibrant communities, the services will be more rapidly diffused and better targeted. The ability to offer VA services depends on the quality of the content of the site, the number of people on it, etc. • **The independent character and brand** of the university (and collaborators) may not be negatively influenced with offering these services.	Value added services (and products) can create a large source of revenue, of engagement, and of annoyance (in some cases). Below a list of possible services, as seen with other initiatives and in literature, and a number of considerations/ recommendations in order to manage these potentially beneficial options. • **Rent-a-Student/Expert** is possible, because it triggers motivation, and is interesting for companies. This function may be developed in order to attract and involve alumni. Profiling becomes increasingly important then. • **Crowdsourcing.** Delft OCW can function as a *crowdsourcing platform*: interesting ideas, solutions and problems on an online marketplace. Placing problems could be charged, or other services can be thought around this model. This option can be combined with the Rent-a-… model, with kudos, recognition, etc… • **Customization of OER.** Offering custom and flexible education is very interesting and an opportunity to make money. It requires a *workflow and teams of experts* (which may be students) that professionally conduct this business. • **On demand printing** of OER. • **Membership-based services**, such as social authoring, customizable courses, access to webinars, papers, and people/support. • **Subscription & Services.** Attracting (international) students and companies with high quality content may lead to new subscriptions. In addition, they can be offered VA-services such as assessments, tutoring, and certification. E-learning may become important. • **Selling statistics and data.** An interesting revenue possibility is to sell the user data to interested institutions and schools. This is especially relevant for high quality learning content and software, as is done by Carnegie Mellon University. The content is free, but the software behind it, the user data, placing it on a different school's platform and other valuable services is not. • **Guidelines and policies** directing and rightfully exploiting these possibilities.

Issue	Explanation & Sustainability	Technological & Institutional
Contributor-Pay	Translating this model to OER could mean relies on the fact that publishers of OER want a quality review and want to be recognized by their OER: • **External creators** of educational content want their (high-quality) content be placed on the website. We have seen that they can already do that, by adding and linking to their respective resources. The crux is the fact that they may want to improve their resources, and want a quality review of it by pedagogues, technologists, human interface experts, etc., which costs money. • **Teachers and experts**, in a future scenario, get higher positions and recognition through OER. They might want to invest a little in creating the best OER.	To be able to use the contributor-pay model, some significant institutional issues must be addressed. • **Clear protocols and workflow** for external creators of OER, what their privileges are if they want their OER to be reviewed. • **Clear policies** that favor creators of popular and useful OER, making publishing OER competitive.
Replacement	Replacing activities can result in cost reduction. Delft OCW may, for certain activities, eventually lead to become an alternative for BB. For instance, support activities may be done by individuals in communities, replacing standard processes. Another activity could be Delft OCW as a learning environment. This leads to cost reductions and more sustainability. • **Alternative.** Blackboard is a closed environment and the platform used by all students and teachers at TU Delft. Both criticized and adored, it has an extremely important position within the organization. It is unlikely that BB will be replaced in the coming years. Still, it can be wise to invest a little in an alternative, and Delft OCW may become one.	Although replacing Blackboard is not considered at the moment, Delft OCW, as it will be more and more integrated with the standard activities of the university, may form an alternative for some activities. It is important to stay ahead, and open for new trends and technologies. • **New technologies and trends.** If Delft OCW wants to serve as an alternative, it has to be upfront in adopting new technologies and addressing trends in learning. *3D and virtual worlds, gaming, and interactive software* may become very important, and significant interest has to be directed to those areas. • **Blackboard specific issues**, such as the ability to contain copyrighted materials, and private spaces, could be considered for Delft OCW as well.
Sponsorship & Advertisement	TU Delft stands for independent research and education. This aspect of its brand may not get lost. Still, sponsorship and advertisement do not necessarily degenerate the brand of the university, it could even improve it. Brands can re-enforce each other.	Delft University of Technology, and later on, the joining institutes and universities, should consider bundling resources with strong brands. • **Preferred partners.** This opportunity should be considered with preferred partners of TU Delft and large enterprises with a strong brand name. • **Publishers (books/articles).** This option, a bit more concealed, could include marketing possibilities for publishers of textbooks, or selling books and articles through the website.

Issue	Explanation & Sustainability	Technological & Institutional
Partnerships & Exchanges	Partnerships are extremely important. • **Universities.** Financial and human resources of other universities and organizations can be used to sustain the development of software and OER, and improve overall sustainability. • **Software companies.** Software, specifically educational and for the project itself, may be built in partnerships with software companies. • **Organizations** that will benefit a lot from the project may be willing to invest in it and partner with Delft OCW to co-develop OER. • **Network effects.** In addition, being connected with more organizations in the Netherlands and worldwide means a larger network, which is very beneficial for the overall value of the initiative.	Partnerships will be very important in sustaining Delft OCW. • **3TU, IDEA league.** Delft OCW has to involve more universities, starting with 3TU and IDEA league. Universities from China (for example) can be important as well. • **Trust and standards** (technical, process) are very important and difficult issues. Organizing *conferences* and having a good process design for involving other institutions is important. • **Process design for involving others** describes how collaboration happens. • **Competition.** It is important to consider other universities, but we should not forget our competitive position.

Table 6-7 - Synthesis & Advice Funding and Revenue Models

During the interviews I noticed that the interviewees were not acquainted with many of the above potential sources of revenue. Explaining the possibilities and describing different options (as seen with other initiatives) it became clear that the potential of business, funding and revenue models have not been considered yet. Delft OCW was seen merely as something that brings reputational revenues, not financial. Although acknowledging the reputational revenues, if implemented well, we should not nullify the potential of the described financial models. Money remains an extremely important and powerful instrument, and sometimes even a stimulant. It can make people run harder, and it could make Delft OCW become sustainable, and increase the value of it. And I do not mean the financial value.

The following section will highlight the critical issues that Delft OCW needs to address in the next phase of the project, and how they should do this. This is based on the first section of this chapter.

6.2 The Road Ahead: Priorities and Sequence

An important wish from both EduTec and ESA (Education & Student Affairs, the problem owner) is that this report defines the opportunities and hurdles that need most priority, and how these must be addressed. This will guide decision-making and help policymakers handle this manuscript. The following section will describe the most important aspects of the advice on a sustainable Delft OCW. They will be prioritized and each recommendation will be described in as much detail as this research allows.

Sustainability has been defined as the ability to continuously meet the objectives of a project. In OER projects, this means being able to create and share open and reusable educational content online. But what was the exact objective of the TU Delft for starting this project? What defines success? As the interviews have shown, there are two main objectives;

- Marketing and economic purposes include attracting new students and researchers; a more efficient creation of educational materials (through online collaboration); and the OCW platform as an instrument to let departments and faculty become part of global knowledge networks.

- Educational and research purposes form the second group. Delft OCW has to create insight (visibility) in education for ourselves as for the external world; produce an itch for learning; be open for and welcome valuable contributions and connections worldwide; and may become an important factor in future learning and education methods and environments.

The above goals do not show a certain commitment, and neither specify the objectives. This clearly is very difficult to do, but it can help to describe a certain level of dedication toward the project. We want to attract new students, and we want to participate in global online and offline knowledge networks, but it does not explicitly describe the relation of OCW with (possibly interested) students, and what is meant with global knowledge networks. Teachers that sporadically get an email from a Chinese teacher or student about their OCW course? Or frequently engaging in online communities, collaborating in creating and discussing new resources with students, teachers, hobbyists, and industry experts? The same applies to the educational and research purposes of the project… what are the specific objectives and what is the level of commitment to reach those objectives?

It must be said that these objectives come from TU Delft policymakers, responsible for the initial development and setup of Delft OCW. It does not say anything about the characteristics and demands of individual end-users and contributors, such as students or teachers. Clearly, their opinions and ideas are important as well, but this research has focused on showing the possibilities of Delft OCW, and relates this to the ambition and ideas of policymakers. Although some end-users (such as teachers and students) may not identify with the advice, it is important that policymakers are aware of the true potential of this project. If they do that, I think that the level of commitment to fully exploit this potential will rise as well as the support for organizational changes that are needed to be able to do this. The interviews with them resulted in insight in the ideas, fears, and level of commitment of policymakers.

This chapter has the purpose of both raising awareness about the potential of this project, and prioritizing the issues that need most attention. The advice in the following sections will be presented as follows:

1. The urgency of starting with the research and development of the second and third layer is made clear, and how this can be done. Exploiting the full potential of Delft OCW, and specifically the proposed future configuration, cannot be done without sufficient research. A comprehensive strategy will help in providing clarity both for policymakers and potential collaborators.
2. This strategy will form an important document to attract other educational institutes, commercial and non-profit organizations, and individuals worldwide. These parties are all necessary to co-develop the future OCW environment and make it thriving and sustainable.
3. During the implementation phase, the OCW organization (including different organizations and institutes) has to be able to provide sufficient support, and must motivate sufficient individuals to add value. Additionally, rules and protocols must be in place to guide and manage the distributed activities of end-users on the site.
4. A continuous activity will be recognizing and utilizing business (and funding) opportunities. In order to be able to exploit all of them, this process must start concurrently with the development of the OCW system and in collaboration with relevant actors and organizations.

