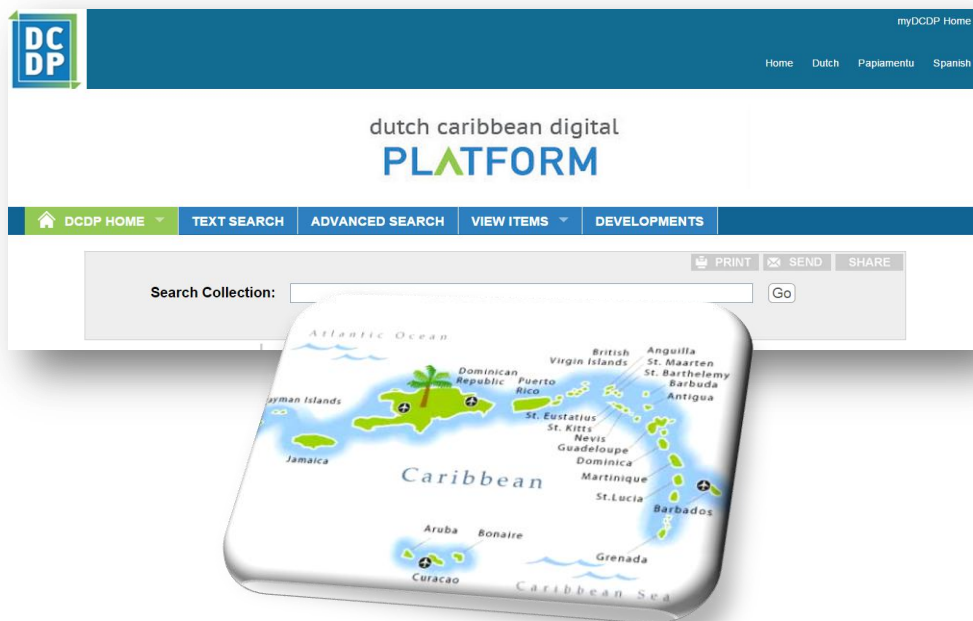




Designing a Digital Community Repository Infrastructure for the Dutch Caribbean

From the Perspective of a Small Island Developing State

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Author Note

Yunette Aniceta, progressnumber 1000586, Faculty of Engineering, University of Curaçao Dr. Moises da Costa Gomez. Thesis to acquire the degree Master of Business Administration. The supervisors of the thesis were Prof. dr. ir. J.I.M. Halman and ir. R. Bulbaai MBA. The research took place at the Library & Research Services of the University of Curaçao, under supervision of the director drs. M. Groenewoud. The Dutch funding organization USONA made it possible to initiate this project. Correspondence concerning this thesis should be addressed to Yunette Aniceta, e-mail: yunette1@gmail.com.

Philippians 4:13

I can do all things through Christ who strengthens me.

New King James Version

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Preface

Conducting this research and writing this thesis has been a long, but exciting endeavour, which would not have been possible without the contribution and support of many professionals, family and friends. First of all, I want to recognize the super-natural strength, love, hope, endurance and patience I have experienced in trusting in my heavenly Father and Saviour, the source of true wisdom, knowledge and truth. I also want to acknowledge the discipline and love for learning, inspired to me by my father Henry Aniceta, and the persevering spirit I obtained from my mother Maria Yolanda Aniceta-Marlin. Completion of this project would not have been possible without the endless patience and support of my loving partner and two loving and talented children Kevin and Clarissa. I want to extend my gratitude to several institutions and individuals who contributed in making this valuable project a success. Without the funds extended by USONA, it would not have been possible to even start this undertaking. The tireless work, commitment and inspiration of the LRS director, Margo Groenewoud, and the Intellectual Property Rights expert, Irwin Korstjens, was indispensable. At the Faculty of Arts, the deans and the LOFO administrator have provided valuable information and feedback to improve the result of the project. During the USONA project, I had the honour to work with some dedicated and enthusiastic assistants in my team, being Joshebeth de Jesus, Mayberly Sambre, Laurie Leverock and Timothy Duijvestein. The valuable contribution and continued support of Joshebeth, even after the project cannot be expressed in words. Finally I want to thank my supervisors professor Joop Halman, Richinel Boelbaai and also the rector magnificus Francis de Lanoy for investing their valuable time and provide the necessary insight to improve the content of this thesis. To all those mentioned here and many others not in this list, I thank you from the bottom of my heart.

Yunette Aniceta
August, 2015

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Abstract

The current study investigated the design of a community digital repository infrastructure to facilitate the development of, management of, dissemination of, use of and access to Dutch Caribbean resources. The Action Design Research methodology was used to iteratively design, develop and validate a prototype at the University of Curaçao, thereby acquiring insight to improve the design and build capacity to develop and manage the repository. Adaptations to the open source SobekCM software made it an excellent platform to incorporate the requirements of the different stakeholders and current trends found in literature. Qualitative empirical data was gathered from stakeholders by means of interviews, group meetings, observations, workshops, and questionnaires that were based on the Technology Acceptance Model. This collaborative concept to facilitate development and management of digital resources is of particular relevance for Small Island Developing States, which are typically confronted with multiple interrelated challenges and limitations to comply with international standards to attain sustainable development. This study provides an initial framework for stakeholders to reduce the lack of local digital resources for the advancement of cultural heritage, education and research, and a prototype for developers to establish a digital repository infrastructure for the Dutch Caribbean SIDS. The results demonstrated the utility of the design, and the concept was readily accepted by all stakeholders. Recommendations include further development of the Dutch Caribbean Digital Platform, and using the prototype as a starting point to establish a sustainable national community repository infrastructure based on the ADR framework and principles encountered during this research, such as integration, convergence, collaboration, glocalization and action research.

Keywords: digital repository, digital library, learning object repository, digitization, integrated repository, convergence, Small Island Development State (SIDS)

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List of Abbreviations / Acronyms

ADR	Action Design Research
BIE	Build Intervene Evaluate
BPoA	Barbados Programme of Action for the Sustainable Development of Small Island Developing States
BT&P	Bureau Telecommunicatie en Post
CITI	Curaçao Innovation & Technology Institute http://citi.cw/ , was Stimul-IT
CC	Creative Commons
CCUNA	Computer Center UNA (changed to ICTS)
DAM	Digital Asset Management
DER	Digital educational resources
dLOC	Digital Library of the Caribbean
DOS	Dienst Openbare Scholen
DOCT	Dutch Overseas Countries and Territories
ECLAC	Economic Commission for Latin America and the Caribbean
FIDE	Fundashon pa Inovashon di Enseñansa na Kòrsou
FIU	Florida International University
FURPS	Functionalities, Usability, Reliability, Performance and Supportability
FMS	Fundashon Material pa Skol
FPI	Fundashon Planifikashon di Idioma
FoA	Faculty of Arts
GCPSE	UNDP Global Centre for Public Service Excellence.
ICT	Information and Communications Technology
ICTS	Information & Communication Technology Services (previously CCUNA)
IEEE	Institute of Electrical and Electronics Engineers

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IFLA	International Federation of Library Associations and Institutions
IR	Institutional Repositories
IPR	Intellectual Property Rights
IWB	Interactive Whiteboard
KB	Koninklijke Bibliotheek
KIT	Koninklijk Instituut Voor De Tropen / Royal Tropical Institute
KITLV	Koninklijk Instituut voor Taal- Land- en Volkenkunde / Royal Netherlands Institute of Southeast Asian and Caribbean Studies
LOFO	Lerarenopleiding Funderend Onderwijs
LOR	Learning Object Repository
LRS	Library & Research Services
MoSCoW	Must, Should, Could and Would requirements
MOWCS	Ministerie Onderwijs Wetenschap Cultuur en Sport
MSI	Mauritius Strategy for Further Implementation of the Programme of Action for Small Island Developing States
OAI	Open Archives Initiatives
OCLC	Online Computer Library Center
OCR	Optical Character Recognition
OER	Open Educational Resources
OECD	Organisation for Economic Co-operation and Development
PoA	Programme of Action for the Sustainable Development of Small Island Developing States
QC	Quality control
RSP	Repositories Support Project
RLG	Research Libraries Group

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RKCS	Rooms Katholiek Centraal Schoolbestuur
SAMOA	SIDS Accelerated Modalities Of Action Pathway
SIDS	Small Island Developing State(s)
TAC	Thierry Apoteker Consulting
TAR	Technical Action Research
TAM	Technology Acceptance Model
UNA	Universiteit van de Nederlandse Antillen (changed to UoC)
UK	United Kingdom
UF	University of Florida
UN	United Nations
UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
USONA	Uitvoeringsorganisatie Stichting Ontwikkeling Nederlandse Antillen
UoC	University of Curaçao Dr. Moises da Costa Gomez (previously UNA)
VPCO	Vereniging Protestant Christelijk Onderwijs
WSIS	World Summit on the Information Society

1. Introduction

This chapter introduces the topic of the study, the background of the project that initiated the study and concludes with the structure of the thesis.

1.1 Topic of the Study.

Several studies indicate that in Curaçao, notwithstanding great effort and financial injections into educational reform measures, there is a lack of local resources to advance culture, education and research. Furthermore, a great deal of the available local resources are obsolete and are not promoting the development of 21st century skills which is required in modern education. The challenges policymakers face to provide modern education that complies with requirements for sustainable development and that meets the demands of the current globalized knowledge era are great. Caribbean Small Island Developing States (SIDS), such as Curaçao, face severe limitations to accomplish sustainable development, which have been internationally recognized and formalized by the United Nations (UN) (UNCED 1992; UN, 1994). The vital role cooperation and technology plays in sharing information to address these limitations is a recurrent theme in the UN resolutions, and there is a growing understanding that issues regarding SIDS need to be dealt with differently than those in developing countries larger in size (UN, 2010; UN, 2014).

This study aims to contribute to the development of a digital repository infrastructure for the Dutch Caribbean resources from the perspective of a SIDS, based on a project that was conducted at University of Curaçao Dr. Moises da Costa Gomez (UoC)ⁱ. Accomplishing this could contribute to facilitate the development, management, use, dissemination, and access to local digital resources. Consequently, this could reduce the lack of modern local resources, and concurrently take advantage of the possibilities Information and Communications Technology (ICT) offers for the sustainable development of Curaçao.

1.2. Background of the Project.

The UoC was established in January 1979 as the University of the Netherlands Antilles (UNA) with three formal task areas:

1. Providing higher education. UoC must educate its students to a level that facilitates them to (a) occupy key societal positions that require a higher education level, (b) gain insight into science and academic knowledge and, (c) to provide effective community service;
 2. UoC should further and/or execute scientific research, as part of both higher education activities and community development involvement;
 3. With or without the help of third parties, UoC should provide training to third parties who desire to continue their study on bachelor or master level.
- (UoC, 2013, p. 4)

With the dismantlement of the Netherlands Antilles in 2010, Curaçao acquired the status of an autonomous country within the Kingdom of the Netherlands, which brought about revived interest in the development of cultural identity and of modern local education and research (Government of Curaçao, 2013). A new role emerged for the UoC, which recognized that a new country required highly skilled citizens and the necessary resources to perform research, to analyze local issues, and to come up with answers or recommendations for these local issues (UNA, 2011, p. 1). The availability of and access to modern local resources in the faculties and the university library are crucial in fulfilling this role.

The Faculty of Artsⁱⁱ at the UoC provides teacher training programs on different levels. In their task of training and forming future teachers, the FoA experiences a lack of local teaching and learning resources, as well as sources to develop local learning resources. The dean of the FoA furthermore indicated that they do not have the capacity to structurally introduce ICT in education, which is required in modern educational practice (Katić, 2008).

The Library & Research Services (LRS)ⁱⁱⁱ at the UoC maintains an extensive, unique collection of Dutch Caribbean books and publications, rich in cultural information, which could be used for local education. This collection, however, is in analogue format and can be accessed only on the premises of the library due to their uniqueness. Therefore, according to the LRS director, these resources are rarely used for the development of local educational resources.

