

Open Content Use in Bangladesh and Sri Lanka – Context Flexibility as an Enabler for Reuse

Mathias Hatakka

Swedish Business School at Örebro University

mathias.hatakka@oru.se

Anders Avdic

Swedish Business School at Örebro University

anders.avdic@oru.se

Åke Grönlund

Swedish Business School at Örebro University

ake.gronlund@oru.se

ABSTRACT

Free-to-use learning material, open content (OC), is ascribed the potential to change the playing field in regards to every individual's right to education. OC is, however, not much used in developing countries. The aim of this paper is to study how actors involved in content development affect reuse of OC. Actor-Network Theory (ANT) concepts are used to describe content development processes in two cases (in Bangladesh and Sri Lanka). Findings show that there are content properties that need to be flexible and adaptable for it to be used. The properties must not only fit with students and content developers, it must also be adaptable to fit with the educational organization and the technologies used for dissemination. Since there are many actors and properties that must be aligned it is unlikely that fully context independent OC can be developed. For OC to play a role for development the focus has to be on developing flexible content that easily can be adapted to different contexts.

Keywords: open content, content development, flexibility, ICT4D, actor-network theory, reuse

INTRODUCTION

Education is a major key for development (Bada et al. 2006; Selinger 2009) and is in the focus of both the United Nations (UN) declarations of human rights (UN 1948, article 26) and the UN

millennium development goals (UN 2008). Education in developing countries is, however, a major challenge (Andersson 2008; Dhanarajan 2001). Factors such as poor infrastructure, underdeveloped educational systems and lack of funding make it hard to reach rural and underprivileged students.

Developing high-quality learning content is both expensive and time consuming (Pagram et al. 2006; Vargo et al. 2003). A possible solution to this is reuse of open content (OC) (Johnstone 2005), an issue which has gained a lot of interest in education for development literature. There are, however, those that suggest that global education is just a fad (Mason 1999) and that all content is culturally specific (Selinger 2004). The culture of the developers will be reflected in the content they create. Albright (Albright 2005) suggests that educational material used in inappropriate contexts may lead to both dysfunctional education and a reduction in the potential for developing countries to contribute to research, training, experience and understanding. Wiley (Wiley 2007) estimated in 2007 that there were over 2500 open access courses available and a large amount of non-course content available for educational organizations to use. The number has been constantly growing and can be expected to be much higher today. At the universities we have studied the use of OC is, however, minor.

This paper studies how actors involved in content design relate to OC during the design process, asking; what factors affect reuse of Open Content?

LITERATURE REVIEW

Open Content and Development

Studies on OC claim that it has the potential to change the social structure of an educational system or a country, e.g. to change the playing field for individuals' right to education (Wilson 2008) or serve as an enabler of freedom and social justice (Keats 2009). Few, if any, of the claims are, however, grounded in empirical data. Caswell et al. (Caswell et al. 2008) claim that "this content has the potential to substantially improve the quality of life of learners around the world" and that it may "change distance education's role from one of classroom alternative to one of social transformer". Statements such as those are often based solely on the provision of free educational content. No empirical findings are provided that show that provision actually

leads to development beyond an expanding body of available resources. More efforts than just providing more content are needed to change historically and culturally established practices.

Putting too much belief in OC as a change-agent may divert us from areas where OC can make a difference. As more and more content is released under open access licences the body of content will continue to expand. But unless we understand how it should be designed to encourage reuse, the development impact will be minimal. Our previous studies show that teachers and content developers (CD) are reluctant to use OC (Hatakka 2008; Hatakka 2009). Inhibiting factors involve both those that directly can be connected to the content, and those that pertain to individuals and organizations. CDs are reluctant to use content without first modifying it. They want to create their own content and they want to add their own ideas, add their perspectives and their flavour to the content. Reuse of OC is thus more likely to work as a “catalyst for the production of new, local OER [Open Educational Resources]” (Albright 2005) than as a replacement of content. As most of the content is created in the developed world, users of OC in developing regions need to either adapt the style and context of the material to make it culturally relevant or adapt the mode of teaching so it fits with the content (Selinger 2004). For this to be possible the content or the organizations needs to be flexible. Flexibility can generally be defined as “the capacity to adapt” (Golden et al. 2000). For OC, this translates into how easily, and to what extent, it can be modified and adapted to educational contexts, or how the organization can adapt to the content.