Next to goals and wishes, actors have pointed out a number of criteria and fears, including the fear for

degeneration of the TU Delft brand. This was mentioned quite often, specifically in relation to options to decentralize certain aspects of the organization.

A prioritized and sequenced advice is described in the following sections. For each proposed action the urgency is made clear, its significance for attaining objectives, and the way it can or should be done.

6.2.1 The Future Starts Today

The future of Delft OCW has been described in the project proposal and depicted in Figure 1-2, which explains the second and third layer. Literature and initiatives have suggested ways to approach the uploading of OER and communication around content. These layers and their respective qualities and characteristics have been described and commented on by stakeholders as well. In those conversations, it was mentioned more than once that we should focus on the first layer, the repository, and take care that most of the university teachers publish their educational content online. The coming years will be focused on developing the workflow and promoting the publication of courseware on the repository. I argue that this is the wrong approach.

- Delft OCW must not become an extension of the traditional educational practices at the university. Publication of courseware according to the centralized one-way, pre-publication review model is not going to bring TU Delft much closer to attaining any of the mentioned objectives. This traditional way of publishing is not sustainable, not efficient, not engaging, and does not exploit the potential of a truly open Delft OCW.
    - Although initially, the courseware may attract certain students and researchers, the organization must be aware that there are already many OCW projects. Furthermore, the number of online educational resources increases with an enormous pace, and a repository with static courseware will become *"just another resource"*.
    - Efficiency in the creation of educational materials is only increased when others can improve or add relevant OER. The current repository and model does not allow that.
    - If users of content on Delft OCW are not able to interact, react, contact, communicate, or have any other form of conversation, it cannot be used as an instrument for creating worldwide knowledge networks. It will be more like a display-cabinet, and visitors may take pictures (copy), but may not improve or re-arrange the showcased materials, or add new materials.
- Starting with the development of the second and third layer does not compromise publishing courseware in the repository. It is not difficult to start an alternative site using, amongst others, the OCW materials, and allowing the visitors to contribute, discuss, and connect.

Simply said, there are important incentives to start with the development of the second and third layer right-away and not many reasons to wait with it. Investments are needed to create the extra opportunities that uploading and communication around content offer.

Research and development

The proposed second and third layer cannot "just" be deployed. The issue is quite complex, and needs a clear vision on the future of OER and education. A dedicated organization must do this with the project's ultimate objectives in mind, the role of OER in the university of tomorrow and in the changing learning landscape in general.

- **Vision & Strategy.** First and foremost, a clear vision of the future of learning and open education must be developed. Research on the future of learning will result in a comprehensive strategy and must guide the development of Delft OCW. This plan, which includes a vision about the future, clear and comprehensible objectives, and a strategy to attain those objectives, will provide clarity to relevant stakeholders and potential participants. Because of its similarities to the second/third layer, the strategy of WikiEducator is explained in Appendix G.
- **Organization.** A dedicated organization that operates autonomously, consisting of IT experts, educational experts, and future users, including teachers, students and representatives of participating institutes and organizations, will develop the second and third layer as a separate website, using the resources from the same repository, allows and supports remixing of content, similar to the Open University's (UK) LabSpace and Rice University's Connexions.
- **Technology.** To engage its users, the website has to be rich in functionalities. The different analyses resulted in various suggestions with regards to the online environment (second and third layer). Communication tools for chatting, commenting, suggesting, discussing, and conferencing increase engagement and allow people to connect online. Networking tools enable people to create a personal profile, import contacts from existing online networks, find and connect to contacts, create group spaces (communities), and export contacts to other networks. Support tools are needed for remixing and recombining content, creating new resources, linking to existing resources, and maintaining quality of the site and its content. Finally, marketplaces for people (employment), for ideas and patents (open innovation and entrepreneurship) are possibilities that need to be considered for attraction, engagement, and sources of revenue.

Appendix H shows a more elaborate advice on the tools and technologies that should be implemented in order to sustain the activities that have been mentioned. Developing the second and third layer, and implementing this in an alternative environment will be difficult, costly, and time-consuming. What adds to the complexity is that the proposed actions are highly interlinked with other factors in the future OCW system. For example, reusing and remixing content is easier with flexible resource types, offered in granular proportions. Also, e-learning opportunities, business models, and communities are complex issues that need to be considered with regard to the second and third layer. The complexity of the future OCW system requires a solid research to support the development. This research will bring about a clear vision about the future of OER and strategy for Delft OCW, to be used during implementation of the future OCW system. A number of relevant research domains have been listed in Appendix I.

This report describes numerous opportunities for making Delft OCW sustainable. These can be repeated in this section, but the most important message may then drown in this ocean of opportunities. I want to stress that the current approach is not sustainable, and that we have to start developing the second and third layer as soon as possible, with sufficient financial and organizational backing. Only after significant investments, the fruits of decentralization can be reaped. Only then will the OCW environment become one of the most important instruments for the TU Delft and participating organizations in becoming an important hub in global knowledge networks.

6.2.2 We're Not Alone

The above, the research and development of a sustainable site with numerous functionalities that fits perfectly in the future learning environment, seems an enormous task. The TU Delft can decrease the

task size significantly through collaboration with others. It is essential that the university seeks and finds other parties that can contribute to the project, making it a collaborative and shared project (possibly changing the name as well). It is difficult and costly to design, develop, and address all sustainability opportunities of Delft OCW solitary. Therefore, involving others might increase the likelihood for success, because of *(i)* the potential contributions (OER, money, engagement) of numerous universities, companies, and individuals worldwide, which is much larger than a single university, *(ii)* the required technologies, networks, people, and expertise, and *(iii)* the acceptance of the system by those who helped develop it. Therefore, Delft OCW needs to connect with other organizations, utilize existing tools and technologies, and enable individuals to contribute to the project.

From a certain perspective, other educational institutes can be considered competitors, and policymakers may be hesitant to have the TU Delft brand name and website shared with others. The TU Delft intends to be a hub in international knowledge networks, and Delft OCW has to contribute to this objective. Collaboration with other universities and organizations is therefore increasingly important, involving them at an early moment, creating trust relationships and collaborations. The university should propagate openness not only in publishing and sharing its courseware, but in its relations with people and organizations as well.

Involving organizations and people

Because currently Delft OCW is still in a development phase, we should think about how the project can be helped with creating software and OER, and designing the platform.

- **Educational institutes** can contribute in different ways. First of all, their resources (people and money) to create and develop OER (including software) form an important asset. Additionally, involving other educational institutes implies having a much larger network of students, experts, and affiliated organizations.
    - For other universities and schools, the TU Delft, as the initiator, should organize get-togethers, a yearly OER event, and online conferences about the future of the project and other specific subjects, such as technology. These events will create trust relationships, initiate collaboration, inform potential collaborators, and generate new opportunities and knowledge.
    - These events produce a document that describes the processes and basic principles for collaboration with other organizations shows the intent of the university toward collaboration. Another result of the events and get-togethers are agreements about standards, technology, support, etc. and in inter-organizational trust relationships.
    - An OCW Technology Center, with representatives of all participating organizations, will be responsible for the implementation of the future OCW system. This organization needs to search for, and utilize existing and proven technologies, and if necessary, develop new software.
- **OER initiatives.** Delft OCW can collaborate with and learn from OER initiatives in various ways. Specifically for software, the efforts already done by other OER initiatives should be used.
    - Connexions (Rice University) has an interesting initiative that truly allows remixing of content. It has developed a wiki-like environment and a supporting workflow, and has a simple but powerful *"lenses"* concept. Users can easily contribute flexible and granular resources, remix existing content, and repurpose different OER into new collections.