With the pressures of globalization and requirements for acquiring 21st century skills, the use of ICT has become a priority in modern libraries and educational institutions in developed as well as developing countries world-wide (Altbach, Reisberg, & Rumbley, 2009; Chandra, 2010). The availability of a digital repository is imperative for the UoC to remain competitive, efficient and effective concerning local education and research. Introducing ICT in institutions has many advantages, but also brings about many challenges. Development of digital resources, introduction of new policies, building new capacities, acquisition of new equipment, and development of a system to make the digital resources available are but a few of these challenges.

In 2012 the FoA and LRS worked collaboratively in a project which was overseen by the Dutch funding institution Uitvoeringsorganisatie Stichting Ontwikkeling Nederlandse Antillen (USONA)^{iv} to initiate the development of an alternative to reduce the lack of local resources. The aim of the USONA program "Onderwijs & Jongeren"^v is to equip the youth of the former Netherlands Antilles to participate in the labor market and in a constantly changing society at the local, regional and global level, through, inter alia, quality assurance of the teacher training education and by contributing to a sustainable foundation education (USONA, 2007a; USONA, 2007b). The USONA project therefore focused mainly on the Lerarenopleiding Funderend Onderwijs (LOFO)^{vi} program of the FoA, and the LRS.

The LOFO is a pre-service teacher education program, whose task is to supply teachers who are ready to work in the first cycle of foundation (elementary) education (pupils between 4 and 8 years old), as well as in the second cycle (pupils between 8 and 12 years old). The goals of the USONA project named "LOFO Project Digitaal Lesmateriaal" were to digitize a sample of the Dutch Caribbean collection of the LRS, to develop sample digital educational resources for the LOFO, and to develop a prototype digital repository in order to make these local resources freely accessible via the Web (Groenewoud, Korstjens, Aniceta, & Greijmans, 2012). This process would provide an opportunity for the participants to build capacity in developing digital resources and concurrently acquire knowledge, and skills in order to innovate their institution. Appendix 1 shows a schematic representation of the participating groups, which formed part of the project plan (Groenewoud, Korstjens, Aniceta, & Greijmans, 2012). These groups included, besides the FoA and the LRS, the Information & Communication Technology Services (ICTS)^{vii} department of the UoC (previously known as CCUNA); an advisory board committee that included important external stakeholders; a Digital Learning Resources Team, responsible for developing sample digital teaching and learning materials and for building capacity at the LOFO; and the Digital Source Materials and Database Team, responsible for digitization of books, harvesting local resources from the internet, and providing a web environment to access the repositories containing the source materials and the teaching and learning materials.

The author of this thesis coordinated the Digital Source Materials and Database Team during the USONA project between August 2012 and May 2013, supported the LRS with functional management of the prototype as an internal consultant between August 2013 and December 2014, and has been functioning as an external advisor since January 2015 when the process of internalizing the repository and partnering with external stakeholders started at the LRS. This thesis reflects the insights acquired between August 2012 and June 2015.

1.3 Structure of the Thesis.

The remainder of this thesis is organized in the following manner. Chapter 2 depicts the challenges Curaçao as a Caribbean SIDS experiences concerning the lack of modern local resources in educational institutions. The research approach that was adopted to design an infrastructure that can address these challenges is then detailed in the remainder of chapter 2. In chapter 3, the problem to develop a digital repository infrastructure at the UoC is analyzed in more detail, by studying the current situation of the stakeholders. Based on this study, a theoretical framework is constructed in chapter 4, resulting in requirements and considerations that need to be taken into account when introducing a digital repository that supports the sustainable development of a SIDS. In chapter 5, the gap between the current situation of the stakeholders and the information gathered from literature is analyzed, resulting in an initial digital repository infrastructure design that could improve the access, use, management, dissemination and development of local digital resources in Curaçao. Chapter 6 details the development and validation of a prototype of the repository infrastructure, and the reshaping of this prototype through increased insight gained by organizational interactions and recurrent evaluation. The thesis concludes with answers to the research questions in chapter 7 in the form of an improved, generalized design and a functional prototype of a digital repository infrastructure, and explains how this could be applied on an individual, institutional, national and regional level to contribute in reducing the lack of local resources. Recommendations for the further development of the infrastructural design are then formulated, which can be of value to the Dutch Caribbean SIDS in general, and the community of Curaçao in particular.

2. The Research Approach

This chapter commences with a description of the "mess" or "system of problems", referring to the interrelated problems that produce dissatisfaction (Ackoff, 1974, p. 427). Difficulties concerning digital resources are discussed on the national and international levels to obtain a broader insight into understanding the challenges on the institutional level, and to define the problem statement. The objectives of the study are subsequently presented, and the scope defined and delineated. The research questions are formulated, and the chapter ends with defining the research framework and detailing the methods used to answer the questions.

2.1 The Needs and Barriers to develop a Digital Repository Infrastructure in Curaçao.

The government program "Regeerprogramma Curaçao 2013 – 2016" (2013) considers Nation Building as one of the strategic objectives for strengthening the national identity of the new country. This program further proposes high level, affordable education with modern teaching practices and new concepts as the main vehicle to empower the youth to face the challenges of the 21st century, and a rapidly advancing world. Recent studies in Curaçao, however, indicate that the quantity and quality of local resources for culture, education and research are not satisfactory.

In a strategic report on local sustainable economic development, the European research group Thierry Apoteker Consulting (TAC) Economics^{viii}, for example, made critical remarks on the adequacy and quality of learning materials, particularly those for teaching Papiamentu (TAC, 2013). TAC further reports that "research is scattered, uncoordinated and insufficient" (TAC, 2013, p. 297) and recommends, inter alia, a reform of the education system from early childhood through tertiary education for reaching the desired economic, social and cultural situation; a sensitization of the children to culture; and also to develop in teenagers "strong emotional feelings for the art and culture of their country, the Caribbean

and Latin American countries as part of their heritage" (TAC, 2013, p.11). This also agrees with findings reported by the United Nations Children's Fund (UNICEF)^{ix}, which identified a lack of local educational materials for the youth in Curaçao, a lack of educational resources in the mother tongue Papiamentu, and asserted that the Dutch model of education leads to challenges in identification with local society and culture (UNICEF, 2013). Curaçao is in the unique situation of having its small mother tongue Papiamentu as a required language in education, but the lack of resources and the lack of economies of scale make it difficult and expensive to develop resources in this language. Reducing the lack of local resources, and providing quality resources is therefore crucial for its educational system (Kibbelaar, 2012; Rafaël, Reints, & Wilkens, 2009).

The emergence of Open Educational Resources (OER) can contribute to reduce the lack of resources, improve the quality of curricula and teaching, and reduce costs in higher education (Commonwealth of Learning & UNESCO, 2015), particularly if they are digital. Developed and developing countries alike acknowledge the importance of ICT in education to provide modern education that supports the development of knowledge, skills and dispositions that the 21st century citizens need to contribute to the current, globalized knowledge society (Gaible, 2009). This includes ICT literacy, cooperation, creativity, social and/or cultural skills, communication, critical thinking, and problem solving skills (Voogt & Pareja Roblin, 2010). Digital educational resources are therefore increasingly becoming freely available as OER, but unless these resources are localized, they cannot offer a solution to the lack of resources attuned to the local culture, particularly in elementary education. Attempts have been made to encourage the open development and distribution of local educational digital resources by individual teachers and organizations alike. Papiamentu yurles^x and Método liber^{xi} are examples of websites where individual teachers placed local resources on the web, while the Grassroots project^{xii} of Fundashon Bon Intenshon^{xiii} and the

Sustainable Kòrsou scholenproject^{xiv} of UNESCO were accomplished through concerted efforts. Existing local digital resources, however, reside on different media such as websites, CDs, diskettes and computers, making discovery of a specific resource a cumbersome process. Digital resources need to be managed to ensure effective and efficient use.

United Kingdom's (UK's) authoritative organization on information technology in education, Jisc^{xv}, states that digital repositories are the preferred method for managing and storing digital content in higher education, and explains an array of benefits this brings for multiple stakeholders (Jisc Infonet, 2010). Jisc describes a formal digital repository as a place where "digital content, or assets, are stored and managed to facilitate searching and retrieval for later use", which supports "mechanisms to import, export, identify, store, preserve and retrieve digital assets" (Jisc Infonet, 2010, pp. 5 - 6). No open digital repository exists in Curaçao, and many interrelated challenges to establish a digital repository infrastructure exist, most of them relating to limitations of being a SIDS.

The United Nations Conference on Environment and Development (UNCED) was the first where there was an international agreement that SIDS are a special group of countries with unique limitations and serious challenges to attain sustainable development (UNCED, 1992). Economic, social and environmental development are considered the three interlinked pillars necessary for sustainable development (UN, 1987). SIDS cope with inherent challenges, like:

"... a narrow resource base depriving them of the benefits of economies of scale; small domestic markets and heavy dependence on a few external and remote markets; external and remote markets; high costs for energy, infrastructure, transportation, communication and servicing; long distances from export markets and import resources; low and irregular international traffic volumes; little resilience to natural disasters; growing populations; high

volatility of economic growth; limited opportunities for the private sector and a proportionately large reliance of their economies on their public sector; and fragile natural environments. Therefore, they are highly disadvantaged in their development process and require special support from the international community" (UN-OHRLLS, 2011, pp. 2-3).

Additionally, introducing the structured use of digital resources in education requires a combination of technology, leadership, collaboration, financial investment, management and policies (Stichting Kennisnet ICT op school & Stichting Kennisnet, 2013) which are often lacking in SIDS (Gaible, 2009; UNESCO Institute for Statistics, 2012). ICT policy is considered a key factor for a successful integration of ICT in education and a facilitator for systemic change (UNESCO, 2011b). While most governments in the Caribbean have drafted or approved ICT policies in education, the UNESCO notes that "in contrast, Curaçao, Dominica, Montserrat and Suriname do not have any formal definitions or regulatory institutions regarding ICT in education" (UNESCO Institute for Statistics, 2012, p.7).

Furthermore, digital repositories are difficult to develop and challenging to manage. Researchers have identified various barriers to acquire structural deposits (Castro, André Ferreira, & Andrade, 2011; OECD, 2007; Pawlowski and Zimmermann, 2007) and, considering the above mentioned limitations, developing and managing a digital repository will be even more challenging for a SIDS.

The interrelated problems SIDS face have been defined by United Nations Development Programme (UNDP) as a "wicked problem", consisting of "large and intractable issues that have no immediate or obvious solutions and whose causes and influencing factors are not easily determined" (Everest-Phillips, UNDP, & UNDP Global Centre for Public Service Excellence, 2014), and this also applies for teaching and learning with technology (Borko, Whitcomb, & Liston, 2009; Mishra, & Koehler, 2007).

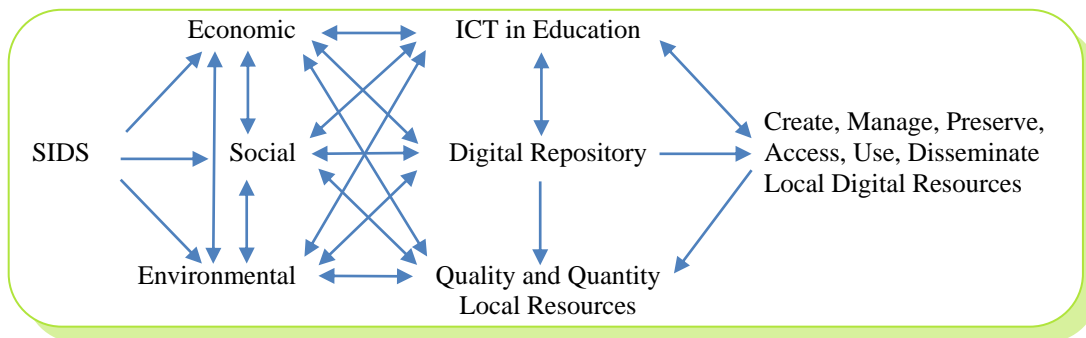


Figure 1: Interdependent Challenges of SIDS causing a Lack of Local Resources.

Figure 1 presents a schematic representation of the interrelated problems that contribute to the lack of quality local resources in Curaçao, which on their turn reinforces the challenges SIDS encounter to attain sustainable development, making this a vicious circle.