Actor-Network Theory

As our previous studies have shown that reuse of OC is more complicated than just developing it and expect it to be used it is important to study all the actors that can influence its reuse. Since there are different perspectives on OC use - adapting the material to fit local actors or adapting the interests of the other actors to fit the material – it is also important to study all actors’ properties to find enabling and restraining factors for reuse, both individual and on a network level. Using ANT as a descriptive framework allows us to trace the content development process and sort out the complex relationships between human and technological actors involved in content development.

Below a brief overview of the key concepts is given. In ANT knowledge is a product of a network of heterogeneous material and knowledge can come in different material forms, e.g. in

papers, presentations or skills embodied in scientists (Latour et al. 1979). A major focus is to trace how stable networks of aligned interests are created and maintained, alternatively why such networks fail (Walsham 1997). Aligned interests means that entities in the network such as work-routines or modules in a system need to be aligned with each other (Monteiro 2000). A network of aligned interests is developed via enrolment and translation. Enrolment means that a body of allies (human and non-human) is enrolled to the network and their interests are translated so they are aligned with the rest of the network (Walsham 1997).

Non-human actors can, depending on what is inscribed in them, stand for, or delegate, a specific viewpoint or perspective (Walsham 1997). In OC this can be the pedagogy, the language or on a more fundamental level the perspective of information. Inscription deals with how the knowledge is inscribed in the artefacts. As most learning material is created in the west and based on western theories it will contain inscriptions which limit its use and relevance in non-western settings (Albright 2005; Wright et al. 2009).

Another key concept is irreversibility which means how difficult it is to make changes. The degree of irreversibility can depend on the extent to which it is possible to go back to a previous point where alternative translations were possible, and the extent to which a specific translation shapes future ones (Callon 1991, p 159). Entire networks and individual actors exhibit some degree of irreversibility which may hinder flexibility. For example if content needs to be delivered as hand-outs the content, CDs and students flexibility are affected. CDs have to translate the content into a printable format which limits what content that can be used. An element in the network that is stable and taken for granted is a black box. The stability of an element is, however, just temporary and if modifications must be made it ceases to be a black box.

METHODOLOGY

The overall methodology for this paper is interpretive case study research (Walsham 1995). The case study methodology allows us to study organizations and individuals in their natural settings, and from practice generate a theory (Benbasat et al. 1987). Benbasat et al also state that “the case method allows the researcher to answer ‘how’ and ‘why’ questions”. This is essential as we need to explain how the informants use Internet resources and how their organizations have organized

content production. We also need to be able to answer the ‘why’ questions as the use or non-use of OC is the main artifact under study. Why do, or do not, CDs use it?

Actor-Network Theory (ANT) concepts are used to describe the content development processes in two cases (Bangladesh and Sri Lanka). We have chosen ANT because it is process orientated, because the content development process actually involves a network of actors, and because it is commonly used for similar situations. In ANT terms, to make it through this process all actors must be aligned with each other in terms of “interests”. This means that actors’ interests must be understood and accepted by other actors, or adjusted for a better fit. In analyzing the content development processes we can find a number of factors that are subject to such alignment. These factors are systematically investigated for the purpose of understanding how OC best should be designed to make it through the local content development process and enable reuse. This is essential if OC should have any possibilities to improve the educational situation in developing countries.

This study comprises two cases, from Colombo, Sri Lanka, and Dhaka, Bangladesh. Five field trips were made, three to Sri Lanka and two to Bangladesh, during 2007-2009. The first author was involved in several projects in Sri Lanka and Bangladesh and the role of the author has been as external expert, lecturer, project coordinator and researcher. The third author was leading the Bangladesh project. All projects concerned distance education but there was a clear demarcation between the research part and the authors’ involvement as the projects’ did not address the aim of this study. The projects have, provided access to informants and have been able to observe their content development processes.