  - Open Learning Initiative (Carnegie Mellon University) is a project that has invested a lot of money in researching and developing high quality OER supporting online education. In addition, quite a significant effort is done in creating a business and revenue model for sharing these resources. Business opportunities include the customization of courses, employment of instructional designers and pedagogues by external parties, subscriptions and services, selling of user statistics and data, and on-demand printing. For similar reasons, the Dutch and British Open Universities can be approached.
  - The Michigan School of Information started an initiative called dScribe[34], where students and teachers collaborate in creation and management of Open Courseware.
  - MERLOT acts as a repository, but also as a space for discipline, workforce development, and partner communities. Another interesting characteristic of the initiative is that it hosts a Virtual Speakers Bureau, through which contributors and member can be employed.
- **Commercial organizations** can be approached not just for funding, but for their specific expertise as well, or to reinforce the Delft OCW brand name, and the network value.
  - Preferred partners of TU Delft (organizations that are closely affiliated with the TU Delft) can be approached about potential collaboration and funding, but it should not remain with just these organizations. There are many innovative companies that can bring value to the initiative (software, expertise, funding).
  - Publishers of educational content may look at the project with Argus' eyes, since it could potentially threaten some of its business activities. It can be an interesting option therefore to consider their involvement in setting up a businesses of selling books online and arranging the on-demand printing business.
  - Online *open innovation* platforms, such as Battle of Concepts, spigit, InnoCentive and FellowForce connect people with ideas and problem.[35] Connecting educational content with real life challenges and issues can engage users, increase contribution of content, and attract business, making it a flourishing learning and business environment.
  - The Delft Valorization Center has lots of expertise about copyright and patents, and insight into unused patents. These patents form an interesting opportunity to create an engaging online learning and business environment. Patents can be combined with OER, and initiate conversations and online communities. In the end, they may even turn into business.
  - In a later stage, an employment platform or marketplace can be created in collaboration with Stud and/or other employment agencies that have affiliations with the university. Interesting alternatives include online freelance agencies as freelance.nl and freep.nl. The OER initiative MERLOT can also serve as an example, since it hosts a Virtual Speakers Bureau (for freelance experts).
- **TU Delft projects**, such as C'MM'N[36], which connects with various companies and institutes, are great opportunities for creating thriving online OCW communities with content, practice, and interaction. Although the future OCW can host community websites, most existing community websites will probably not be transferred to the OCW initiative itself, but through RSS and other technologies both separate websites may utilize the each other's content. More specifically: on OCW there will be content arranged and remixed specifically for C'MM'N, forming a small online C'MM'N group. It also shows the latest activities of the original C'MM'N website. Connecting OCW with separate initiatives will increase attention and engagement for both the OCW and the initiatives. Other possibilities include Nuna, Formula Zero, Tribler, and numerous other interesting projects that have their roots at the university.

- **End-users** (including TU Delft students) form a crucial group of people. A successful second and third layer, meaning the uploading and communication around content requires active involvement of the site's visitors, who are distributed over the internet. Collaboration also means empowering end-users to add content, comment on it, and connect to others. Next to technological issues (previous section), of equal importance are institutional ones. Guiding and supporting the development and sustenance of the OCW project is crucial, and is discussed in the next section.

I recommend the TU Delft to embrace others, from single individuals to large enterprises, and enable them to co-develop and contribute to the project in their way, in their domain, and with their expertise. In 2009 the first official collaborations have to be in place. It will be clear in what way universities, schools, commercial and non-profit organizations, students, and other individuals can contribute to the project. At the same time, the actual co-development of the online environment has to start with a few pilot projects, closely integrated with the research.

6.2.3 Direct, Support, Promote

When students, faculty, and individual end-users have the technology and platform at their disposal to contribute or change materials, connect and communicate, it does not mean that this in fact will happen. It needs to be promoted and supported through tools, and managed and directed with certain protocols and rules. These rules are meant to create spaces for people to collaborate and foster new initiatives, and are not meant to regulate and affect the autonomy of users.

Institutional changes

The research and development of the second and third layer requires a number of policy changes to support important actors, such as students and academics, and involve them in this project. This is crucial, because the future OCW environment and organization is not an extension of their normal practices, and requires a changed mindset of them as well.

- **Governance system.** An overall democratic governance system should be in place that respects internal rules and policies of TU Delft and participating institutions, as well as the wishes and demands of the online OCW community. This governance system describes the rules and policies that help and promote self-organization by individual end-users and participating organizations, including the TU Delft,
- **Carrots and sticks.** Contributors of OER, both internal groups (teachers and students), as external groups (anyone) should be supported and motivated. Specifically for internal groups, incentives for academics can become useful. Carrots include kudos, exposure, tenure, and assigning certain prestigious roles. Employment and assessment criteria can serve as sticks to stress the relevance of openly publishing materials by academics. Publishing OER must become a kind of competitive activity between contributors (both internal and external).
- **Division of labor.** A new division of labor allows experts to focus on expertise, with ample support (faculty support teams) for creating high quality learning materials. It should be clear which privileges, policies and prices apply for supporting internal groups and people, and for supporting external parties (part of business model).
- **Flexible employment.** An employment policy that supports the flexible employment of students, experts and support teams by internal and external parties through Delft OCW can contribute to the sustainability, because it increases motivation for contributors.

Rules for online activities

Since many activities, such as creating new content and software, and approaching potential funders, are adopted in a decentralized fashion, rules and protocols must be in place to manage and control the quality and security of the website, and protect the brand of the university.

- **Online activities.** Changing and adding content, commenting on it and suggesting changes, and overall communication online should not degenerate the TU Delft brand name. Etiquette and protocols can serve to direct online activities, but these should not thwart self-organizing principles. Rules must be developed in collaboration with the parties that have most insight in it, and is related closely to the previous recommendation on collaboration. So for example, protocols, rules and workflow principles for flexible employment need to be developed with online freelance employment agencies. Similarly, the TU Delft can learn about rules and protocols for discussing and contributing resources from initiatives as MERLOT, Connexions, OU's Open Learn Initiative, and Wikipedia.
- **Software.** Clear standards and protocols, plus supportive online documentation and tools, must make sure that new software and applications for Delft OCW are secure and supported, useful, and sustainable.
- **Funds.** Addressing potential funds and organizations by teachers and faculty for sustaining distributed OER communities must be regulated to prevent malpractices and annoyances.

Support users/contributors

Support comes in many forms. It can be physical, for instance helping teachers creating learning materials, or digital, through online documentation. It can also be a combination through online communication on discussion forums or social software. Support is arranged both in a centralized as decentralized way.

- **Physical support and quality maintenance.** The OCW Technology Center (see previous section) has a number of important functions.
    - Not only it controls the basic development and direction of the project's technical architecture, but also provides support to those who need it. This does not necessarily mean having a call-centre, but can also imply answering questions on help forums and creating FAQ-lists and online manuals.
    - The OCW Technology Center also maintains the overall quality. They set the minimum quality level required for the *'official zone'* (materials endorsed/created by OCW members), indicate the do's and don'ts, and rules that apply regarding quality and behavior. In addition, they can remove and block content and people, if necessary.
- **Online support** lowers barriers for creating content and software, using the site, and finding relevant information or people: manuals, help forum, FAQ, etc.
- **Offline support** for teachers and students at participating universities. TU Delft teachers should support and accredit contributions and allow students to contribute to their OCW domain. dScribe (mentioned in 6.2.2) is an interesting model that can be adopted.
- **Professional support teams** (per faculty) offer support for the uploading and improving of educational resources, possibly enhancing them to granular, interactive learning objects. This relates to changes in the division of labor (above, this section).
- **Communities.** Support and guidelines for setting up and cultivating OER-communities are necessary for the emergence of decentralized, self-organizing OCW communities.

Promote and market

Making people do things sometimes involves money, but in many occasions, this instrument is unavailable, or even counterproductive. Informing individuals about possibilities, explaining the added value, and motivating them to do stuff sometimes are much more effective.

- **Marketing programs** (online for every visitor and offline for students and teachers) inform people about the benefits of creating and reusing flexible learning materials. Publishing in open formats (like XML) and using open licensing to enable reuse should be promoted as well as commenting and suggesting changes by the site visitors.
- **Start workshops and events** for interested people from the TU Delft and participating organizations.

6.2.4 Money

With the actual implementation of the new OCW environment, the TU Delft can start deploying business and revenue models. The descriptions about the funding and revenue opportunities form an important asset of this report. During interviews it became clear that policymakers had not thought of Delft OCW as something that could make revenue. They consider *"revenue"* in terms of prestige and attraction toward (international) students and researchers.

Section 0 describes various business opportunities, including marketplaces for ideas, patents, problems, and people, the customization of courses, flexible employment of experts and students, and numerous value added services. The TU Delft has to consider these opportunities, because they not only can create revenues, but increase dedication, engagement, and attraction and prestige as well. Also, a larger and more professional network increases the sustainability and value of the project, and may even improve education. The future Delft OCW allows for many funding and business opportunities, so openness toward business models other than the described ones is an imperative.

Deploy business and funding models

There are different ways to utilize the opportunities of this environment, and in line with the recommendation on collaboration, this should not be done in a solitary way. Making use of the full potential of each opportunity requires a dedicated team of entrepreneurial-minded people, with expertise about the domain they want to link to Delft OCW.

- **Brand name.** Make criteria about the way business and Delft OCW (the NEW environment) can be combined. These criteria must specify in exact terms the brand name TU Delft, and of which elements it is constituted. These criteria may result in rules and protocols for conducting business on the future OCW environment. Since there will be numerous other stakeholders involved, these rules and protocols will change and adapt over time, to represent the organization behind the initiative.
- **DCE.** Involve the Delft Center for Entrepreneurship (DCE) and collaborate with this organization about business models and the potential of Delft OCW. This may result in the involvement of students and organizations in their network for developing and deploying certain business models.
- **Technology.** Many business opportunities may be conveyed through tools available on the website. Interface issues, rules and protocols for plugins, development and support policies, and other related matters must be described and defined in detail by the OCW Technology Center.

- **Domain-specific funding.** Organizations that are active in a certain domain may only be interested in funding the development of OER in their specific domain. Therefore, funding of specific OER domains should be supported by the OCW organization.
- **Funding.** As mentioned, only very innovative projects are eligible for funds from the larger global foundations. The above project, if executed well, will be highly innovative, not just because of its characteristics, but also because of its openness to include innovation from participating organizations and individuals. Requests for funds are offered to the national government and the EU (Lisbon strategy) at an early stage, emphasizing the value of open education, and specifically this initiative.