2.2 The Problem Statement.

Curaçao copes with a lack of local resources, which undermines its sustainable development (TAC, 2013 p. 249). Digital resources, managed in a digital repository, can reduce the lack and improve the quality of local resources, but many challenges exist. If no collaborative action is taken to structurally address these complex problems, inherent limitations and barriers, not only will the need for local digital resources increase, but the gap in technological development compared to other countries in the region will continue to grow. Curaçao also runs the risk of providing education that fails to develop citizens with the capacity to provide innovative and sustainable solutions for local challenges, as well as citizens with the necessary abilities to participate in the current globalized knowledge era. The problem statement was formulated as follows.

The interrelated challenges to develop a digital repository that facilitates the development and management of local digital resources forms an obstacle to the timely and adequate provision of the required information, which compromises the sustainable development of a SIDS such as Curaçao.

2.3 The Objectives.

The *external objective* of the research was to acquire insight to enable the design and development of a sustainable digital repository infrastructure, appropriate for all relevant stakeholders of the Dutch Caribbean SIDS, in order to facilitate the provision of quantity and quality local resources. This infrastructure could facilitate the use of, creation of, management of, preservation of, dissemination of and access to multidisciplinary digital resources of the Dutch Caribbean, which in turn could contribute with reducing the lack of local resources.

The *internal objective* of the research was twofold and consisted of both a design and a development component. The design objective was directed on a robust digital repository infrastructure that would support the sustainable development of a SIDS given their limitations.

The development objective consisted of a functional prototype repository at the LRS that facilitated research and knowledge management, that supported 21st Century education, and that assisted with preservation of the cultural heritage, based on information gathered from literature and empirical data gathered from internal and external stakeholders. The goal of the resulting artifact was to provide a better understanding of the repository concept, and enable the stakeholders to provide valuable insights to validate and improve the infrastructural design. The prototype could further serve as a stepping-stone to proceed with the development of an improved repository infrastructure

2.4 The Scope, the Definitions and the Delineation.

The results of this design-oriented research project **do not** provide a full set of specifications for the repository infrastructure, or produce a fully functional repository. The design is preliminary in nature, and the repository will not solve the lack of local resources.

The research project was limited to designing an initial digital repository infrastructure for the stakeholders, and developing a prototype at the LRS with sample Dutch Caribbean resources for the advancement of culture, education and research.

The study **does** provide information on digital repository trends, requirements and frameworks, as well as considerations to facilitate the sustainable development of a SIDS. This can be used as a guide for stakeholders that want to be informed. The working definition for sustainable development used by the UN is "development, which meets the needs of the present generation without compromising the needs of future generations to meet their own needs", which was defined in the Brundtland Commission Report named Our Common Future (UN, 1987, para. 2).

The study **does** provide an initial design for a digital repository infrastructure for stakeholders who want to use, discover, access, manage, disseminate or develop local digital resources. One definition of an infrastructure according to the online Merriam Webster dictionary is "the underlying foundation or basic framework (as of a system or organization)" (<http://www.merriam-webster.com/dictionary/infrastructure>). Such framework can be further developed to accommodate individuals or institutions in a small community such as Curaçao with options to reduce the lack of digital resources by contributing to existing repositories, or design and develop their own.

The research **does** provide initial requirements of the stakeholders which were represented in the advisory committee, thereby facilitating the process of a thorough requirement elicitation at a later stage. In this study, the stakeholders are limited to institutions that could contribute with development and management of local digital resources to reduce the lack of resources for culture, education and research.

The research **does** result in a functional digital repository prototype at the LRS, consisting of a relational database, a web application and sample local digital open

educational resources. This enabled the stakeholders to obtain initial indicators to plan digitization projects and to build capacity by designing and working collaboratively.

Local resources refer to materials originating from or discussing the Dutch Caribbean, which consists of the six Dutch Overseas Countries and Territories (DOCT) which are Aruba, Curaçao, St. Maarten, and Bonaire, St. Eustatius and Saba (the three latter are also called the BES territories). Localized resources refer to resources that have been adapted to the mother tongue and/or culture of these islands. Open Educational Resources (OER) is defined as "teaching, learning and research materials in any medium that reside in the public domain and have been released under an open licence that permits access, use, repurposing, reuse and redistribution by others with no or limited restrictions (Atkins, Brown & Hammond, 2007)." (Commonwealth of Learning & UNESCO, 2015, p. v). This study limits itself to OER in digital form, consisting of digitized books as source materials for cultural development, digital teaching and learning resources for elementary education as educational resources, and research articles of the six islands.

Preservation of cultural heritage is an important factor in this study, which has been defined as "the legacy of the tangible artefacts and the intangible attributes of a specific group of people, a society, or even a country" (Van der Aa, 2005).

The research **does** provide recommendations on how to proceed with the design of the infrastructure and the development of the repository to include more stakeholders and disciplines. The results of this study can thus serve as a model that can be further expanded to support sustainable development and reduce the lack of local resources.

2.4 The Research questions.

To achieve the objectives of the study, the central research question (CRQ) was formulated as follows.

How can a digital repository infrastructure for Dutch Caribbean resources be designed and developed for the stakeholders in order to attain a more sustainable development for Curaçao as a Caribbean SIDS?

The central research question is subdivided into the following research questions

1. What are the challenges to establish a digital repository with Dutch Caribbean resources, based on the current situation of the stakeholders?
2. What are the requirements for a digital repository from the perspective of the sustainable development of a SIDS, based on information found in literature?
3. How can a digital repository infrastructure with Dutch Caribbean resources be designed for the stakeholders on Curaçao, given the challenges SIDS face to meet the requirements found in literature?
4. What insight can be obtained from the stakeholders to improve the sustainability of the design, with development of, interaction with and evaluation of a prototype digital repository containing sample resources?

2.5 The Research Framework.

The nature of the problem required the researcher to design an infrastructure, contribute to knowledge, and also develop a prototype to gain experience and skills through interaction with an information system that embodied new concepts. The Action Design Research (ADR) information system method (Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011) with its corresponding framework was therefore used in this study as a guide. ADR is intended for research projects for applied disciplines, which originate from a practical problem and where the researcher should provide theoretical insights, while concurrently solving a problem in an organizational setting (Sein et al., 2011).

ADR recognizes that the design, development and evaluation of information systems are not sequential, but intertwined, which renders stage-gate methods inappropriate. Given the fact that design problems are also considered wicked problems (Buchanan, 2005), the integrated and iterative process of ADR is suitable to address these problems, using "the increasing understanding of the organizational environment, to influence the selection of design constructs, and/or interleave the two" (Sein et al., 2011, p. 43). In developing an information system for education, Bolici and Virili (2013) thus describe ADR as "a method for overcoming the dichotomy between technological rigor and organizational relevance and exploiting the interaction between social contextual factors and design properties" (p. 6).

ADR encompasses four stages that contain principles and tasks. Appendix 2 shows the ADR framework combined with these principles and tasks, as well as an illustration of the different iterative cycles that are performed in the process. The first stage is the Problem Formulation stage, which is triggered by a problem perceived in practice or anticipated by researchers. The research opportunity is conceptualized on existing theories and technologies, and the problem scoped and defined as an instance of a broader class of problems. The second stage is the Building, Intervention and Evaluation (BIE) stage, where an initial IT artifact is built based on the information specified in stage 1. Through an iterative process of building, intervention and evaluation in an organizational environment, the artifact is further shaped and design principles are articulated for the class of problem. The third stage is the Reflection and Learning stage, which is an ongoing activity of identifying a solution for the particular situation and how this could be applied to a broader class of problems. The fourth and stage, Formalization of Learning, is the translation of lessons learned into general solution concepts for a class of problems. This falls out of the scope of this thesis, but the reflection does provide indications for possible generalized principles. Figure 2 provides an overview of the ADR framework, super-imposed with the pilot study and research questions.

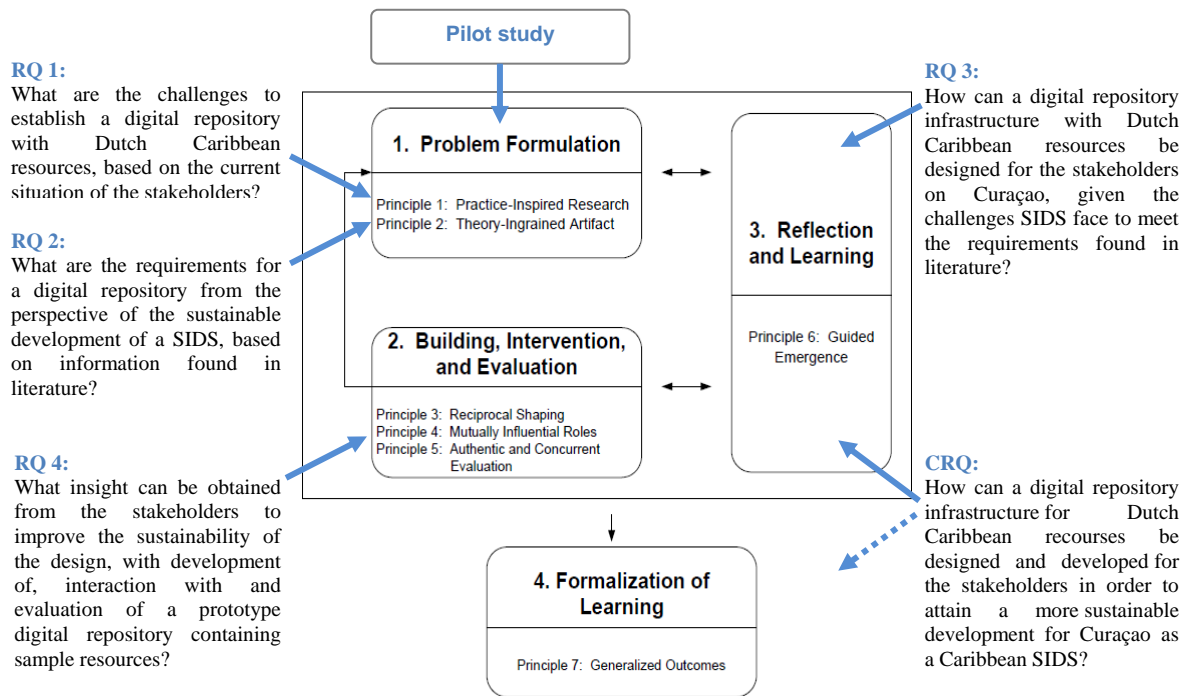


Figure 2: The Action Design Research Framework (Sein et al., 2011) with Research Questions.

The ADR framework was used to guide the research process in this study. To obtain insight into the problem, a preliminary pilot study was conducted. The challenges the stakeholders faced concerning development and management of digital resources were placed in an institutional, national and international context to guide the empirical investigation of the current situation as well as the theoretical study on developing and managing digital repositories and digital resources in SIDS. Analysis of the resulting requirements of the users and those found in literature yielded specifications for designing an initial digital repository infrastructure. Development of a prototype and recurrent adaptations based on the validations and the emergent situation of the stakeholders were used to acquire insight, which was used to improve and generalize the design in order to answer the research questions.