Data Collection

Several data collecting methods were used to utilize multiple sources of evidence (Yin 1994). Teachers and CDs in both cases have been interviewed about, i) their Internet usage, ii) limitations and restrictions to using material from Internet in their content development, iii) how they use material from Internet in their content development, iv) problems with using Internet material, v) benefits of using Internet material, and vi) how Internet material should be improved to enhance reusability. In Sri Lanka nine interviews were done. The Sri Lanka informants worked as CDs or instructional designers (IDs) at University of Colombo School of Computing (UCSC). They had excellent computer skills and access to Internet. In Bangladesh five teachers

who were responsible for creating content for their courses were interviewed, including follow-up interviews with four of them. The computer literacy among the Bangladesh informants varied. Each interview lasted 30-60 minutes. Due to geographical reasons, in Bangladesh questionnaires were distributed to 27 teachers at both private and public universities and the questions concerned, i) their Internet usage, ii) problems with using Internet material, and iii) benefits of using Internet material. The questions in the interview guide and the questionnaires were designed based on OC literature and our previous experiences from the two cases. Our descriptions of the actor-networks were verified by one teacher from Bangladesh and one CD from Sri Lanka.

Observations were done in both Sri Lanka and Bangladesh during each of our visits. In Sri Lanka the observations were done at UCSC and in Bangladesh at Bangladesh Open University (BOU). During the observations we studied the content development process and how they used Internet in their daily work. The observations allowed us to verify the answers from the questionnaire and interviews and they allowed us to gain an understanding of the educational context in both cases.

Table 1 summarizes the data collection for our two cases.

Table 1. The number of informants distributed by cases and data collection methods

	Interview	Questionnaire	Observation
Bangladesh	Five interviews with teachers (follow-up interviews with four of them)	27 questionnaires to teachers	Observations during two visits to BOU (2007 and 2008)
Sri Lanka	Nine interviews with CDs.		Observations during five visits to UCSC (2008-2009)

Analysis

The analysis was an iterative process where we switched focus as we needed to consider both the whole actor-network and each individual actor. The overall aim for the analysis was to find

factors inhibiting or enabling flexibility. To achieve this we first needed to understand each actor individually and how actors affected each other. We started the analysis by tracing the content developing process (see Actor-Networks) for each case. This enabled us to map out the actors involved in the content developing process and to find relationships between them. When comparing the two cases the notion of actor was used to identify and specify actors that were related to content development. In the following refinement we focused on the role of the actor regardless of whether a concept is well established in the educational context or not. For example, the “teacher” concept is well established in education, but in one of our cases teachers were not present. This insight resulted in the identification of the actor “content developer” as the central actor. After this phase we had defined a set of actors in a content development network and how they were related.

In the next phase we analysed OC from each actor’s perspective using ANT concepts to note what is relevant for context flexibility. We analysed the entire actor-network and how the actors were related to each other. After that we analysed each actor to identify which properties enable or restrain flexibility in terms of enrolment, translation and irreversibility (see Properties Affecting Context Flexibility). The key concept here is the degree of irreversibility of a property. The higher the degree of irreversibility, the less flexible the property and thereby the actor.

ACTOR-NETWORKS

Both cases are situated in developing countries in southern Asia. They concern education with large student populations. The infrastructure in both cases is also underdeveloped and only 0,4% of the population in Bangladesh have access to Internet (CIA 2009a) and 5,5% in Sri Lanka (CIA 2009b) .

Sri Lanka

The Sri Lanka case concerns content development for an external bachelor degree in information technology (eBIT) at UCSC. Students can follow the course in distance mode, accessing the content via a Learning Management System (LMS), or they can visit private learning centres that teach the eBIT curriculum. All content that is developed is in electronic form and distributed via their LMS. Type of material created can vary between courses but usually include flash animations, study guides, assignments (e.g. multiple choice quizzes).