6.3 Wrapping up the advice

The advice I formulated in this chapter is the result of an analysis of several OER initiatives, literature review, interviews with TU Delft policymakers, and experiences that have been acquired on different conferences and during an extensive online course about *"Open Education"*. Specifically the two latter sources of information inspired me to conduct this research, and formed my view and opinion on the subject matter. Although this opinion has given direction in the search for solutions and opportunities for sustaining Delft OCW, the eventual advice has been substantiated, adapted, and enforced with the opinions and beliefs of TU Delft policymakers. I belief that this document is useful for policymakers of TU Delft, but also for other institutes that consider an open education project. The following illustration shows the advice as it has been described in the previous sections.

Figure 6-1 - Advice for a sustainable Delft OCW

It is crucial that, before anything can be undertaken, or before any investments are made, that the potential of the proposed OCW environment, specifically the second and third layer (described in the project proposal), are recognized by the organization of Delft OCW. In collaboration with EduTec, a

solid strategy for the future of project should be made. This is done by a separate project group which solely focuses on researching and developing the second and third layer. The result of this phase is a clear and comprehensive strategy and proposal for the development of the second and third layer, which forms the basis for the following activities.

With a clear strategy and proposal, Delft OCW can more easily involve organizations and individuals. These can contribute in a variety of ways, including creating materials, managing the site, providing business opportunities and funding, and sharing expertise and resources.

During the first few pilots for the second and third layer, the TU Delft and participating organizations must be able to provide the necessary support and motivate sufficient individuals to contribute and add value to the site. Additionally, rules and protocols must guide and manage the distributed activities of end-users on the site.

In an early stage, the potential business (and funding) opportunities must be considered, concurrently with the development of the future OCW system, so it will be able to exploit these ancillary markets.

Epilogue

Kevin Kelly already said it in the '90s: Follow the Free. (Kelly, 1997) His book describes how free content and services form a basic characteristic of Internet economies. Open Courseware, and in a broader sense, Open Educational Resources, are typical products of this free Internet culture. Giving away assets, content, and services does not mean giving away business. On the contrary, it means generating business and innovation. Many OER initiatives, including Delft OCW, are involved in giving away content, but have not yet figured out how to sustain the development and publishing of free and reusable content over time. Projects with beautiful intentions therefore might disappear or get lost in the ever-expanding information space, and large investments might go up in smoke. During the research on the future of Delft OCW, to me it became abundantly clear to me that it holds enormous potential that can cause great educational and financial benefits for the university, her students, teachers and researchers, her whole network of commercial and non-profit organizations, and many interested individuals worldwide. It can also significantly contribute to the overall purpose of the university, which is to play an important role in solving major scientific and technological challenges from the perspective of sustainability. By sharing her state-of-the-art research and education, the university profiles herself on the world map of knowledge institutes, and by offering a platform where current issues can be discussed and people can connect, she will create a place where people continually find new and valuable information and people.

The emphasis in this report was on researching the future of Delft OCW and defining the second and third layer, which allow individuals to add content, comment and discuss, and connect with each other. The ideas and perspectives on the future of Delft OCW, propagated in this report, have not come out of the blue, but are clearly in line with issues and trends that have emerged in our interconnected society. Instead of looking at my own position as a student or researcher in my university, I have looked at society and learned from its dynamics and successes. I have seen that communication (third layer), which ultimately is what the digital technology and media are all about, determines the socio-economic success and sustainability in it. This has been underlined by both the IT and education experts I interviewed. Communication happens in complex and dynamic networks, and therefore we must understand the logic of networks to be able to set out a clear direction for the future of Delft OCW. In January this year (2008), with the TU Delft 166th Dies Natalis, Charles Vest said that technological change supersedes social change and that technology changes culture, economies, and education. (Vest, 2008) We should therefore listen to the technology, and try to understand what it is telling us.

I hope this report makes clear that Delft OCW in the current state is not listening to technology, and hence, does not listen to society. Success of this project, and its sustainability, will eventually depend on the value it creates for society. This value flows from the opportunities, known and not known, offered in open systems. Charles Vest, in his speech about the university of the future (Vest, 2008) mentioned new innovation and organizational models, and specifically the open innovation models adopted by many organizations, such as IBM. He also described the meta-university, being part of global knowledge networks. The university must see openness as an instrument that enables her to form and be part of as many knowledge networks as possible. The more systems and networks that interact and participate, the more value can be acquired by the university.

Higher connectedness will cause more opportunities for use, but also for misuse, mentioned a few times by the interviewed actors. Still, this fear should not cancel out the numerous future opportunities for Delft OCW. There are great benefits in exploring and exploiting the power of decentralized and autonomous networks, but complete recapitulation to the bottom is not what it is about. Clear coordination and governance structures must guide the activities online, specifically when options are abundant. Another criterion is to move technology to invisibility, enabling end-users of all kinds to contribute without friction caused by technology.

Invest in the future, not in the past.

Works Cited

Anderson, C. (2006). *The Long Tail: How Endless Choice is Creating Unlimited Demand.* London: Random House.

Atkins, D. E., Brown, J. S., & Hammond, A. L. (2007). *A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities.* William and Flora Hewlett Foundation.

Benkler, Y. (2005). Common Wisdom: Peer Production of Educational Materials. In D. Wiley (Ed.), *Advancing the Effectiveness and Sustainability of Open Education at the 17th Annual Instructional Technology Institute.* The Center for Open and Sustainable Learning (Utah State University).

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom.* New Haven: Yale University Press.

Chatti, M. A., Jarke, M., & Frosch-Wilke, D. (2007). The future of e-learning: a shift to knowledge networking and social software. *International Journal of Knowledge and Learning , 3* (4-5), 404-420.

d'Oliveira, C. (2006). *OCW Publication Formats: User Needs and Future Directions (Draft Working Document).* Draft working document for discussion purposes, Massachusetts Institute of Technology, MIT OCW, Boston.

de Moel, P. (2007, April 3). TU Delft OpenER: Actor analysis (DRAFT). Delft.

Delft University of Technology. (2007). *Delft Open Educational Resources: Project proposal for the pilot phase for the open publication of educational materials of the TU Delft.* Delft: Delft University of Technology.

Denzin, N. (1978). *Sociological Methods: A Sourcebook (2nd ed.).* New York: McGraw-Hill.

Dholakia, U. M., King, W. J., & Baraniuk, R. (2006, May). *What Makes an Open Education Program Sustainable? The Case of Connexions.* Retrieved September 3, 2007, from Organization for Economic Co-operation and Development: www.oecd.org/dataoecd/3/6/36781781.pdf

Downes, S. (2005, October 17). E-learning 2.0. *eLearn Magazine* .

Downes, S. (2007). Models for Sustainable Open Educational Resources. (A. Koohang, Ed.) *Interdisciplinary Journal of Knowledge and Learning Objects , 3*.

Enserink, B., Koppenjan, J. F., Thissen, W. A., Kamps, D., & Bekebrede, G. (2003). *Analyse van Complexe Omgevingen (reader spm2110).* Delft: Faculteit Techniek, Bestuur en Management (TU Delft).

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry , 12* (2), 219-245.

Foote, T. (2005). *Wikipedia (Presentation at 2005 Open Education Conference).* Retrieved April 10, 2007, from Centre of Open and Sustainable Learning (COSL): http://cosl.usu.edu/media/presentations/opened2005/OpenEd2005-Foote.ppt

Fox, S., & Manduca, C. A. (2005). *Open education for educators: An example from the geosciences (presentation at OpenED conference, Utah: 2005).* Retrieved April 10, 2007, from Centre for Open and Sustainable Learning: http://cosl.usu.edu/media/presentations/opened2005/OpenEd2005-Fox.ppt

Geser, G. (2007). *Open Educational Practices and Resources, OLCOS Roadmap 2012.* Open e-Learning Content Observatory Services (OLCOS).

Giles, J. (2005, December 14). Internet encyclopaedias go head to head. *Nature* .

Goldberg, C. (2001, April 4). Auditing Classes at M.I.T., on the Web and Free. *New York Times* .

Hanf, K., & Scharpf, F. (1978). *Interorganisational Policy Making.* London: Sage.

Hargroves, K., & Smith, M. H. (2005). *The Natural Advantage of Nations (Vol. I): Business Opportunities, Innovation and Governance in the 21st Century.* London: Earthscan/James&James.

Horton, D. (2005, December 2). *How to get people to work for free.* Retrieved April 14, 2007, from Free Software Magazine: www.freesoftwaremagazine.com/articles/recruting_people

Howe, J. (2006). The Rise of Crowdsourcing. *Wired* (14).

Hýlen, J. (2007). *Giving Knowledge for Free: The Emergence of Open Educational Resources.* Paris: OECD-CERI.

Johnstone, S. M. (2005). Open Educational Resources Serve the World. *Educause Quarterly Review , 28* (3).