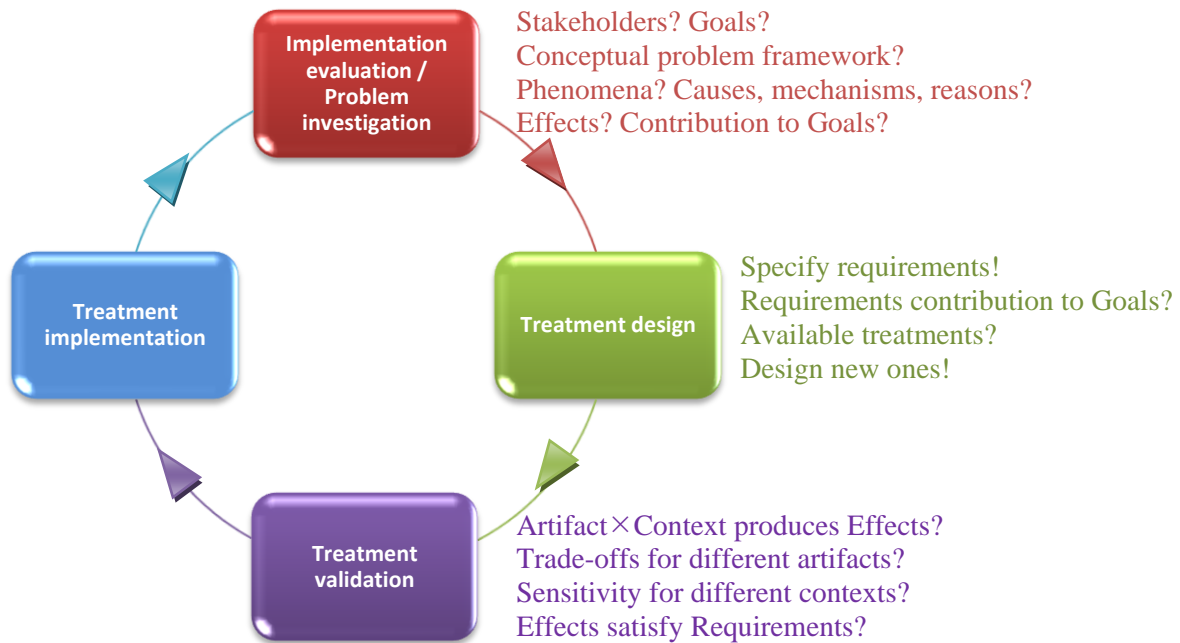


Figure 3: The Design Cycle as part of the Engineering Cycle (Wieringa, 2014)

To specify and complement the activities in the ADR stages, guidelines of the Design cycle of Wieringa (2014) were used, which is illustrated in Figure 3. The Problem investigation corresponds with activities of Stage 1 in ADR; those in the Treatment design with the 1st round of stage 3 of ADR; and those in the Treatment validation with stages 2 and 3 of ADR. Furthermore, the Technical Action Research (TAR) of Wieringa (2014) was used as a guideline to differentiate the different roles of the researcher in the Treatment validation; as empirical researcher and as the client's helper (Wieringa, 2014)

2.6 The Method.

This qualitative study followed a more exploratory and practical approach. The ADR principles guided the process of collecting data to answer the research questions in each stage. The iterative design and prototype development of a repository infrastructure took place between August 2012 and June 2015, during which the researcher had different roles: coordinator of the Digital Source Materials and Database Team, internal consultant at the LRS and external advisor of the LRS.

2.6.1 Stage 1: Problem Formulation and Analysis.

Stage 1, combined with the pilot study and reflection and learning on the problem, provided answers to the first, second and third research question between August 2012 and December 2012. For the pilot study, empirical data was gathered through unstructured interviews with internal stakeholders at the UoC, attending conferences and conducting informal conversations to obtain the view of external stakeholders on the project. Local documents and literature were studied to better comprehend the challenges SIDS institutions face concerning development and management of digital repositories. The information gathered during the pilot study was used to guide the empirical investigation of the first research question, as well as the theoretical literature study of the second research question.

To answer the first research question, empirical data was gathered from unstructured and semi-structured interviews with the internal stakeholders, and from a group meeting with the members of the advisory committee. Details on the appointments that provided empirical data during the USONA project are shown in appendix 3. Notes and initial minutes were drafted during and immediately after the encounters with the stakeholders, which were also recorded. To avoid a personal bias that may occur with interviews and observations, and to enhance the reliability of the data, the minutes were completed by the researcher and her main assistant separately, aided by the recordings. The minutes were subsequently merged by the researcher.

The second research question was answered by studying literature on SIDS, digital repositories and digital resources. State-of-the-art criteria for developing and managing digital repositories in SIDS were studied using scholarly articles, policy briefs, white papers, and similar documents. Searches were initially based on keywords such as SIDS, digital repository, digital library, institutional repository, learning object repository, digitization, ICT in education, digital educational resources, and trends in collaboration and integration.

Scholarly literature was used from the inception of the USONA project in 2012, which is why the literature dates from 2009 to 2015. The criteria for recent articles were not applied when concepts were defined or when historical development were discussed. Articles were retrieved from databases such as EBSCOhost^{xvi}, Emerald Insight^{xvii} and Google scholar^{xviii}, and also by using search engines to discover studies in other openly accessible repositories.

The UN's international agreements on sustainable development of SIDS were the main sources used to describe and explain the context of SIDS. Data on websites of the UN and affiliates such as UNESCO^{xix} and UNICEF were therefore also consulted. Data acquired through research by the recognized UK organization Jisc^{xx} and its Repositories Support Project (RSP)^{xxi}, a 7 year initiative contributing to building repository capacity within UK higher education institutions, were used as the main source for digital repositories. Furthermore, data was acquired from authoritative and reputable institutions, such as SURF^{xxii}, the International Federation of Library Associations and Institutions (IFLA)^{xxiii}, and the Organisation for Economic Co-operation and Development (OECD)^{xxiv}. "Living documents" on these sites, which are updated incrementally, were also used as a source for information. One of the objectives of the research was to provide knowledge and information to the stakeholders, and therefore, documents that were freely accessible have been used as much as possible. The hyperlinks to these articles are included in the reference list, and those of the websites are placed as end notes which in the last appendix named Link to Websites. These links were revisited on March 2015.

The third research question was answered by analyzing the results of the first and second research questions, and by designing an initial repository infrastructure in collaboration with local and international experts. Local experts included M. Groenewoud for library and research issues, I. Korstjens for Intellectual Property Rights (IPR) issues, E. Ehteld and D. Manuel for issues concerning tertiary teacher education, O. Resida for issues

concerning the teaching and learning environment at the LOFO, and G. Greijmans for matters concerning digital teaching and learning resources. Views of external experts included the Program Director of the Digital Library of the Caribbean (dLOC)^{xxv} Ms. B. Wooldridge, the developer of the SobekCM platform Mr. M. Sullivan, the Technical Director of dLOC Ms. L. Taylor, and the developer of the Metamorfoze guidelines in the Netherlands for the digital preservation of resources Mr. H. van Dormolen.

2.6.2 Stage 2: Building, Intervention and Evaluation of the Prototype.

Stage 2 entails the development and validation of a prototype and the subsequent adaptations through renewed insight, which took place between January 2013 and December 2014. The fourth research question was answered by using insights that was acquired during two iterations of the Building, Intervention and Evaluation (BIE). The researcher and her team were assisted by the developer of the SobekCM application in building the platform, and uploading the digitized books, who also came personally to the island to provide assistance. The Digital Learning Resources Team developed the learning resources, and the copyright expert developed a guide to address the IPR issues. The researcher also participated in a 2-week dLOC Advanced Topics Training (<http://ufdc.ufl.edu/AA00016149/00001/>) in several universities, libraries, museums and archival institutions throughout Florida, concerning digitization of multiple media and managing the SobekCM digital repository.

Intervention took place through several workshops and presentations to, inter alia, the LRS staff, LOFO teachers and students, members of the advisory committee and teachers of the A.E. Goilo school. Since acceptance of the repository was an important aspect of the research, evaluation interviews were conducted and data was gathered using questionnaires based on the Technological Acceptance Model (TAM) (Davis, 1989). Although TAM is typically used in quantitative research to predict the users' acceptance of an IT artifact, in this

study it was used to minimize the researcher's bias that can occur when relying solely on interviews and observation, and thereby increasing the reliability of the evaluation of the stakeholders' acceptance. A Likert scale of 1 to 5 was used, ranging from completely disagree to completely agree, with 3 being neutral. Averages were calculated for the categories *perceived usability*, *ease of use* and *intention to use*, and categories with an average greater than 3.0 were considered to be accepted. The prototype was considered to be accepted if the overall average was greater than 3.0. The TAM questionnaires were based on questions used by Davis (1989) and Yuen and Ma (2008), and were slightly adapted on the questionnaires for the stakeholders. The questionnaires for the advisory committee and the LRS director are shown in appendix 5. Additional questions to these important stakeholders are discussed in the results. The questionnaires for the LOFO students and the teachers of the elementary A.E. Goilo school are shown in appendix 6. These questionnaires consisted of fewer items and these stakeholders did not receive additional questions. The active participation during the BIE stage served to generate support and involvement of the stakeholders, which enabled them to provide more valid feedback.

2.6.3 Stage 3: Reflection and Learning and Initial Formalization of Learning.

Stage 3 took place between January 2015 and June 2015, and contains a reflection on insights gained during the BIE stage. A better understanding was acquired by all participants through the design, development, re-design and adaptations of the digital repository infrastructure. Using the prototype enabled the stakeholders to intuitively contribute to ideas to improve the design, which were discussed through meetings with the stakeholders, particularly with the director of the LRS. These insights in design improvements and initial generalization, combined with the literature study and the current situation, aided the researcher in answering the central research question.

STAGE 1: THE PROBLEM FORMULATION

"When asked what he would do if given one hour to save the world, Einstein replied that he would spend 55 minutes to understand and formulate the problem, and 5 minutes to execute the solution." Arthur (2013) uses this anecdote to clarify that defining the problem is the most important step toward designing a solution for complex business problems that require process changes and software development. In this stage, the problem was analyzed in more detail in order to design a suitable alternative to reduce the lack of local digital resources in a way that promotes the sustainable development of a SIDS such as Curaçao. The first three research questions are addressed in this stage, each in its respective chapter according to the framework discussed in chapter 2.

Chapter 3 describes the situation of the stakeholders concerning local development and management of a digital repository and its digital resources. Information gathered from conferences, interviews with the internal stakeholders and the first advisory board meeting resulted in a synthesized overview of the needs, desires, requirements and challenges, as well as collaboration opportunities to address these challenges. The common challenges encountered were regarded as a practice-inspired problem and a knowledge-creation opportunity (Sein et al., 2011), and served as a guide for literature research.

Chapter 4 discusses theories applicable to the situation described in chapter 3, which serve to inscribe theoretical elements in the initial design of the artifact (Sein et al., 2011). This was accomplished by defining concepts of and requirements for a robust digital repository for higher education, as well as aspects that need to be considered for the sustainable development of a SIDS.

By analyzing the gap encountered between the current situation and the literature study, and searching for solutions together with experts in the field, chapter 5 provides initial requirements and an initial design for a digital repository infrastructure.

3. The Current Situation of the Stakeholders

This chapter discusses the results of the first research question:

What are the challenges to establish a digital repository with Dutch Caribbean resources, based on the current situation of the stakeholders?

A study of the stakeholders at the beginning of the project provided information to draft the situation at the start of the project. The first section elaborates on the USONA project, to provide insight into the goals of the initial funding institution. The second section presents a summary of the empirical data that was acquired through interviews with the internal stakeholders at the UoC that identifies their needs, desires and requirements concerning a digital repository and digital resources. Given the fact that a collaborative approach was perceived as essential to overcome the challenges, the collaboration opportunities with the external stakeholders are also mapped here. The third section provides the view of the external stakeholders by summarizing the information obtained at conferences and of the first advisory committee meeting. The last section presents a tabular overview of the situation of the stakeholders to provide an answer to the first research question.

3.1 The Project 'LOFO Project Digitaal Lesmateriaal (USONA 085)'.

The project was funded by the USONA program "Onderwijs & Jongeren" to assist the foundation education in coping with the need of local resources, and also to safeguard the quality of the teacher training education program for foundation and vocational education (USONA, 2007). The LOFO was thus of special importance in this project. The objective of the project 'LOFO Project Digitaal Lesmateriaal (USONA 085)' – a section of the USONA Project 2004171 called 'Beleids- en Invoeringsplan Nieuw Opleidingsonderwijs', – was to

develop a sustainable basis for the local development of digital educational resources (Groenewoud et al., 2012). The project had the following practical objectives

- A. Digital source material: set up a database for the storage of digital source material, which was suitable for developing digital educational materials;
- B. Platform for digital educational materials: set up a Web environment within which digital learning materials could be saved and shared;
- C. Professionalization of LOFO: set up a format for the arrangement of digital learning material and provide training.