Content development at UCSC is instrumental and hierarchal where different actors are responsible for different parts of the content development process. The different roles are Subject Matter Expert (SME), ID and CD. SMEs decide what material that the course should be based on and what should be presented to the students. They are involved in preparing the syllabus and teaching materials. IDs are responsible for organizing the course and the material, they decide the pedagogy to be used and how the instructions should be structured. Most of the teaching material that IDs receive from SMEs is based on teacher-centred educational format and has to be converted to a learner-centred format. CDs design the content based on the materials provided by SMEs and IDs. Before publishing the content it has to be approved by the SMEs. IDs do, however, have some influence on what material to use.

“There is a subject matter expert, we also can decide up to some extent but it is always the subject matter expert who takes the final decision.” (Instructional Designer, Sri Lanka, 2008)

The knowledge of OC is relatively low among the informants but they do use Internet material in their content development, e.g. they use examples from Sun’s webpage in their Java course. They are reluctant to use full courses or lectures but they use Internet to find e.g. examples and images. They do not use the material as it is; they modify the material to fit with the scope and structure of their courses.

“If we are using exercises we take it from the Internet and then according to our requirements, the things that our students use, we modify it and then we have to show it to the SME who also sometimes makes modifications to it, then we can use it.” (Instructional Designer, Sri Lanka, 2008)

They also provide links to Internet material as supplementary reading for the students.

Figure 1 summarizes the actors involved in Sri Lanka. The figure also traces the content from the repository to the end-users (students). The human actors are the students who either access content directly (as supplementary reading) or access the translated content via the LMS. CDs are responsible for creating the content based on SMEs and IDs requirements. The material created by the CD is transferred back to the ID who is responsible for adding the material to the LMS.

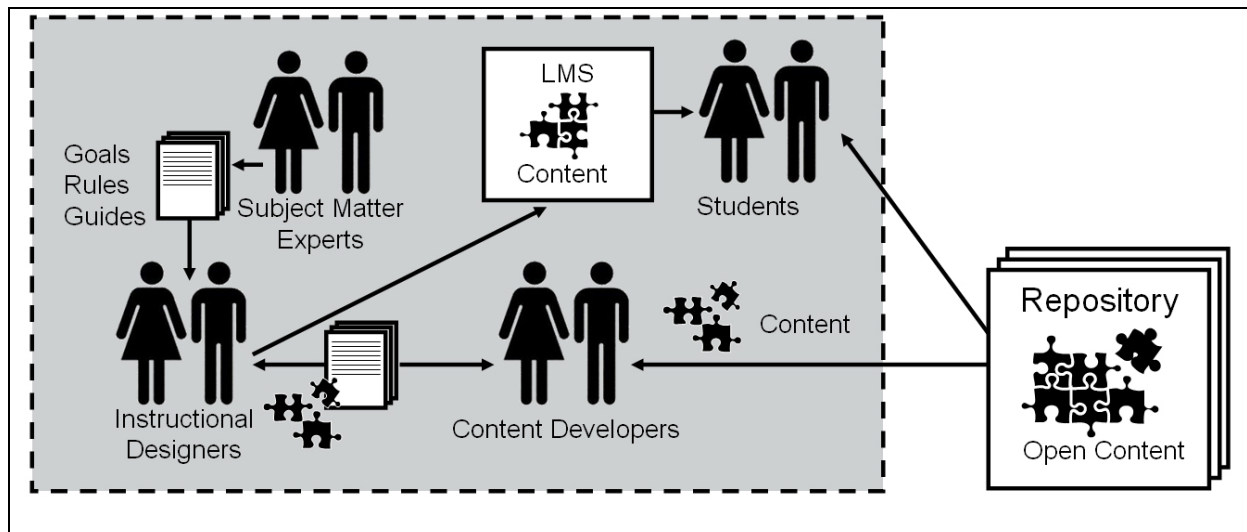


Figure 1. Actors in Educational Content Production at UCSC, Sri Lanka

Bangladesh

The Bangladesh case involves Bangladesh Open University (public), State University of Bangladesh and Daffodil University (private). It involves both content development for campus-based courses and distance courses. Media used for distance courses are printed material, television, radio and mobile phones. Internet is only used in campus-based courses to provide the students with course material and supplementary readings. As the media used to deliver education differ between the universities in this case many different types of material are developed, including video recorded lectures, study guides (both printed and electronic), assignments and quizzes (both printed and electronic), text books, etc.