Kansa, E., & Ashley, M. (2005). *Embedding Open Content in Instruction and Research (presentation at OpenED conference, Utah: 2005).* Retrieved April 10, 2007, from Centre for Open and Sustainable Learning: http://cosl.usu.edu/media/presentations/opened2005/OpenEd2005-Kansa.ppt

Keeley, B. (2007). *Human Capital; How what you know shapes your life.* Paris: OECD.

Keen, A. (2007). *The Cult of the Amateur.* New York: Doubleday Business.

Kelly, K. (1997). *New Rules for the New Economy: Ten Radical Strategies for a Connected World.* New York: Penguin.

Kok, W. (2004). *Facing The Challenge; The Lisbon strategy for growth and employment.* Office for Official Publications of the European Communities.

Koohang, A., & Harman, K. (2007). Advancing Sustainability of Open Educational Resources. *Issues in Informing Science and Information Technology* , 535-544.

Larsen, K., & Vincent-Lancrin, S. (2006). The impact of ICT on tertiary education: advances and promises. In B. Kahin, & D. (. Foray, *Advancing Knowledge and the Knowledge Economy* (pp. 151-168). Boston: MIT Press.

McAndrew, P. (2007, October). personal communication.

McHenry, R. (2005, December 14). *The Faith-Based Encyclopedia.* Retrieved February 18, 2008, from Tech Central Station: http://tcsdaily.com/article.aspx?id=121305E

Ripamonti, L. A., De Cindio, F., & Benassi, M. (2005). Online communities sustainability: Some economic issues. *The Journal of Community Informatics , 1* (2).

Schmidt, J. P., & Surman, M. (2007, September 2). *Open sourcing education: Learning and wisdom from iSummit 2007.* Retrieved December 28, 2007, from iCommons.org: http://icommons.org/resources/open-sourcing-education-learning-and-wisdom-from-isummit-2007

Scholz, R., & Tietje, O. (2002). *Embedded Case Study Methods: Integrating Quantitative and Qualitative Knowledge.* Thousand Oaks: Sage.

Siemens, G. (2006). *Knowing Knowledge.* online: Lulu.com.

SitePoint. (2003, January 2). *How To Turn Lurkers Into Posters.* Retrieved January 18, 2008, from SitePoint: http://www.sitepoint.com/print/turn-lurkers-posters

Sjoer, E. (2007). *Evaluation proposal Delft OCW.* Delft.

Soy, S. K. (1997). *The Case Study as a Research Method.* Retrieved June 18, 2007, from University of Texas at Austin: http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm

Stacey, P., & Rominger, R. (2006). A Dialogue on Open Educational Resources (OER) and Social Authoring Models. *OpenEd Conference.* Logan: Utah State University.

Tapscott, D., & Williams, A. D. (2006). *Wikinomics: How Mass Collaboration Changes Everything.* New York: Penguin.

Thille, C., & Lovett, M. (2007). Open Learning Initiative: measuring the effectiveness of OLI statistics course in accelerating learning. *OpenLearn: Researching open content in education* (pp. 74-76). Milton Keynes: OU.

TU Delft (a). (2007). *Delft Open Educational Resources: Project proposal for the pilot phase for the open publication of educational materials of the TU Delft.* Delft: Delft University of Technology.

TU Delft (b). (2007). *Instellingsplan 2007-2010.* Delft: TU Delft.

Tuomi, I. (2007). Learning in the Age of Networked Intelligence. *European Journal of Education , 42* (2), 235-254.

Tuomi, I. (2006). *Open Educational Resources: What they are and why do they matter.* Paris: OECD-CERI.

Vest, C. M. (2008, January 11). The University of Tomorrow: Innovation, Competition, and Cooperation in the Knowledge Age. *presentation at 166th Dies Natalis TU Delft* . Delft, the Netherlands.

Walker, E. (2005, September 28). *A Reality Check for Open Education (presentation at OpenED conference, Utah: 2005).* Retrieved April 19, 2007, from Centre for Open and Sustainable Learning: http://cosl.usu.edu/media/presentations/opened2005/OpenEd2005-WalkerEd.ppt

Walton, J. (1992). Making the Theoretical Case. In C. C. Ragin, & H. S. Becker, *What is a Case? Exploring the Foundations of Social Inquiry* (pp. 121-137). Cambridge, UK: Cambridge University Press.

Wiley, D. (2007). *On the Sustainability of Open Educational Resource Initiatives in Higher Education.* Paris: OECD-CERI.

Wiley, D. (upcoming). The Learning Objects Literature . In D. Wiley.

Wiley, D. (2005). *Thoughts from the Hewlett Open Ed Grantees Meeting Utah*. Retrieved June 13, 2007, from Iterating towards Openness: http://opencontent.org/blog/archives/192

World Commission on Environment and Development. (1987). *Our Commons Future (Brundtland Report).* Oxford: Oxford University Press.

Yin, R. K. (2002). *Case Study Research: Design and Methods (3rd edition).* Thousand Oaks: Sage Publications.

Links to websites

[1] http://ocw.mit.edu
[2] http://olpc.org
[3] http://wikipedia.org
[4] http://web.mit.edu/newsoffice/2001/ocw.html
[5] http://www.creativecommons.com
[6] http://www.hewlett.org/Programs/Education/OER/
[7] http://ocw.tudelft.nl
[8] http://overfishing.org/
[9] http://cnx.org (Rice University)
[10] http://merlot.org
[11] http://ocw.usu.edu/
[12] http://openlearn.open.ac.uk/
[13] http://labspace.open.ac.uk/
[14] http://nosignificantdifference.org
[15] http://openlearn.open.ac.uk/course/view.php?id=3416&topic=all
[16] http://www.hewlett.org/Programs/Education/OER/openEdResources.htm
[17] http://sakai.org/
[18] http://www.redhat.com/ & http://www.opensuse.org/
[19] I: http://ocw.mit.edu & http://ocw.usu.edu; II: http://openlearn.open.ac.uk, http://www.cmu.edu/oli & http://www.courserepository.org; III: http://cnx.org, http://labspace.open.ac.uk, http://oercommons.org, http://curriki.org & http://merlot.org
[20] http://mit.ols.usu.edu/
[21] http://www.unionlearn.org.uk/initiatives/learn-1029-f0.cfm
[22] http://labspace.open.ac.uk/course/view.php?id=2398 (more info about remix/reuse can be found here)
[23] http://cnx.org/help/ipfaq
[24] http://curriki.org/
[25] http://oercommons.org/
[26] http://merlot.org/
[27] http://ocw.tudelft.nl/about-opener/opener-team/
[28] http://www.minocw.nl/english/education/363/Higher-education.html
[29] http://www.utwente.nl/ & http://w3.tue.nl/en/
[30] http://db.intersek.ntnu.no/athens/partners
[31] 3 Universities of Technology in the Netherlands: http://www.3tu.nl
[32] http://www.readwriteweb.com/archives/crowdsourcing_million_heads.php
[33] http://tinyurl.com/yqufed
[34] http://ocwblog.org/?p=30
[35] http://battleofconcepts.com/, http://spigit.com/, http://innocentive.com/, http://fellowforce.com/
[36] http://www.cmmn.org/