To avoid that the project was being conducted in isolation, and to obtain input of external stakeholders, an advisory committee was formed consisting of internal and external stakeholders. The advisory committee included important institutions concerned with development of local culture, education and research. Their task was to provide input in major decisions before, during and after the development of the prototype repository, and to validate the results during the USONA project. The internal stakeholders of the UOC were the LRS and FoA, which were technically supported by the ICTS^{xxvi}. The LRS represented libraries in general and academic libraries in particular, and the FoA represented teacher training programs and institutions offering tertiary education. The external stakeholders were: the Ministerie van Onderwijs, Wetenschap, Cultuur en Sport (MOWCS)^{xxvii}, which represented government policy makers at the Ministry of Education; the Fundashon Planifikashon di Idioma (FPI)^{xxviii}, which represented the cultural institutions and developers of educational books and resources for all levels of education, particularly those in the local vernacular Papiamentu; the Fundashon Material pa Skol (FMS)^{xxix}, which represented institutions developing all types of local educational resources; and the Rooms Katholiek Centraal Schoolbestuur (RKCS)^{xxx}, Dienst Openbare Scholen (DOS)^{xxxi} and Vereniging

Protestant Christelijk Onderswijs (VPCO)^{xxxii}, which represented the three main school denominations for primary and secondary education.

3.2 The Internal Stakeholders.

This section provides the goals, challenges and collaboration opportunities of the internal stakeholders at the UoC, namely the FoA the LRS and the ICTS.

3.2.1 The Faculty of Arts at the University of Curaçao.

The FoA at the UoC provides teacher training programs for primary school teachers through the LOFO program. The LOFO representatives declared that there was a significant shortage of local teaching and learning materials as well as source materials to develop these educational resources. The lack was experienced the most for the education area MNT (Mens, Natuur en Techniek), which deals with nature, the education area M&M (Mens en Maatschappij), which deals with people and society, and also for the local vernacular Papiamentu, which is a segment of the language education area TGC (Taal, Geletterdheid en Communicatie). A great deal of the educational material that is used in primary education on the island originates from the Netherlands, which is often inadequate for teaching subjects that require a local perspective in order to be relevant, and to adequately connect with the perception and experiences of the pupils.

The LOFO teachers and pre-service teachers need to develop these materials themselves, which requires much of their time. The LOFO students arbitrarily make some digital materials, using mainly Word and PowerPoint, but these are not collected or stored structurally for re-use or to be used as an example to others. Through participation in a local competition, the students acquired an Interactive Whiteboard (IWB), but this is not being used optimally due to the lack of knowledge on how to operate it. The LOFO teachers

indicated that the ICT tools they use are mainly beamers, laptops and CDs that accompany the books and methods that they use.

Due to the lack of experience and skills working with digital educational resources and digital repositories, the dean of the FoA could not specify requirements for the repository. The dean declared that there is a need at the faculty for a structural introduction of ICT, and that the FoA is lagging behind in this aspect. The dean remarks that to close the gap, the faculty team needs to:

- get to know what the recent ICT developments in education are;
- acquire the ability to make didactically appropriate digital learning resources;
- have digital resources readily available to use it in their courses;
- be able to model the use of digital resources to the students.

The LOFO staff identified several challenges for a successful implementation of digital technology in the classroom, such as:

- the lack of knowledge, experience and skills do this on their own;
- the lack of time to participate in training sessions to acquire these skills;
- the lack of a teacher with adequate background to be assigned the role to pull the necessary innovation;
- the use of ICT is not integrated in the teacher training program and there is no space in the curriculum to transfer this type of instruction to their students;
- the great amount of guest lecturers makes it difficult to introduce ICT structurally in their program;
- the lack of possibilities for using ICT tools and infrastructure on the LOFO premises, i.e. a multi-functional room where students can develop learning materials using equipment such as computers, printers, scanners, and the like.

With introduction of the Special Educational Needs (SEN) program at the FoA, the staff need to work closely together with education systems in the Netherlands and also make use of their educational resources digitally. To this end, they obtained a SharePoint license. The FoA also participate in a collaboration program with other teacher training schools in the Netherlands through the Interactum^{xxxiii} initiative, which organizes the exchange of interns. The FoA, as all faculties at the UoC, use the Blackboard Learning Management System version 6, and are awaiting the introduction of a newer version with more collaboration and e-learning functionalities. Blackboard however is mostly being used as a "digital bulletin board" to post announcements, and the more interactive features to offer digital education, such as Discussion Board, have not been activated for use at the FoA.

3.2.2 The Library & Research Services at the University of Curaçao.

As the university library, the LRS supports the faculties in education and research by providing services and resources. These resources include, but are not limited to, books, scientific literature and e-journals. The book collection of the LRS originated from the Scientific Library of Curaçao that was established in 1959. With the realization of the "Bibliography of the Netherlands Antilles" and subsequent passionate collection of all publications that are relevant to the Dutch Caribbean islands, the Dutch Caribbean collection — also referred to as the "Antiana collection" — has gradually become one of the most valued collections of the LRS. The cultural significance of the Antiana collection for a nation in development is eminent. This collection contains valuable local resources, unique publications and rare books which can be used as educational resources in their own right, as source material to support development of other educational resources, or as sources that could be used for local research.

Part of this unique cultural heritage runs the risk of being lost through use or destroyed by other disasters, such as fire for example. An increasing number of the resources are starting to degenerate, mostly due to acidification of the paper and deterioration through use. To safeguard the collection from further damage, a part is stored separately from the other collections in a temperature-controlled environment for conservation, and patrons need to make reservations to access these resources. The fact that the Antiana collection is in analogue format and can be accessed and viewed only on the library premises contributes to the fact that this collection cannot be used to its full potential. One important way that the LRS desires to improve its service to its patrons as well as the whole community is by digitizing and placing this Dutch Caribbean collection in an openly accessible repository. This would improve the visibility and accessibility of this collection, but also preserve part of our cultural heritage.

The maintenance of the Antiana bibliography, the continuous collection of paper and digital-born material, and the preservation of these resources pose serious challenges for the LRS. The challenges for the LRS staff to support the development of a digital repository, provide digital source materials and guide the digitization activities, were grouped as follows:

- They do not have the necessary knowledge, experience, or skills to digitize the source materials or to develop or manage a digital repository.
- They aspire to digitize according to the standards of *Metamorfoze* (van Dormolen, 2012) to preserve the content in a sustainable way and maintain interoperability with international standards, but have no insight into these standards.
- They want to acquire the necessary knowledge, experience and professionalization by developing their own repository, but do not have a clear vision of what the repository should be able to do, what the risks and possibilities are, and how the interrelationships among the different stakeholders should be formalized.

- They expressed that the web environment and repository functionalities offered by dLOC provide an example of what they desire to offer to their patrons. The SobekCM platform, however, is in development and has not been used by institutions individually. It is not clear whether SobekCM is capable to fulfil the needs of all the stakeholders.
- They are understaffed and therefore need to make extensive use of part-time students for their regular activities. This makes it difficult to charge the current staff with the task to acquire the skills necessary to manage the innovation envisioned.
- The amount of digital resources that the UoC could produce would not be enough to warrant the time, effort and costs involved in creating a repository for the FoA and one for the LRS. A critical mass of digital resources needs to be acquired for the repository to be relevant. Harvesting and other possibilities need to be investigated.
- There needs to be an interaction among the LRS, the dLOC, the FoA and other stakeholders on the island, but it is not clear how this should be accomplished;
- There is no policy being used at the LRS to coordinate IT activities.
- Their IT needs are attended to by the ICTS department of the university, which is also understaffed.

The library has been a member of dLOC for some years, and upon her visit to Curaçao, Ms. B.Wooldridge, the coordinator of dLOC, declared that they also have started focusing on educational resources. After giving a demonstration of SobekCM, the software on which dLOC is based, Ms. Wooldridge indicated that the organization is moving towards making this software openly available for public use. She offered to provide assistance and customization to fit the needs of the LRS, should the LRS choose to use this software as the

basis for their repository. The LRS also forms part of the Dutch Caribbean Library Association (DCLA) ([March 2012, http://www.fobid.nl/node/72](http://www.fobid.nl/node/72))^{xxxiv} to foster cooperation with knowledge centres on the ODCT and Suriname. The goal was to promote the development and use of information, preservation of cultural heritage, and work efficiently on digitization and making resources available. The LRS has had a good relationships for many years with institutions in the Netherlands, such as the Koninklijke Bibliotheek (KB)^{xxxv}, the Koninklijk Instituut voor de Tropen (KIT)^{xxxvi}, the Koninklijk Instituut voor Talen- Land en Volkenkunde (KITLV)^{xxxvii}, and FOBID, which is a Dutch Library Forum.

The director of the LRS, Ms Groenewoud, envisioned a digital repository infrastructure consisting of two web platforms to reduce the lack of local educational resources, as shown in figure 4. The internal web platform would allow LOFO teachers and students to acquire source materials from a database of the LRS to develop teaching and learning resources. The educational resources could then be placed in the repository of the LOFO. Educational resources that the LOFO desired to make available and source material from the LRS that were not under embargo and belonged to the public domain could then be made available to others through a separate community web platform. Educational institutions and individuals of all levels could then use the community platform to access the local resources provided by the UoC as well as other sites, such as dLOC, to develop more local educational resources. These resources could then be added to the LOFO database and over time contribute to build a critical mass of local digital educational resources. The database of the LRS would then be managed by the LRS to adhere to its own cataloguing system for the source materials through a digital library.

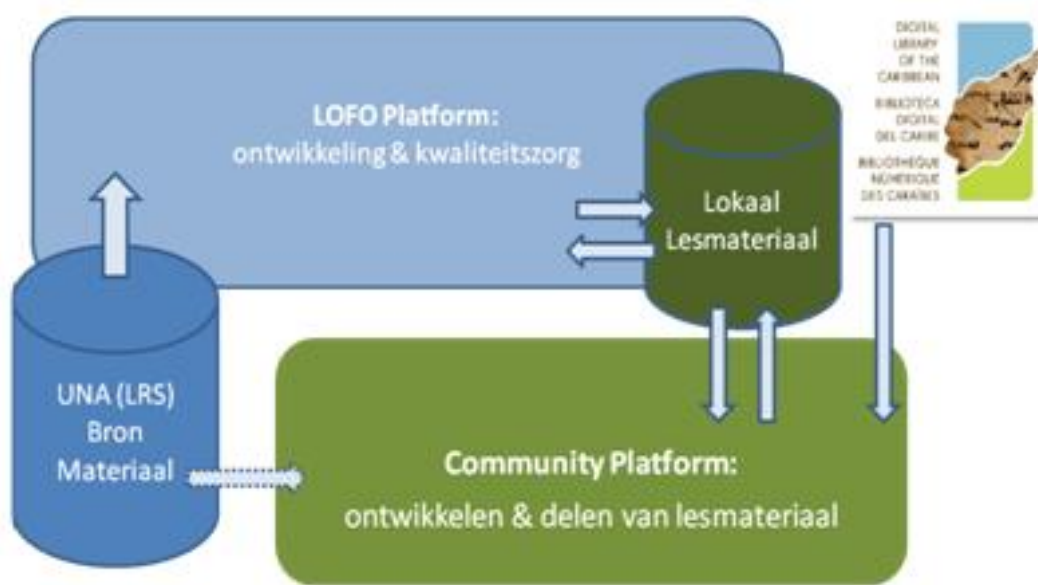


Figure 4: An initial collaborative digital repository design of M. Groenewoud

3.2.3 The Information & Communication Technology Services at the University of Curaçao.

The ICTS (previously known as CCUNA) is the department in charge of IT support for the whole university, and has been appointed as facilitator in the project. The UoC has aspirations to make e-learning and the use of ICT in education a more integral part of the curriculum, which is in line with the general trend that ICT is playing an ever increasing role in our society, education and research. Interviews with Mr. Schmidt revealed that to facilitate this, the ICTS was in the process of introducing the newest version of Blackboard together with the Blackboard Collaborate for all faculties. The ICTS was also in charge of the installation of Sharepoint, as part of the new collaborative program of FoA with educational systems in the Netherlands. Installation of these learning environments, in combination with all the other responsibilities for the UoC was placing enormous pressures on its personnel. The ICTS was considering the use of cloud services to outsource certain application and

server needs to reduce the workload. The following challenges were identified at the ICTS as the department appointed to support the technical part of the digital repository.