Content is highly dependent on text books, and electronic material is mainly used to supplement the books. Teachers are also CDs, responsible for creating content for their courses. They have more freedom compared to the Sri Lanka case when it comes to using Internet material in their courses. Teachers are, however, restricted by educational rules and regulations.

“First the university decides [which material to be used in a course], the university [...] has the prospectus and this contains the course list and a brief paragraph of the content of each of the courses, and it also indicates that these prospectus and the paragraphs of content are being authorized by university council missions. So these things are the guiding force for which you may go in some other directions, so teachers start consulting with this sets of

guided paragraphs. Then we will use some other materials to make things enriched.”
(Teacher at a private University, Bangladesh, 2008)

They are reluctant to use Internet material since it has to be approved by different committees. The committees together with the academic council are the main authorities of curriculum development. Content development is also guided by rules and regulations of the University Grants Commission of the Ministry of Education. An approved course is being published in the prospectus and will act as guidelines for teachers when design the content.

“In every school there is a school committee and a curriculum committee which are very powerful committees. Which materials that should be used for the course is decided by the curriculum committee, what type of material that we will use, even who will be the examiner, who will be the writer of different books it is also decided by the curriculum committee. And then it will have to go through school committee and the academic council [...], so there are many formalities there, one person cannot decide what will happen.”
(Teacher at a public University, Bangladesh, 2008)

The knowledge of Internet material was low among most of the informants because of low IT and information literacy. All informants did, however, use Internet material to some degree in their content development. Depending on the type of material they sometimes use it without modification (e.g. PDF files) but most often they alter the material and they prefer to only use small pieces of information (e.g. a short text, an example or an image). Because of the shortage of computers and lack of Internet access in Bangladesh universities cannot rely on Internet as the medium to deliver course material and have to use other media. For example one teacher prefers to use PDF files as they easily can be printed and delivered to students.

Figure 2 gives an overview of the content development process. Students are either provided with material via a variety of media from the university or access the material directly from Internet (provided as supplementary reading). Teachers use Internet resources and modify them to both fit the context of the student and the delivery medium available. They are, however, restricted in their use by both educational rules and regulations and by different committees.