The Future of Delft Open Courseware – Appendices

Appendix A – Creative Commons

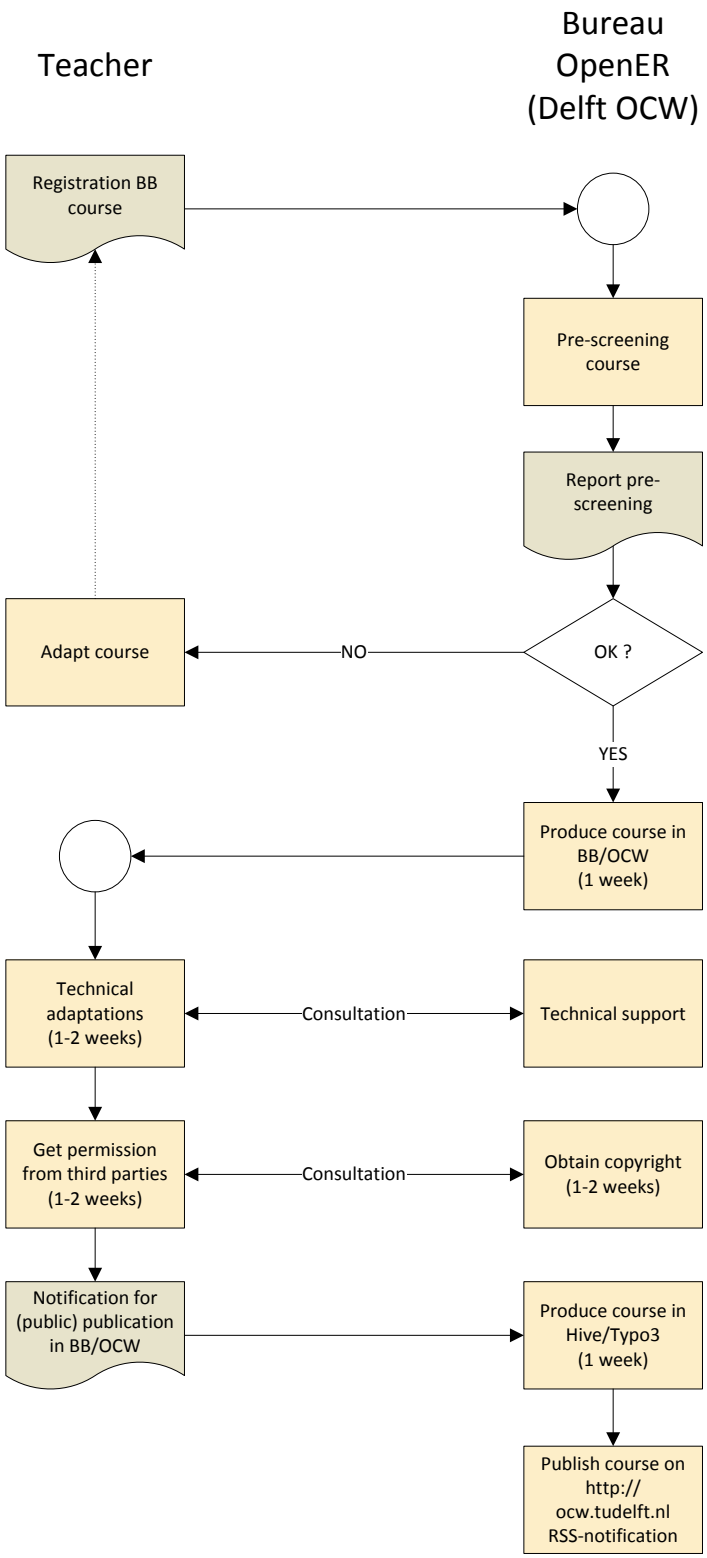
Copyright is an apparently simple right to get or have: the origin of the work has to be in the author holding the copyright. They apply for literary works, computer programs, artistic products (such as music and drawings), and games. The rights related to copyright concern reproduction (also of derivative works), production and distribution of copies, and the performance and display of the work publicly. Moral rights include attribution and integrity.

The copyright spectrum is demarcated by the public domain (total openness) on one side, and copyright (total restriction) on the other. In between there are many licenses with different levels of openness.

Creative Commons provides a set of licenses on their website and clear documentation and software to use them. Anyone can add an open license to his or her creation, allowing creators of content to exert different levels of freedom. The most relevant options are:

- **Attribution (By).** You let others copy, distribute, display, and perform your copyrighted work — and derivative works based upon it — but only if they give credit the way you request.
- **Noncommercial (NC).** You let others copy, distribute, display, and perform your work — and derivative works based upon it — but for noncommercial purposes only
- **No Derivative Works (ND).** You let others copy, distribute, display, and perform only verbatim copies of your work, not derivative works based upon it.
- **Share Alike (SA).** You allow others to distribute derivative works only under a license identical to the license that governs your work.

Appendix B – Workflow Delft OCW (first layer)



Appendix C – Education and Student Affairs

Education and Student Affairs is considered the problem owner in this research, because the department is has the main responsibility for financing and scaling of Delft OCW. Anka Mulder and Joost Groot Kormelink both hold important positions in the steering committee and project group. Anka Mulder is the Director of ESA, and holds a position in the steering committee. Joost Groot Kormelink is ESA staff member, responsible for ICT in education and consultations with the Association of Universities in the Netherlands (VSNU).[1] He holds positions in the project team, as project manager Organization and Finance, and is the project team representative in the steering committee.

ESA constitutes of four main sections.

- Staff ESA consists of director, staff members, and secretary office. Furthermore, it is responsible for the website and brochures.
- The international office advises faculties on admissions, mediates in applications for housing, visas and residence permits, helps out with banking and insurance, and provides the necessary support for exchange programs. In addition, the International Office provides extensive information on universities abroad, as well as scholarships/grants, funds and other useful tips for studying abroad.
- The Shared Service Centre (SSC) is responsible for the education-related administrative support for all TU Delft study programs.
- Student and Staff facilities include Student & Career Support; FOCUS Centre of Expertise in Education; Connection with Secondary Education; CICAT Management Centre for International Cooperation; Ombudsman; Sports and Cultural Centre.

[1] http://www.tudelft.nl/live/pagina.jsp?id=c7be0ccf-612c-46dd-9d55-69494200958d&lang=en

Appendix D – Actor & Network analysis

The table below shows the analysis of the criticality of actors toward the sustainability of Delft OCW.

Actor	Resources	Exchange-able	Dependence	Critical
Steering Committee	Authority over strategic decisions, financial resources, contacts.	No	Ideas and decision must be approved by the steering committee. Although they have not a day-to-day involvement with the project, they are responsible for strategic decisions.	Yes
Project Team	Implementation and some strategic decisions, technical and organizational know-how, financial and human resources, information.	No	The project team has enormous power over the decisions made. They possess knowledge, information, and other resources that allow them to take decisions rather autonomously.	Yes
Participating academics (during pilot phase)	Expertise, human resources.	Yes	Although the academics are important during the start of the project, they are not the only ones in the university.	No
Students (3TU, international)	Time, expertise, human resources.	A single student is exchangeable, as a group they are not.	The sustainability of Delft OCW will depend on students worldwide. Their voluntary efforts will form one of the most important foundations for sustainability.	Yes
Academics (teachers, Ph.D. students, researchers)	Expertise, human resources, contacts.	As with the student, as a group they are irreplaceable.	At least for the coming years, the creation and uploading of new resources depends largely on academics.	Yes
Commercial organizations	Expertise, financial resources.	Yes	Companies can provide funding and expertise. Possibilities exist to involve companies for sustaining Delft OCW.	Medium
Commercial organizations (publishing industry)	Legal procedures, expertise, human resources, contacts.	Somewhat; more research is published openly (Open Access)	In case the publishing industry possesses a lot of the content that is supposed to be published, their influence can be rather high. Still, with more and more projects opening up education (including books, articles), their position becomes weaker.	No
Not-for-profit organizations (i.e. research institutes, foundations)	Financial resources, expertise.	Yes	Foundations and research institutes can both contribute knowledge and money to sustain Delft OCW. Still, their contributions are not of primary concern.	No
Educational institutes (3TU, ATHENS, etc.)	Financial resources, human resources, expertise, network/contacts,	Medium	The sustainability of the project will depend to a large degree on the willingness and quality of collaboration with other universities.	Yes
Government	Financial resources, legislation.	No	Although the government can be important, the project is set up without considering their input. They may not be so important.	No

Appendix E – Interview questions

This appendix describes all the interview questions, and at the same time it forms an overview of the main research issues. The different interviews vary only slightly between each other, so the choice has been made to append only one list of questions. The results of the interviews, and the differences amongst them, are explained in the main text.

The interviews are divided into different components. These components (Organization, Motivation, Types of Resources, Types of End-user Reuse, and Foundation/Revenue Model) are derived from literature and deal with different aspects of sustainability in OER-projects. This has been explained in the main text, chapter 3. The interviews were done in the following order:

- Wim Veen (education expert, professor in Education and Technology, TU Delft)
- Jacob Fokkema and Paul Rullmann (members Executive Board, TU Delft)
- Cock Huizer and Willem van Valkenburg (IT Department, TU Delft)
- Anka Mulder and Joost Groot Kormelink (Education and Student Affairs, TU Delft)

The results of earlier interviews have been used in following interviews, and the amount and focus of the questions have been altered slightly depending on the subject being interviewed. Below, only one set of interview questions is shown, because most questions remained the same for all interviewees. For all interviews, a period of 7 years is taken as a default for describing the future.

E.1 Introduction: sustainability

To start of, a short conversation is conducted about the concept sustainability, and discussing the three-layer model that is described in the project proposal.

1. How would you define sustainability of Open Educational Resources?
2. Could you just shortly point out what your ideas are considering the second and the third layer, mentioned in the project proposal, also known as the lab-environment?

E.2 OCW Objectives

This part is about the future of Open Educational Resources, and specifically creating a view on the future of Delft OCW and the direction it should go and what kind of learning it should support. The result shows the differences between the current short term objectives and the specific long term objectives of the lab-environment and its place in the future of learning.

3. What are the long-term objectives of Delft OCW?
4. How can the lab-environment contribute to sustaining and attaining these objectives?
    - What does that mean for the functionalities of the lab-environment, what should it enable/do? What are specific goals for this part of the system?

E.3 Organization

The organization factor concerns the level of decentralization of different activities needed to sustain the environment (e.g. creating content, support, quality maintenance, etc).

- Clarity about the activities done in this lab-environment, and by whom/level of decentralization;
- support for these activities (people/tools) and quality maintenance; and
- some ideas on how this environment looks like.

5. Regarding the lab-environment, what activities, roles and responsibilities do you distinguish? Please specify in as much detail as possible, and emphasize the level of decentralization and involvement of students.
   - Activities (What?)
   - Roles & Responsibilities (Who?)
6. Could you define possible difficulties and opportunities?
7. How can these be addressed?