- The UoC has grown in student numbers, ICT facilities, buildings and employees, but instead of a commensurate increase there has been a reduction of ICTS employees, which is structurally understaffed.
- The ICTS has no experience with developing and managing digital repositories, or with setting up digitization projects.
- Neither the UoC management nor the ICTS have developed an integral coordinated information policy plan to guide the structured management of ICT usage within the UoC.

3.3 The External Stakeholders.

To obtain the view of external stakeholders on the project, the project plan was presented at two conferences during the pilot study, and at the first advisory committee meeting. Appendix 4 provides additional information on the external stakeholders of the advisory committee, more details on the conferences, and includes results of a small survey that was performed by the coordinator of the Digital Learning Resources Team.

The conference "Connect & Co-operate", with the subtitle "The road to a successful Information Society"^{xxxviii}, was organized in order to gather feedback from multiple stakeholders to continue with the development of a Master Plan for Curaçao as an Information Society, which had started a few years earlier. Another ICT related conference in that period, was "Integratie van ICT in onderwijs- en leerprocessen", objectives of the conference were to provide support in integrating ICT in the educational field. Presentation of the USONA project plan at the conferences brought forth a better view of the need for local resources, and the existing intricate problems to introduce ICT in all educational levels.

Policymakers that were present indicated that an ICT policy for education was being drafted, and the difficulties this entails. Attending the conferences also revealed many possibilities for other stakeholders to contribute with developing a local digital repository infrastructure in the future, such as the Knowledge Platform Curaçao, the Ministry of Economic Development^{xxxix}, Stimul-IT (now CITI)^{xl}, Bureau Telecommunication & Post (BT&P)^{xli} and Fundashon pa Inovashon di Enseñansa na Kòrsou (FIdE)^{xlii}.

During the first advisory committee meeting on January 17, 2013, the director of the LRS and the dean of the FoA explained the concept of the project to the external stakeholders. Mr. Korstjens explained that according to the jurisdiction, all the content would be freely accessible in the library building, but only resources free of copyright would be visible to all. The researcher showed some examples of digitized books and how to "browse" and search, and Mrs. Greijmans gave a presentation as to what the web environment could look like. Throughout the presentation, the stakeholders could interact and provide feedback on the concept. The following list contains the main comments concerning the needs and requirements of the stakeholders.

- Most educational materials are bought in the Netherlands and do not relate to the local environment; our unique birds and lizards for example are not discussed in these books.
- There is a real need for access to source material that relates to the local nature and cultural heritage. There is little information available on the internet, but these topics do appear in local flora and fauna books. Some history books also contain information on the local cultural heritage.
- A lot of local knowledge, cannot be accessed. If one does not know it exists or know where it is stored, it is difficult to locate the information. For many people, especially the younger generation, information that cannot be found on the

Internet does not exist for them. At the moment the content of the paper collection can only be found by the words in the metadata that are entered in the catalog system. If the publication is digital one has the added benefit to search in the text.

- There is a need for local educational resources, but due to the island's small scale, development of local resources is extremely expensive and the government is limited in developing these resources.
- The source materials at the LRS have metadata that are appropriate for books, but learning materials have specific metadata. In developing a web environment for LOFO, it would be useful to be able to search on a specific word, select content from a specific education area, or arrange it according to the curriculum.
- Facilitating teachers with an environment to set up their material also entails establishing conditions and procedures on the content that is uploaded.
- Copyright restrictions poses a problem, but if the work is placed in the university repository, authors would probably be more inclined to make it openly accessible.

The response of a small survey conducted by Ms Greijmans with school boards of the RKCS and the VPCO also indicated that a lot of time and money is being invested to improve the infrastructure, equipment and computer skills of the teachers. The managers indicate that there is insufficient local material, and that the availability and awareness of local resources is still too low. The language plays a vital role, but developing DER is considered complex because of several factors. The managers indicate that the novice teacher insufficiently ICT-proficient is, and expect that the LOFO will start providing more training concerning working with the digital whiteboard and development of DER, and therefore support the initiative to set up a repository. They do not have the expectation that the repository will be used spontaneously by the teachers, and mention promotion, support for the teachers and quality control as necessary steps for a successful introduction of the repository.

3.4 The Challenges of the Stakeholders to Establish a Local Digital Repository.

To be able to answer the first research question, table 1 summarizes and categorizes the stakeholders' needs and challenges for development and management of local digital resources, to provide an overview of the current situation. This table also lists the collaboration opportunities that could facilitate overcoming these challenges.

Empirical research revealed that the stakeholders have different goals and needs, but that the challenges are quite similar. There was generally no experience with development and management of digital resources or with a digital repository; no clear understanding of the goals, opportunities and risks of digital repository; no ICT policy in place at any level (including governmental), and many factors inhibiting structured introduction of ICT; no space in curriculum for ICT; an overall lack of human resources and consequently a lack of time for professionalization; many issues concerning IPR; a lack of local educational resources; difficulties to form a critical mass on individual level; and concerns of sustainability of the project. Many of these challenges stem from the limitations of being a SIDS, making it necessary to develop an infrastructure that takes the local situation into consideration. These common challenges were used to serve as a practice-inspired problem and opportunity for knowledge creation.

Sth.	Goals, Needs and Desires	Challenges	Collaboration
Foa	<ul style="list-style-type: none"> • ICT knowledge and capacity to close gap • Digital teaching and learning resources that can be used for primary and tertiary education • Local source material • Teachers that can model ICT usage • Easy way to store and manage digital resources for use and re-use in their courses 	<ul style="list-style-type: none"> • Need help to introduce ICT in education • Understaffed and no time for professionalization • No experience digital development • No experience digital repository • No ICT policy • No ICT capacity, knowledge • No Space in curriculum for ICT • Too many guest lecturers • No ICT infrastructure • Lack local educational resources 	<ul style="list-style-type: none"> • Interactum • Dutch high schools and universities
LRS	<ul style="list-style-type: none"> • Become a hybrid library with own digital repository, separate from FoA with own cataloguing system • Build capacity to digitize Antiana book collection according to Metamorfoze guidelines. • Repository with functionalities similar to dLOC • Users with different privileges (for master files) • Crawling and harvesting to reach critical mass • Restrict access to resources with IPR • IPR free resources for the whole community and easy transfer to dLOC • Searches: simple, text, advanced • UoC output like theses in the repository, researches from databases and harvested collection • Other stakeholders and schools can contribute to and use content • Investigate if SobekCM is appropriate 	<ul style="list-style-type: none"> • Understaffed • No experience digitization • No experience digital repository development / management • No ICT policy • IPR issues • No critical mass • Limited amount of local resources • Uncertainty concerning coordination and collaboration 	<ul style="list-style-type: none"> • dLOC • KIT • KITLV • KB
ICTS	<ul style="list-style-type: none"> • Integration with Blackboard, Sharepoint • Provide e-learning opportunities 	<ul style="list-style-type: none"> • Understaffed • No experience digitization • No experience digital repository development / management • No ICT policy 	<ul style="list-style-type: none"> • BPNP • Knowledge platform • CITI • SURF
External	<ul style="list-style-type: none"> • Specific tags for DER • Collaboration • DER in Papiamentu and Dutch • Business case • Develop prototype • KB, newspapers • Digitization source material • Education For All goals • Information Society 	<ul style="list-style-type: none"> • No experience with dig rep • No experience digital repository development / management • No experience digitization • Limited use/possession of digital resources • Sustainability of the project, follow-up, ownership, financial • Closure USONA • No ICT policy MOWCS 	<ul style="list-style-type: none"> • FIDE • CITI • Aruba, Bonaire • MOWCS • Min Econ Dev • Fide • CITI (Stimulit) • FIU

Table 1: Goals, Needs, Challenges and Collaboration opportunities of the Stakeholders

4. Digital Repositories and Sustainable Development of SIDS

This chapter discusses the results of the second research question:

What are the requirements for a digital repository from the perspective of the sustainable development of a SIDS, based on information found in literature?

Based on the common challenges and requirements encountered in chapter 3, a framework of theories on digital repositories for SIDS is presented here, according to the method discussed in section 2.6.1. The first section provides relevant repository concepts for educational institutions, focusing on resources for education, research and culture. The second section provides trends and requirements that are essential to obtain a robust digital repository. Given the fact that SIDS are required to perform in a global market, notwithstanding their limitations, the third section examines factors that are considered essential in SIDS to overcome their barriers for sustainable development. To answer the second research question, the fourth section concludes with an overview of important factors that need to be considered when designing a digital repository infrastructure for SIDS,

4.1 Digital Repositories and Their Digital Resources.

This section provides the concept and background of digital repositories, and focusses those used by libraries, educational institutions and universities.

4.1.1 Digital Repositories.

A digital repository is part of a Digital Asset Management (DAM) system. Sawarkar (2001) defines DAM as "a set of processes that when working together give a *system, repository, and enabling workflow process* for managing publishable media content such as images, illustrations, documents, audio, video and physical (non-digital) elements". The asset

repository has many functions, such as "organizing, viewing, indexing, abstracting, translation, searching, browsing, archiving, purging, reviewing, revising, versioning, tracking, and auditing of files", but also "uploading and downloading files or viewing information anywhere on the net, depending on the access permissions, and automatic email notifications" (Sawarkar, 2001). The purpose of the asset repository according to Sawarkar (2001), is to provide "easy querying, asset identification, metadata retrieval, asset conversion, and export into publishing applications".

4.1.2 Digital libraries.

With the introduction of the Internet in the mid-1990s, digital libraries emerged as one of the efforts of academic libraries to disseminate information and to preserve and distribute historical and cultural heritages, mainly for the scholarly community (Seaman, 2004). The IFLA/UNESCO Manifesto for Digital Libraries (2012) describes a digital library as

"an online collection of digital objects, of assured quality, that are created or collected and managed according to internationally accepted principles for collection development and made accessible in a coherent and sustainable manner, supported by **services** necessary to allow users to retrieve and exploit the resources" (p. 1)

The IFLA/UNESCO Manifesto (2012) also states that the digital library should "bring together collections, services, and people in support of the full life cycle of creation, dissemination, use and preservation of data, information and knowledge", and describes its mission as to "give direct access to information resources, both digital and non-digital, in a structured and authoritative manner and thus to link information technology, education and culture in contemporary library service".

Digital objects that reside in repositories are either digital born or have been made digital. The Federal Agencies Digitization Guidelines Initiative^{xliii} (FADGI) makes a distinction between digitizing as "the creation of digital objects from physical originals" and digitization as a process that includes "selection, assessment, prioritization, project management and tracking, preparation of originals for digitization, metadata collection and creation, digitizing, quality management, data collection and management, submission of digital resources to delivery systems and into a repository environment, and assessment and evaluation of the digitization effort" (FADGI, 2009).

Digitizing for the purpose of preserving and/or replacing the original object must adhere to higher requirements than for publishing on a website. Digital preservation has been described as the " managed activities necessary: 1) For the long-term maintenance of a byte stream (including metadata) sufficient to reproduce a suitable facsimile of the original document and 2) For the continued accessibility of the document contents through time and changing technology" (Jantz & Giarlo, 2005). Van Dormolen (2012), for example, who developed the *Metamorfoze* guidelines that the LRS desires to adhere to, has specified many technical details in his guideline for preservation of analogue resources, making it necessary to have special scanners and specific skills.

To make the resources discoverable in a repository it is crucial to tag them with appropriate metadata, which is often defined as "data about data". According to Hunter (2003), metadata also provides "the underlying foundation upon which digital asset management systems rely to provide fast, precise access to relevant resources across networks and between organizations". Due to its broad support, traditional repositories often use the Dublin Core^{xliv} metadata initiative.