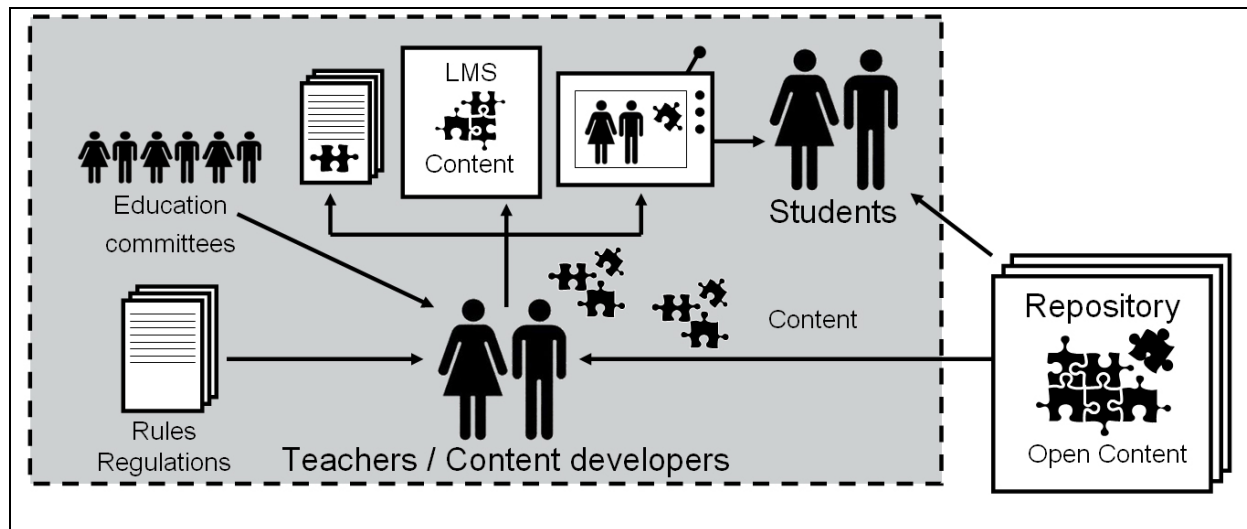


Figure 2. Actors in Educational Content Production in Bangladesh

PROPERTIES AFFECTING CONTEXT FLEXIBILITY

Educational Organization

In Bangladesh, universities' rules and regulations as well as the education committees (school and curriculum committee) affect how OC can be used and in Sri Lanka OC use is restricted by SMEs and IDs. The organization affects enrolment of new actors and enables or restricts which translations that are made possible. In Bangladesh the organizations have rules and restrictions on what material to use in a course, in effect limiting enrolment of new actors (OC). The same is true in Sri Lanka where SMEs and IDs limit CDs' enrolment of content. The organizations' decisions on technology used to disseminate education also play a major role in both enrolment and translation. Those decisions are, however, severely restricted by the infrastructure of the countries.

“Well there are a lot of problems in Bangladesh. Technically we are not that advanced, we do not have advanced technology and also, you see sometimes... in open university we experience these things when we are going to operate this, what is it called, the teleconferencing and when we started we saw that in one centre there was no electricity, so the problems are there.” (Teacher at a public University, Bangladesh, 2008)

The educational organizations, thus, determine enrolment and translation of both content and technology.

There is a difference between the two cases, in Sri Lanka the organization has not yet become stable and several changes in both content development, technology used for delivery, pedagogy etc. have been tried (Wikramanayake et al. 2007). The organization, thus, exhibits a lower degree of irreversibility in comparison to Bangladesh where the educational system and organizations are shaped through history going back to the colonial time. As new actors are made available for enrolment (e.g. new technologies and learning material) the black box needs to be “opened” and the education dissemination need to be restructured if enrolment of the new actors should be made possible, something that only has been done to a limited extent.

Content Developers

In our two cases the actors responsible for adapting the learning content are the teachers (Bangladesh) and CD (Sri Lanka). They are responsible for creating material to be transmitted to students via different media. They are restricted in their enrolment of learning content by:

- Organizational rules and regulations
- Course and education goals
- Restrictions teachers and CDs put on their own content development
- Context of the students
- Technologies available

The organization, the technology and the goals are restrictions that are forced on the teachers, causing a high degree of irreversibility. CDs themselves also impose restrictions on their use of OC. They see it as their job to create the content and they are reluctant to use something that someone else has created. They want to be able to control what content that is transferred to the student.

“I won’t just copy or reuse what ever has been created by someone else. I want something with my own flavour, with my own intellectual, psychological and emotional flavour. It’s my perspective.” (Teacher at a private university, Bangladesh, 2008)

So even if they find material that fits the context of their course they still may not use it because of personal preferences. CDs are also aware of the importance of locally relevant content and will only use content that the students can recognize themselves with.

“The other very important thing is targeting the culture of our students. Different countries have different student cultures. When we create material for Sri Lanka students we can follow their culture. That is important.” (Instructional Designer, Sri Lanka, 2008)

Teaching practices are shaped through history and it is much harder to change cultural factors than to e.g. add technology to education (Grönlund et al. 2008). Both cases are also situated in countries that traditionally have a transmission structure of education or what Freire (Freire 1970) refers to as the banking concept of education where students are seen as empty containers that should be filled with knowledge. The teaching practice, thus, displays a high degree of irreversibility.

“I found that most teachers give a prescription: take a tablet and you learn everything. And why they should take a tablet, how they should take the tablet and what’s in the tablet... all these things and the process of learning are somehow missing.” (Teacher at a private university, Bangladesh, 2008)

Teachers with low computer and information literacy do not use Internet material to the same degree as those more skilled. This is both because they have a harder time to find suitable material but also because that they have a harder time modifying the material to fit with the network (Hatakka 2009).

Student

As most OC is created in the west, the culture and context it mediates will often clash with the culture of users from other countries. Locally adapted content is seen as important and teachers will not use content that is not relevant to their students.