E.4 Motivation

Related to the level of decentralization and peer production is motivation: the more decentralized an initiative is set up, the more an initiative depends on voluntary efforts, the more important intrinsic motivation becomes. The previous section determined the how and by whom activities are done, and this section will explain why these people will do it.

8. For which of the mentioned activities in the lab-environment is intrinsic motivation the key issue?
   - What is needed to make this happen, technically and institutionally? (communities, etc.)
   - Does the lab-environment increase motivation? If so, why?

E.5 Types of resources

There are many different types of resources. Differences are in the level of Instructional Design, the media (simulation, multimedia, html, XML, etc.), internal vs. external resources. This section will discuss the differences of these resources, and their place in the lab-environment. It is also important to know how the resources are part of the environment.

9. What will be the role of OER in the primary process of the TU Delft in 7 years?
   - What about the integration of the LMS and OER-environment?
   - What is the role of classroom teaching and courseware at the university in 7 years?
   - How do OER relate to the upcoming trend of personalized and lifelong learning?
10. What could you say about the types of resources for the future lab-environment?
    - Instructional design or teaching resources (e-learning)
    - Internal and external resources (quality, recognition)
    - Type of media and flexibility resources (remixing)
    - What implications does this have for TU-policy?
11. How will the current implementation be integrated with the future lab-environment?
    - How will the change occur?

- What problems and obstacles do you distinguish in realizing this change?

E.6 Types of end-user reuse

The type of end-user reuse concerns the way the offered materials will be reused. In most cases of adaptation of resources it is explicitly necessary to have access to the source code, but publishing in a flexible format usually is more difficult and expensive, as explained in the previous component. Most users will not be highly technical, so helping them by connecting them to the right tools (such as WYSIWYG editors rather than raw XML or HTML) could enhance reuse. Besides tools, physical support can be considered as well, although this may be costly. Support can be organized centrally, or, more cheaply, in a decentralized fashion in a network of volunteers, although this may be less reliable.

12. Who are relevant end-users of the lab-environment?
    - What is the value proposition for each of them?
13. What are the most relevant types of end-user reuse?
    - What are the most important factors for enabling these kinds of reuse?
    - How will this reuse be supported?
14. What are the implications of Web 2.0 on learning, specifically in relation to OER?
    - Do you have any idea how tools and technologies that enable easier production, assembly, and evaluation of resources be used within the lab-environment?

E.7 Funding model

Besides normal funding, there can be a number of other sources for money to sustain the environment. Different models are described in literature, and the possibilities for Delft OCW are discussed.

15. **Endowment/foundation/donation model.** It might be interesting for companies to provide financial support, or collaborate in the production of resources or software. The name and brand of the university might be hurt when there is too much commercialization, but where to draw the line?
    - How can the lab environment make use of sponsorship or advertisement opportunities?
    - Companies that are engaged in the same domain as a specific department could benefit from high quality educational resources. Under which circumstances would they be willing or interested in donating money to support the production of high quality OER?
16. **Segmentation model.** VA services, such as Rent-An-Expert, Rent-A-Student. Other possibilities are on demand courseware, learning objects, training for lifelong learners (special options for distance and lifelong learners), and print on demand.
    - What are potential value added services that can be offered within the OER environment?
    - Will contributors be more willing to put effort in making and improving OER, or helping other people, if this leads to exposure and employment opportunities?
17. **Contributor-Pay model.** A model used for publishing articles, where the contributor pays for the costs of a direct publication within an online repository. This idea can be applied to challenges, case studies, or assignments (by companies) as well. A company provides an educational resource (such as the examples above), and pays for the audience, and possibly subject of course.
    - Under which circumstances would companies be willing to pay money for post a case study or

assignment (where they serve as the subject of the case study) within a course? Or develop a case study in cooperation with a company?
- Under what circumstances would companies be willing to contribute challenges or assignments for students?
- Under which circumstances would teachers be willing to include high quality and educational challenges or assignments made by companies in their courseware?

18. **Replacement model.** There are some criticisms on Blackboard as a learning environment. With those in mind, and the needs and wants of the future lab-environment, the usefulness of the environment remains at least to be questioned. It would be interesting to know some details about the usefulness of BB for OER, its usefulness in general in the future learning landscape of the university, and the difficulties of replacing or changing the environment.
    - What are the most important criteria on the online environment of lab environment? (*needs*)
    - What functionalities would you like to see represented in the lab environment as well? (*wants*)
    - Do you think Blackboard will be able to do this in 7 years time? Why (not)?
    - If they are not possible to do this, there are two possibilities: change the OER objectives or replace BB with an environment that is built to do the things needed. What are the most important consequences for both choices?
    - Should the choice of platform depend on the openness of the code itself? (open source)
19. **Sponsorship/advertisement model.** The free access to resources involves a marketing strategy. *"Free"* radio and television is an example, but in several OER initiatives the commercialization is much less explicit.
    - What are the possibilities for advertisement and sponsorship of courses or the whole project?
20. **Partnerships and Exchanges.** Ideas on how organizations and other universities will contribute to the project, how they will be involved.
    - Is collaboration between universities or the development of the lab-environment by and for more universities desired?
    - How can other universities and organizations contribute to the project's sustainability?
    - What are the greatest barriers for collaboration and a shared space for educational resources?

E.8 Final considerations

In this final section we finalize the interview with a few important generic questions about the most important factors that influence the probability of implementation of this environment.

21. SWOT analysis lab-environment: Considering the objectives stated,
    - What are the most important opportunities and threats for this lab environment? (external)
    - What are the most relevant strengths and weaknesses for this lab environment? (internal)
22. What are the implications of OER on learning at the TU Delft?
    - What criteria do these ideas impose on the OER environment, and on the form and function of OER?
23. How will the project ideally look like in 7 years? What are the most important factors influencing the outcome?

Appendix F – Synthesis of results about the component "Organization"

In the description of the initiatives, we have seen different activities that relate to the organization of an OER-initiative. These are described in the overview below.

Creating and managing OER	Reviewing & Quality management	Support
• Centralized/top-down • Centralized/networked • Decentralized/bottom-up	• Centralized/Pre-publication • Decentralized/Post-publication	• Centralized/physical • Decentralized/tutorials, tools, help forum

Figure 1 – Initiatives: Organization activities and options

To make these activities work, specifically in case of decentralization, a number of tools are implemented, and some institutional issues apply. These are depicted in the following scheme.

Tools & Technologies	Institutional issues
• Online authoring/wiki tools • Learning objects assembly tools (portfolio, tagging, learning journals) • Quality tools (lenses concept, rating) • Communication & Community tools (forums, IM, Flash-meeting, workgroups)	• Review protocols • Status & profiling

Figure 2 – Initiatives: Tools & Institutional issues

From the interviews, the following factors emerged as being crucial to consider.

Creating, linking to, managing, and arranging OER	Reviewing & Quality management	Support
• Decentralization enables the creation of knowledge networks. • Social interactions and the quality of connectivity between users are crucial. • Research and education are more intertwined. • Linking to and embedding existing networks and communities. • Control of teachers and experts still crucial.	• TU-brand should be visible. • TU reputation may not degenerate.	• Centralized support for experts. • Pedagogical and technical support. • Online support

Figure 3 – Interviews: Organization activities and options

The above has a number of institutional and technical consequences, expressed below.

Tools & Technologies	Institutional issues
• Existing technologies rather than building new technologies. • Marketplace for ideas and problems (intertwinement research and education). • Labeling or quality system (brand/reputation). • Metadata is automatically generated. • Open APIs and RSS (using external information).	• Division of labor will change: experts on content, support for creating high quality learning materials. • Formats and protocols are necessary for quality and homogeneity of the website and its content. • Marketing should inform teachers and experts about the positive aspects of decentralization.

Figure 4 – Interviews: Tools & Institutional issues

This wraps up the findings of the research on the component *"Organization"*.

Appendix G – Strategic steps of WikiEducator

Creating a viable strategy and vision for sustaining Delft OCW is very important, we have seen. Although this is a whole new research in itself, I have included a description of the strategy of WikiEducator. WikiEducator is a community project working collaboratively online toward a free version of the education curriculum by 2015.[2] This initiative has been included, because it resembles Delft OCW in a number of aspects.

- **Creating OER.** Creating educational content. Both projects aim for publishing and creating content for (formal and informal) educational purposes. The difference is that WikiEducator aims for providing a free version of the education curriculum by 2015, which is different from publishing educational materials created at the TU Delft. On the other hand, Delft University of Technology will try to tap into the wisdom of crowds in creating new and adaptive OER, like WikiEducator.
- **Importance of communities.** Secondly, both initiatives aim for the establishment of community networks and collaboration with other free content initiatives;
- **Technologies.** Fostering and developing technologies that support the mentioned objectives is a similarity between the projects as well.