Teaching and learning materials are increasingly being adopted in digital libraries and digital archives, and some consider that providing learning materials for all levels of schools

is one of the most important roles of electronic libraries (Tsai, Hwang, Tsai, Hung, & Huang, 2012). This is in accord with UNESCO's view of the digital library as a tool to bridge the digital divide, given their view that "equal access to the cultural and scientific heritage of mankind is every person's right and helps promote learning and understanding of the richness and diversity of the world", for current and future generations (IFLA/UNESCO, 2012). The pedagogical characteristics of educational resources, however, make it challenging for libraries to adopt them in traditional repositories (Jisc Infonet, 2010). One of the preferred ways to open the learning resources to the use of students and teachers therefore, has been to place them in learning object repositories (Porter, Curry, Muirhead, & Galan, 2002, p. 5).

4.1.3 Learning Object Repositories.

Learning Object Repositories (LORs) appeared in the same period as digital libraries. According to Ternier (2008) LORs are repositories that manage learning objects and/or their metadata, and he asserts that there is no difference between LORs and digital libraries. Providing educational resources through LORs is considered essential for the development and adoption of ICT in education, which is why many educational administrations and institutions create and maintain such repositories (Monge, Ovelar, & Azpeitia, 2008).

Separating the learning resources into "chunks" of learning objects is regarded as a method to increase the efficiency and effectiveness of the use and reuse thereof. The Learning Technology Standard Committee^{xlv} workgroup at the Institute of Electrical and Electronics Engineers (IEEE) defines learning objects as "any entity, digital or non-digital, that can be used, reused or referenced during technology-supported learning" (LTSC WG12, 2002). The breadth of possibilities this definition allows has caused a proliferation of adapted definitions, but Friesen (2009) explains that which is highlighted by each definition, namely "modularity as a technological and design attribute for the object and its content, emphasizing

the 3 “self-contained”, “building block” or ”object-oriented” nature of the technology”. This research adheres to digital resources, thereby adhering to Wiley's (2002) definition of learning objects, being "any digital resource that can be reused to support learning".

According to the Organisation for Economic Co-operation and Development (OECD), digital learning resources have the potential to catalyze systemic innovation and professionalization, and contribute to modern teaching and learning practices (<http://www.oecd.org/edu/ceri/ceri-digitallearningresourcesassystemicinnovation.htm>). With the advancement of OER and open licensing, which is built within the existing framework of IPR (UNESCO, 2012), more and more resources are becoming freely available for education at all levels, with exemplars such as Khan Academy^{xlvi}, Merlot^{xlvii} and OER commons^{xlviii}. OER can contribute significantly to: development and improvement of curricula and learning materials; course design; interactive contact sessions with and among students; quality teaching and learning materials; assessment tools for diverse environments; and links with the world of work (Commonwealth of Learning & UNESCO, 2015, p. 3). The Dublin Core which, as noted earlier is used as the metadata standard, lacks however specific attributes to describe the pedagogical perspective of a learning object (Koutsomitropoulos, Solomou, Papatheodorou, & Alexopoulos, 2010). Several other metadata standards were therefore adopted in LORs to address this issue, such as IEEE Learning Object Metadata^{xliv}, IMS Metadataⁱ, CanCore^{li} and Advance Distributed Learning Initiative (ADL SCORM)^{lii}.

In contrast to early, primary and secondary education, much research can be found on repositories designed for higher education and research, which are aimed to advance knowledge and provide open access to a wider community. Armbruster and Romary (2010) proposed four ideal types for repositories for higher education and research: Subject-based repositories, Research repositories, National repositories and Institutional repositories (IRs). When discussing digital repositories in literature, authors most often refer to IRs.

4.1.4 Institutional Repositories.

IRs are based on principles that were previously established for digital libraries (Candela, Castelli, & Pagano, 2011), and appeared in the early 2000s. IRs contain resources of an institution, often referring to the output of a university. Lynch (2003) defines an IR as "a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members". IRs started out as a countermeasure to the commercial publishing power, aiming to promote free exchange of research to a wider community by managing, preserving and providing open access to scholarly publications of the universities (Furlough, 2009). Because of its open nature, the IR "expands access to research, reasserts control over scholarship by the academy, increases competition and reduces the monopoly power of journals, and brings economic relief and heightened relevance to the institutions and libraries that support them" (Furlough, 2009). IRs also provide services such as long-term preservation, organization, access and distribution of the intellectual output of a single or multi-university community (Furlough, 2009; Lynch, 2003).

IRs are often managed by university libraries and/or supported by the IT department (Duncan, 2004). Universities are considered to be the institutions that should produce, transmit and disseminate scientific knowledge and professional know-how through their IRs, through which they have an important role in the process of developing 21st century citizens in the current information and knowledge era (Vrana, 2010). IRs are increasingly adopting different types of digital assets, functions and roles. According to Armbruster and Romary (2010), an IR that captures the whole output of a university can be viewed as a showcase to impress others by displaying online open access to its collection, as well as a library, holding an institutional collection, research results and research data, works of qualification, artistic creativity, teaching and learning materials.

4.2 Trends and Requirements for Digital Repositories

With the introduction of digital libraries in the mid-1990s, a new way to disseminate information and to preserve and distribute historical and cultural heritages emerged for the scholarly community (Seaman, 2004). In the same period, LORs also appeared due to the importance of digital educational resources, but, as noted earlier, were difficult to include in traditional repositories. IRs appeared in the early 2000s, aiming to promote the free exchange of research to a wider community, and relied mostly on self-archiving by individual scholars, but most repositories failed to reach the desired level of content volume that was anticipated (Furlough, 2009; Jisc Infonet, 2010; Seaman, 2004). Around 2004, Seaman (2004) started identifying trends of aggregation, integration, and openness in digital libraries, such as Courseware systems and the Library; Authentication as an Enabling Technology; Digital Archiving, Curation, and Preservation; and Digital Production. The increasing collaboration and sharing of information in and among institutions provided many benefits, and gave rise to the need for interoperability and integration among repositories and other systems (Candela, Castelli, & Pagano, 2011; Jisc Infonet, 2010). In the same period as Seaman, Duncan (2004) also reported on trends of convergence in libraries, repositories and web content management systems to improve system interoperability, user experience, and communication across organizational lines. Convergence is considered by Duncan (2004) as an ideal showcase for cooperative planning and smart IT investment which compels and opens new doors for collaboration among stakeholders, thereby creating a greater understanding of their roles in the repository. Convergence is described by Duncan (2004) as "the natural (or in some cases, planned) evolution of multiple systems and multiple services into a single, holistic environment, one completely accessible from the friendly neighborhood web browser". Benefits include reduced duplication of effort of an institution's valuable, and increasingly expensive digital resources, allowing them to become better stewards of institutional funds,

and improved faculty, instructor and student utilization of the resources Duncan (2004). Furthermore, the IFLA/UNESCO manifesto (2012) notes that libraries are making a shift from managing the products and the output of research and scholarship, to facilitating the process of scholarship, teaching, and research that result in those products, and that repositories and digital data management should be functionally integrated into the mission and services of the library. The manifesto suggests a collaborative digital library of public and research libraries must be able to interoperate and is seen as a way to form a network system of digital information to accommodate the needs of the Information Society (IFLA/UNESCO Manifesto, 2012)

Jisc Infonet (2010) describes integration as "the process of setting up your repository to work with other systems, so that data can flow from one system to another" (p. 13), and defines three types of integration: integration with external systems to get items into a repository, integration with systems to get items out of a repository, and integration with systems that provide services to a repository. To allow information to flow between interoperable systems, protocols and metadata standard are vital. Inclusion of OER in repositories, for example, provides numerous benefits for researchers, scholars, the institution and the whole community (Jisc Infonet, 2010) and is becoming even more important according to the recommendations defined in the 2012 Paris OER Declaration (UNESCO, 2012) and their implications (Pawlowski & Hoel, 2012). Learning objects, however, need other types of metadata elements to describe them effectively if they are to be included in traditional repositories. To avoid the problems of using only one metadata schema, application profiles were introduced (Koutsomitropoulos, et al., 2010). Duval, Sutton and Weibel (2002) define an application profile as "an assemblage of metadata elements selected from one or more metadata schemas and combined in a compound schema", which allows

principles of modularity and extensibility in order to comply with the functional requirements of an application without losing interoperability with the original base schemas.

The increasing collaboration, integration and convergence in and among institutions resulted in more integration among university IRs to overcome barriers in the need for efficiency in searching, and data sharing among universities, (Monghole, 2015), among other institutions like museums and archivists, among libraries (DISC), among educational resources (Coursera^{liii}), among universities, research institutes and research projects, (NARCIS^{liv},) among heterogeneous resources / (Delpher^{lv}), and among institutions of the higher and lower education, integrating digital educational resources and methods (Wikiwijsleermiddelenplein^{lvi}). Federated search was another development, which enables a more integrated approach with a single interface that provides “support for finding items that are scattered among a distributed collection of information sources or services, typically involving sending queries to a number of servers and then merging the results to present in an integrated, consistent, coordinated format” (Baeza-Yates & Ribeiro-Neto, 1999).

Collaboration, integration and convergence gave rise to several types of repositories, such as inter-institutional repositories (Baker, 2006; Wooldridge, Taylor, & Sullivan, 2009), multi-institution repositories (Awre & Cramer, 2012) and supra-institutional repositories (Donovan & Watson, 2008; Hitchcock, 2011). The Digital Assets Repository of Bibliotheca Alexandrina, for example, is an IR that also includes "the full lifecycle of a digital asset: its creation and ingestion, its metadata management, storage and archival in addition to the necessary mechanisms for publishing and dissemination", while integrating different sources of digital objects, metadata and applications (Mikhail, Adly, & Nagi, 2012, p. 8).

Digital repositories, however, are difficult to develop and, once in place, it is challenging to manage them and to acquire structural deposits due to various technical, economic, social, cultural, political, legal and human barriers (Castro, André Ferreira, &

Andrade, 2011; OECD, 2007; Pawlowski and Zimmermann, 2007). Integrating features makes it even more challenging. Developing and maintaining a digital repository requires thorough preparation and ongoing responsibilities, both of which require numerous aspects to be taken into consideration on management and technical levels. The RSP combined the knowledge and best practices of seven years of practice with institutional repositories on a comprehensive site with information on what one should know before and after establishing a repository ^{lvii}. Appendix 8 provides a checklist in the form of questions that need to be considered before setting up a repository for the categories: Before you start; Setting up a repository; Policies and legal issues; and Resourcing for sustainability. The RSP also developed an info kit for digital repositories, with valuable information on management and technical framework (Jisc Infonet, 2010). Table 2 provides a list of the management and technical issues.

Universities are required to increase the use of technological resources, often with reduced budgets, and knowing the most critical factors to enhance technological innovation efforts maximizes the chances for success (Dennison, 2014). The Higher Education Critical Success Factor Innovation Model (Dennison, 2014) provides a list that faculty and IT leaders consider most critical factors in relation to technology innovation, adoption, and diffusion. In order of relevance, these 17 factors are: Professional development and training; Executive- and administrative-level support; Skilled technical support; Stakeholder involvement; Skill level and commitment of faculty/students; Innovative culture/collaborative environment; Resources and financial support; Incentives/rewards/time for innovation; Technology/infrastructure; Perceived value/addresses need; Ease of use; Quality; reliability; and flexibility of technology; Proven effectiveness; Strategic planning and governance; Project management; Enhances teaching and learning; and Cost efficiency.