“We have always believed that what ever we are going to teach the learners, the learners must identify themselves with the locals and the familiar surroundings otherwise they won’t be able to grab the situation.” (Teacher at a public University, Bangladesh, 2008)

Aligning the interests between the content and the students are thus seen as very important.

Students are restricted by, and restrict, enrolment of content based on:

- Students’ culture, including issues such as learning style, local context etc.
- Students’ access to technology

Both the students' culture and their access to technology display a high degree of irreversibility. The students' culture is shaped through history and even though efforts were made in both cases to change aspects of it – there has been projects started to improve interactivity (Andersson et al. in press) - it has proven to be hard to change.

Learning Content

As content expresses the culture of its creator it will have properties that make it inappropriate to use in other contexts. The content's properties need to be flexible so that CDs can translate it so as to make it fit with the rest of the network. Often it is enough if one of the properties cannot be translated for the CD to disregard it.

CD enrolment of OC is determined by:

- The organizations' rules and regulations
- The goals with the education
- The teacher's and CD personal preferences
- The student's context
- Technology used for delivering content

As OC can come in a variety of forms it is hard to generalize which properties of each piece of content that is subject for translation. To define the properties that need to be flexible we build on a previous study about inhibiting factors for reuse of Internet material in developing countries (Hatakka 2009). Table 2 summarizes the properties that affect context flexibility in OC.

Table 2: Summary of OC Properties (Adapted from (Hatakka 2009))

Property		Description
Form properties	Language	In which language the content is presented, e.g. English
	Language style	In what sub language the content is presented, e.g. Indian English or colloquial language
	Pedagogy	The pedagogical approach; how content is logically presented to students

	Graphical layout	How the material of the content is presented to teachers and students
Content properties	Scope	The scope of the content, e.g. basic Java programming
	Granularity	To what degree modules of the content can be distinguished and accessed, e.g. variable declaration in Java
	Difficulty level	The level of knowledge, e.g. basic-intermediate-advanced
	Context	Cultural/context aspects of examples and environment of the content
	Knowledge type	Whether the content is controversial
Technology properties	Size	The physical size
	Computer skills requirement	Skills required for using the content
	Media	Media for transferring educational material, e.g. video, PDF

A high degree of irreversibility of the properties presented above will hinder translation. The properties can all display a different degree of irreversibility and can vary based on which value the property has, e.g. if the media is a PDF file it will display a higher degree of irreversibility than if the content is a text file. Some properties also have an affect on the irreversibility of other properties; if the medium is video this will increase the irreversibility of e.g. pedagogy and context as the medium puts certain limits to what future translations are made possible. Irreversibility can also occur for Context and Knowledge type properties, since e.g. some subjects like agriculture are more inclined to be pervaded by local culture than e.g. computer science.

Dissemination Technologies

Different media are used for the dissemination of the content in our two cases. The technology will enable and restrict enrolment of learning content and the translation needed. As an example, one teacher in Bangladesh preferred to enrol PDF files as the delivery mode is printouts.

“[...] if you download the PDF you can easily get the printout which will look like a text book.” (Teacher at a public University, Bangladesh, 2008)

The choice of technology is also restricted by educational rules of the country. For example, Bangladesh Open University is the only university that is allowed to deliver distance education in Bangladesh.

Enrolment of learning objects is restricted or enabled by:

- Technology approved by the university for delivering learning content
- Technology available to the students
- If the technology can display and deliver the content

DISCUSSION

Based on the analysis it is clear that the actor most likely to be translated is the learning content. It is, of course, easier to translate e.g. the pedagogy in an OC than to change historically established pedagogical practices. While this argument seems reasonable in most cases, there may be exceptions. For example, an organization may want to change teaching practices or if the content is of a high enough quality the teacher may find it suitable to adapt to the content. We have, however, not seen this in neither of our two cases. Even though the OC usage in our two cases is low, it has always been the content that has been adapted to fit with the organization and the teacher's perceptions of how education should be delivered. Table 3 summarizes the different actors and the properties that effect translation. The point of departure is the properties of the Learning Content. The table shows how these properties are interrelated to the other actors.