The most important aspect that the initiatives have in common is the fact that they both need the efforts of many, distributed around the world in communities and loosely-joined networks, to sustain the project. Since the strategy described by WikiEducator specifically aims for this, it is highly relevant for the TU Delft. Realizing the vision of WikiEducator involves building a strong, global, thriving community. The strategy, depicted in the illustration below, focuses on:

- Building capacity and skills of the community to engage meaningfully in the mass-collaboration required for the design and development of high quality learning resources.
- Developing tutorials and tools to support the development of open communities and free content developers so that resources can be reused in multiple contexts.
- Fostering connections through virtual networks, ecosystems and smart implementation of free software solutions. Communities, technology think tank meetings and strategic relationships with similar communities and initiatives contribute to this.

Delft OCW must, like WikiEducator, build capacity and skills of the community, but this implicitly means another criterion: *the existence of a Delft OCW community*. This community, consisting of numerous global knowledge networks, needs to grow and be cultivated with tools, technologies, and support, online and offline. In the advice, this is described in more detail. In addition, online support will sustain the development of these communities and reuse of OER. Finally, the third element

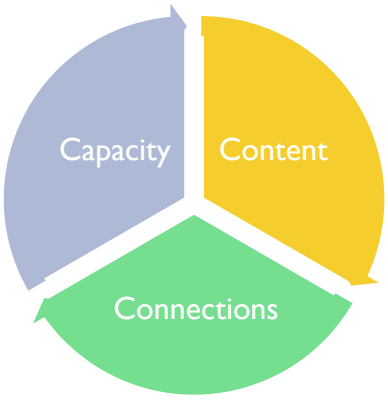


Figure 5 – Strategy WikiEducator

[2] http://www.wikieducator.org/WikiEducator:About

addresses the importance of fostering connections between individuals, organizations, and communities. Communication and connections between users on a practical level is essential, but just as significant are the strategic relationships with organizations and other projects and initiatives. How these elements can are addressed by WikiEducator, can be read in below.

Phase 1: Establishing foundations. During this phase technologies and processes are set up to facilitate community development. Delft OCW currently focuses on publishing content online, and has not reached this phase yet. This can be explained from the fact that the community layer (third layer) builds on top of the first two layers. Although Delft OCW has not yet published many OER, and is focused on improving the workflow processes for the first layer, it is clever to look forward at this step. WikiEducator approaches it as follows:

- Capacity, both technology and information resources, is built for participation and supporting the creation of OER;
- through self-organization and decentralization, allowing the community to determine the kinds of projects, structures and communication mechanisms for WikiEducator;
- establishing a democratic governance model from the community for WikiEducator;
- collaborative and democratic development of community policies that support and promote the values of the WikiEducator community;
- strategic relationships networking to ensure the right connections for a sustainable community.

Phase 2: Scaling up free content development. Using the foundations that were established in phase 1, now the emphasis is on creating and improving the online content rapidly. This can be realized through ongoing community development, accentuating scalable capacity development. This means starting projects and building tools and manuals that support or increase the quality or adoption of open education. Examples are defining pathways for users and contributors, setting up a one stop portal for communities, describing skills necessary for fulfilling certain roles and conducting certain activities, guidelines for designing and developing learning content, implementing quality assurance mechanisms, generating a fund raising strategy, setting up and fostering national and regional initiatives that contribute to the project, and updating and improving existing technologies and free software solutions to scale up the rate of OER production.

There are many similarities between these strategic steps and the advice formulated in the project.

Phase 3: Sustainable implementation of free content in education. This final step regards using the contributions in mainstream educational activities (not just informal). For Delft OCW this means that the content that is created online in a decentralized fashion will be used in education. This requires adoption of teachers and students, who, in a possibly intertwined process, will decide on using the best available content online. In the main advice, this is described as well.

Appendix H – Technology, Tools & Formats

The success of Delft OCW, as has been portrayed in this report, will depend to a high extent on the used and offered technology and tools. Almost all of the discussed possibilities to make Delft OCW sustainable should be made possible through the implementation of various technologies, both on the front-end, as the back-end. It all has to lead to an online environment where people can easily contribute content, connect with the right people, find relevant information, and form communities. It also has to make other things possible, such as applying some of the mentioned business opportunities and offering value added services. The sections below explicate different technologies and tools, and describe the value of such technologies.

> *Listen to the technology, and find out what it is telling you.*
>
> Carver Mead

H.1 Users and usage

User information and usage statistics relate to finding relevant people and content, is important for motivation of contributors, personalization, and quality, and overall sustainability.

- Profiling system that securely stores and updates user and usage data and statistics for personalization and online identification. It has to allow different privacy levels and roles, and should be searchable.
- Transparent usage statistics for original authors, because it increases motivation. Automatic metadata software creates and adds data to OER about usage & popularity, content & category, and relevant content and people.
- A rich array of useful functionalities empowers users to personalize the site, participate, and contribute. External technologies must be used as much as possible.
- Delft OCW has to be both inwardly open as outwardly. This means that it allows and utilizes external information sources and applications, but lets information, content, and tools flow out of the system as well, to be reused elsewhere.

H.2 Creating OER

There will be no reason to visit Delft OCW if there is no valuable and relevant content on the site. Creating high quality learning resources, authoring OER online, adding, uploading and linking to materials is one of the basic activities users/contributors will have to do.

- A format for creating new high quality learning resources that indicates and defines criteria and standards about technology, pedagogy, and setup. This should be maintained and supported by support teams. (centralized)
- Authoring tools (and relevant format & workflow) that direct and support online creation of fine-grained, modular and adaptable OER in a flexible format. Focus on making the tasks that are organized in a decentralized manner as small and automated as possible. (decentralized)
- Customizable licenses with sufficient online documentation let users choose the level of openness.
- Linking and uploading tools to enable anyone to contribute links or upload materials. A format must ensure homogeneity and comparability.

- A shared repository and integrated workflow allows teachers to add materials from Delft OCW to Blackboard, and vice versa.
- Tools for making custom sharable collections (or courses). Again, a format is important, so the collections can be compared and searched. This should be connected with the profiling software.
- An *"ideagora"* is a kind of (online) marketplace for connecting ideas with solutions, and vice versa. These challenges can both serve as educational content and source of revenue. The latter can be explained from the perspective of offering value for those that pitch challenges (such as companies), and those that have solutions (for example students, experts). Solutions can also come from the mountain of unused patents.

H.3 Quality maintenance

Quality, with good reason, is considered a basic principle of Delft OCW. If quality is low, not only will the site become unsustainable, but additionally harm the strong brand name of the university. Through technology and tools, but also through policies and protocols, quality must be guaranteed.

- Software that allows resources to be seen from a certain quality lens. These lenses are set up and controlled by individuals and organizations. A *"TU Delft lens"*, controlled by the university and its teachers, guarantees a certain quality, meanwhile a *"Math lens"* shows all results about Mathematics. Combining these lenses shows high quality Math OER.
- Quality maintenance tools that allow decentralized control over the quality of OER. This concerns tagging, rating and adding metadata to OER, but also adapting and remixing content, and commenting, suggesting, and discussing.
- Quality depends on context: context can be improved with metadata. Small metadata schemes (to be filled in by users) are supplemented with automatic metadata software.

H.4 Communication

Without communication no connectivity, without connectivity, little value. Connectivity and communication, and specifically the barriers faced by users when conducting communication and connection activities, will decide the value and sustainability of Delft OCW.

- Annotation, discussion, Q&A, comment, chat, and conference tools must be integrated.
- Social networking capabilities are vital, because users have to be able to form open and closed virtual communities. These communities may become the backbone of the project.
- Flexible employment mechanisms and system enabling organizations to hire students and faculty based on their contributions and expertise.

Appendix I – Additional research

This research on the future of Delft OCW is not conclusive, far from it. It shows a perspective on Delft OCW (and open education in general) that may have not been considered by the organization of TU Delft before. During the analysis, many issues have been addressed, but, as one would expect, many questions were raised. Although the report provides a rather substantiated advice on how to conduct the development and organization of Delft OCW the coming years, many issues still need investigation.

Technology changes all the time, and regarding education, the near future will offer quite an array of technological opportunities and tools. It is important to remain at the frontline of advancing education. Technology plays an important role in that, although it will be difficult to choose the right technologies, and keep pace with all the developments.

- 3D and virtual worlds, gaming, and interactive visual tools;
- Learning environments, the role and possibilities of Blackboard and Delft OCW;
- Social and community tools, specifically the interplay between Delft OCW and all available tools and technologies;
- The relevance of publication formats that allow easy re-editing (XML) and authoring versus formats that are cheaper to publish, but less adaptable (PDF);
- The possibility of collaborating with (for instance) the CNX (Connexions) project, to use their technology and authoring tools, workflows, rules, etc. This will lower developing costs enormously, and both parties will be helped.

Not just technological opportunities will be important in sketching and designing a good OCW environment and system, but educational issues are also highly relevant. Clearly, technology and educational opportunities are highly interrelated. New issues and existing questions need to be answered in the light of open education.

- The reusability paradox in relation to Delft OCW and creating easily adaptable OER;
- The potential of online education must be investigated and transcribed into clear business models. Endorsement and assessment are interesting issues when education becomes more openly available and increasingly flexible.