Table 3. Actors' Properties

Learning Content	Student	Content Developers	Organization	Technology
Content				
Context	Culture	Culture	N/A	N/A
Scope	N/A	Scope of course	Goals	N/A
Granularity	N/A	Scope of course	Goals	N/A
Difficulty level	Knowledge level	Level of education	Regulations	N/A
Knowledge type	Culture	Personal preference, and goals	Goals	N/A
Form				
Language	Language	Language used	Regulations	N/A
Language style	Language preference	Language used	Regulations	N/A
Pedagogy	Learning style	Pedagogy	Regulations	Technology used
Graphical layout	Personal preference	Personal preference, and technology available	Technology	Technology used
Technology				
Media	Access	Media for transfer	Technology	Technology used
Size	Bandwidth	Media for transfer	Technology	Technology used
Required skills	Computer skills	Computer skills	N/A	Technology used

The implication of this for OC's potential to aid in development is that it is unlikely that OC by itself can act as the change agent that so many claim. Practices that are constituted in history are unlikely to change because of the availability of learning content. OC can work as a substitution

of content as teachers choose to replace their current content with OC or, as has been shown in the paper, more likely an adapted version of OC to fit with their current practices. It can work as an increase of knowledge as more content are available and students can either themselves find relevant content or get it as supplementary readings. But the high degree of irreversibility of the teachers (although the degree of freedom of the teachers differ between our cases) and organizations means that new educational structures will not emerge just because content developers and teachers get access to more content. For a change in structures to take place, use of OC needs to be accompanied by other development efforts. OC can not be seen in isolation. Even though the usage of OC is low in our two cases we can see an increase in the amount of material that students gain access to, as well as a replacement of limited content with OC. The low use rate can be explained by the lack of flexibility in the content as well as content developers' reluctance to use material that someone else has created. This means that just increasing the number and quality of OC will only have a limited effect of OC as a catalyst for local production of content.

Regarding whether the use of OC from the western world will "westernize" the developing world is that if OC is not developed to be more flexible and thereby more adaptable, either of two things could happen; it will not be used more than today or it will be used without being adapted. The latter alternative will definitely result in less flexible but more "westernizing" OC. The less irreversible the content, the more adaptable will it be to local knowledge and local conditions.

By using ANT as a descriptive tool we have been able to chart and explain the complex relationships between actors and the actors internal properties in OC use. Switching focus made us able to study how the actors are interrelated, and how their internal properties affect content enrolment and translation. Furthermore we have, by using the concept of irreversibility explained which properties of which actors that are easiest and most appropriate for translation.

CONCLUSIONS

In this paper we have provided a structured and systematic view of how OC has to go through a process of adaptation so as to be used in local contexts. We have shown that this process include several actors, each having properties that enable or restrict reuse of OC. We have summarized these properties and showed how they have to be aligned to allow for reuse of OC. We have shown that the actor-network as a whole must exhibit enough flexibility for actors' interest to be

adjusted, and we have argued that because most other actors are relatively rigid, it is important that the content itself is designed for flexibility.

This paper has discussed content flexibility in terms of how OC can be adapted for reuse in a context different than it was designed for. The debates about global education have raised a concern about the appropriateness of using learning content in contexts and cultures that significantly differ from the context it was designed in, and for. This study shows that there are several properties of the content that need to be flexible and adaptable for it to be used in different contexts. The contents' properties must not only fit with the properties of the students and the content developers (teachers or others), they must also be adapted to fit with the educational organization and the technology used for dissemination of the education. The study also shows that completely context independent content cannot be developed. The focus of OC developers who want to make their content reused should be on developing content with a high degree of flexibility for local adaption. Even though we argue that the content needs to be flexible so that it can be aligned with the interests of the other actors, efforts are also needed to help improve the infrastructure, pedagogy etc. to support use of OC that today is deemed inappropriate. The content can, thus, not be seen in isolation.

Since different actors can affect reuse of OC, it needs to be designed so that the content can be adapted to the local context. It is our conclusion that **the debate about global education should switch focus to how content made globally available can be designed and developed to support local adaptation rather than how it can be made globally relevant from the start.** Developing content that easily can be translated to other contexts will increase its potential to work as a catalyst for local production of culturally relevant content.

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