Management Framework	Technical Framework
<ul style="list-style-type: none"> ▪ Planning Approach ▪ Business Case ▪ Key Stakeholders ▪ Identifying the Benefits ▪ Costs ▪ Risk Management ▪ Repository Policy Framework ▪ Strategic Policies and Mandates ▪ Operational Policies ▪ Preservation Policy ▪ Legal and Policy Framework ▪ Copyright ▪ Repository Steering Groups ▪ Staffing Repositories ▪ Training Repository Staff ▪ Advocacy ▪ Culture Change ▪ Core Message ▪ Advocacy Options ▪ Advocacy Activities 	<ul style="list-style-type: none"> ▪ Platform Choices ▪ Software Skills Needed ▪ Hardware and Operating Systems ▪ Installation and Customization ▪ Configuration and Development ▪ Pilot and Test Services ▪ Cover Sheets ▪ Integration ▪ SWORD ▪ OAI-PMH Harvesting ▪ RSS/Atom ▪ Registering Repositories ▪ Search Engines and Repositories ▪ Technical Maintenance ▪ Technical Policies ▪ File Formats ▪ Metadata ▪ Metadata and the Repository ▪ Metadata Types and Schemas ▪ Metadata Standards ▪ Application Profiles ▪ Subject Classification ▪ Workflows ▪ Submission Workflows ▪ Handling Embargoes ▪ Versions

Table 2: Management and technical framework (Jisc Infonet, 2011)

For a digital repository to be certified, it should comply to the specifications of a trusted digital repository. Reputable institutions as the Consultative Committee for Space Data Systems (CCSDS), the Research Libraries Group (RLG), and Online Computer Library Center OCLC state that a trusted digital repository must "provide reliable, long-term access to managed digital resources to its Designated Community, now and into the future" (CCSDS, 2011, p. 2-1; RLG-OCLC, 2002). RLG/OCLC (2002) specifies requirements, policies, practices, and performance that can be audited and measured, and meet detailed responsibilities. CCSDS (2011) provides a comprehensive discussion and explanation of each item in the categories Organizational infrastructure, Digital object management, and Infrastructure and security risk management, to facilitate the process of certification. The authors recommend each institution, however, to take these responsibilities into consideration, whether their repository is to be certified not. Appendix 7 provides a summarized version of these responsibilities.

4.3 Considerations For Overcoming Barriers in Higher Education in SIDS.

This section uses information found in literature to clarify the challenges in SIDS and identify possible principles that can be applied to overcome barriers in education.

4.3.1 International Conferences on Sustainable Development of SIDS.

In the Rio Declaration on Environment and Development (or Earth Summit) in 1992, the UNCED identified the SIDS as a special group of developing countries with unique challenges, stating that

Small island developing States, and islands supporting small communities are a special case both for environment and development. They are ecologically fragile and vulnerable. Their small size, limited resources, geographic

dispersion and isolation from markets, place them at a disadvantage economically and prevent economies of scale. (UNCED, 1992: 17.124)

In this document, named Agenda 21, Section G of Chapter 17 is dedicated to the sustainable development of small islands. This acknowledgement led to the first global conference on the sustainable development of SIDS, which resulted the Barbados Programme of Action (BPoA) in 1994. In the BPoA, short, medium and long-term goals for sustainable development were specified on national, regional and international levels (UN, 1994). The UN countries committed themselves to support the SIDS to overcome their limitations to attain sustainable development. The BPoA remained the blueprint for the several international conferences that followed to evaluate the progress and define further action (<http://www.sidsnet.org/milestones-timelines> provides a schematic layout).

The Mauritius Strategy for Further Implementation of the Programme of Action for Small Island Developing States (MSI) in 2005 (UN, 2005) and the recent SIDS Accelerated Modalities Of Action (SAMOA) Pathway in 2014 (UN, 2014) were two important global conferences that followed, to evaluate the progress, the constraints, and the need for support of SIDS to comply with the economic, social and environmental development aspects, which are considered the pillars of the holistic and integrated approach to sustainable development (Gomes & Hosein, 2014).

A National Report Of Curaçao was drafted for the first time by policymakers in relation to the SAMOA Pathway, where the focus was predominantly environmental issues (Ministry of Health, Environment and Nature, 2014). SIDS in general, and Curaçao in particular, have encountered several barriers to comply with these international agreements. As the focus of this thesis is on digital repositories in higher education, some barriers in this field will be studied in the next section in order to design a solution that takes these issues into consideration.

4.3.2 Barriers Encountered By Higher Education Institutions In Small States.

A study to overcome the barriers to implementation of the MSI showed that all the Caribbean SIDS agreed that on the national level they needed "support for investment to develop science, technology and innovation for sustainable development, with specific emphasis on research and development, in accordance with national interests and priorities as very important"(Gomes & Hosein, 2014, p.12). On international level, the results were:

Approximately 60 per cent of Caribbean SIDS thought that obtaining support from the international community to strengthen national statistical and information systems, including data collection and management, as well as analytical capabilities for decision-making would be an effective strategy to remove the barrier to availability of robust data. (Gomes & Hosein, 2014, p. 16)

In this sense also, a robust digital repository infrastructure that facilitates local research and modern ways to disseminate information is vital. Tertiary education institutions are important for the development of education, research and culture a country, particularly for SIDS. UNESCO's International Institute for Education and Planning (IIEP)^{lviii} produced a series of papers on the challenges of Tertiary Education in Small States^{lix}. Bhoendradatt (2011) notes in this series that increasing financial investments is necessary in order to comply with the social demand and the desire to participate in the knowledge economy forms a great challenge. According to Bhoendradatt (2011, p. 7), these financing challenges must be based on good financing decisions, sharing costs, diversifying income sources, creating new sources of income, building partnerships at home and abroad, and creating wealth beyond teaching and research. Martin and Bray (2011) elaborated on the scarcity of high-level academic human resources and challenges concerning accreditation, and in searching for solution notes that small states differ widely from each other – geographic location and

natural characteristics, the language communities to which they belong, the availability of resources, the sizes of their populations, and the levels of regional and other collaboration – and that therefore there is no one-size-fits-all solution. Martin and Bray (2011) indicate that two particular variables seem to be influential in small communities: population size and the level of regional collaboration. Separating these two variables in High and Low levels resulted in four quadrants (Martin & Bray, 2011, p. 275) and recommendations are formulated for institutions in each of the quadrants. The UN have committed resources to support SIDS in achieving sustainable development, and considers technology, information and collaboration on all levels as key enablers to reach these goals. The UN state that "ICTs offer a singular means for SIDS to address their development constraints of remoteness, lack of economies of scale, and limited human resources." (UN, & Department of Economic and Social Affairs [DESA], 2010, p.31). Chandra who also wrote in this series, states that respond to the pressures of globalization, developed countries have experienced an exponential growth in the use of ICT in education, but many developing countries and Small Island Developing States (SIDS) still lag behind (Chandra, 2010; Gaible, 2009). According to Chandra (2012, p. 5), factors inhibiting effective use of ICT in tertiary education in SIDS include "lack of top-level leadership; lack of adequate connectivity and its high price; inadequate financing; lack of national up-take from 'pockets of excellence'; lack of adequate secondary infrastructure; inadequate ICT technical manpower; ICT-illiterate teachers and educational conservatism and skepticism about the quality of education mediated by technology". Chandra (2012) indicates that capacity development is crucial to overcoming these factors that limit the use of technology in higher education in SIDS. This series provides support for tertiary education in small states on Planning in the context of globalization (Martin & Bray, 2011). Altbach, Reisberg and Rumbley (2009, p. 123) explain that globalization refers to the "broad economic, technological, and scientific trends that

directly affect higher education and are largely inevitable in the contemporary world.", and that internationalization, concerns the "specific policies and programs undertaken by governments, academic systems and institutions, and even individual departments to deal with globalization". Isabella (2014), who studied the accreditation process of (very small) Caribbean SIDS, particularly in Curaçao, states that "not only global standards need to be taken into consideration in an organization while aiming to achieve the organizational objectives, but also the local demands and needs are to be considered " (p. 53). Isabella (2014) explains that there is an interdependent relationship among national needs, demands and trends in higher education which cannot be separated from global developments. and that small communities should tie down global to local. Isabella (2014) proposes tying down global to local or, as others refer to it, glocalization (Patel & Lynch, 2013; Robertson 1994).

4.5 Digital Repository Requirements for the Sustainable Development of a SIDS

The literature study revealed that The UN PoAs have established that use of ICT and technology are crucial for SIDS in this advancing education, research and culture, and they emphasized that collaboration with stakeholders on all levels is essential for sustainable economic, social and environmental development. The collaboration, integration and conversion trends concerning repositories fit well in this endeavor, but literature also warns of the difficulties and risks that accompany these trends. Developing and managing a repository in higher education, however, requires institutional capacity to adhere to many management and technical requirements, critical success factors for technological innovation, and several and types of policies must be in place to fulfil the requirements for certification of a repository. The interdependent relationship between national needs, demands, and trends in higher education and global developments, makes it necessary for higher institutions to "tie down global to local" (Isabella, 2014).

5. A Preliminary Design of the Digital Repository Infrastructure

This chapter discusses the results of the third research question:

How can a digital repository infrastructure with Dutch Caribbean resources be designed for the stakeholders on Curaçao, given the challenges SIDS face to meet the requirements found in literature?

Through analysis of the problem – which corresponds to the first round of the reflection and learning stage in the ADR framework – the initial requirements and a preliminary design for a digital repository infrastructure were drafted in collaboration with experts in the field. The first section discusses the gap that had been identified between the literature study and the situation at the UoC. In the second section, an approach to design a solution is presented, based on information gathered from literature. The third section discusses the initial requirements and the preliminary design of a digital repository infrastructure to bridge the gap that was identified, by applying digital repository trends and recommendations for SIDS discovered in the literature, and capitalizing on the opportunities of SIDS. The chapter concludes with a discussion with answers to the third research question.

5.1 Analysis of the gap between the current situation and literature.

The UoC recognizes its pivotal role in capacity building, nation building, and sustainable development of the local economy and society, which relies heavily on human capital. (UoC, 2013, p.3). Providing excellent higher education and building knowledge and leadership on all levels is therefore a strategic key focus area for the UoC (UoC, 2013, p3). To be able to reach these strategic goals, digital resources and ICT capacity are crucial; both at the faculties that provide higher education, as at the library that facilitates research and knowledge dissemination. As the national university library, the LRS is the one in charge of

providing modern resources and services to support culture, science and education. With experience and skills in managing and cataloguing publications, and with a valuable collection of local and Dutch Caribbean publications, the LRS is the designated place to manage a digital repository, and to collect, preserve and provide open access to these resources. The IFLA/UNESCO Manifesto (2012) states that "Equal access to the cultural and scientific heritage of mankind is every person's right and helps promote learning and understanding of the richness and diversity of the world, not only for the present generation, but also for the generations to come", and Koutsomitropoulos et al (2010) state that "Digital repositories, used by universities, libraries, archives and other education specific institutions, have the responsibility for efficiently handling learning objects".

On the faculty level, the LOFO has a vital role in providing modern local education as the teacher training institution for primary education. In its declaration on cultural diversity UNESCO states in Article 5 that "all persons are entitled to quality education and training that fully respect their cultural identity " and notes that "culture is at the heart of contemporary debates about identity, social cohesion, and the development of a knowledge-based economy" (Stenou, 2002, p.4). It is at the LOFO where the next-generation teachers are being formed to educate the next-generation citizens, who are expected to be digitally proficient and with high patriotic values. Mishra and Koehler (2006) state that digital technology can no longer be ignored in developing educational resources and suggested incorporating technology, pedagogy and content in teaching resources. Teaching with technology is required in education, but it is considered even more critical for institutions that teach pre-service teachers (Katić, 2008).

There is a gap, however, regarding what is encountered in literature and the situation at the UoC. Neither the LRS or the FoA are using technology in higher education in a manner that concords with the information found in literature. Furthermore, there is no digital

repository to facilitate the use and management of digital resources. The literature study revealed that developing and managing a repository requires institutional capacity to adhere to many management and technical requirements. The long list of challenges encountered at the different stakeholders made development and management of the initial digital repository infrastructure a difficult task. The literature study also revealed that SIDS needed to collaborate on multiple levels to keep track with global developments, and yet remain unique.

Analysis of the problem revealed that SIDS must adhere to seemingly disparate requirements when addressing their challenges to fulfill to the requirements for sustainable development. They need to design unique local solutions (to guarantee that their culture is safeguarded and that their unique situation and limitations are being taken into consideration) and design solutions that conform to the globalization process while collaborating and forming partnerships on national, regional and international levels (to overcome their economic, social and environmental limitations).. To be able to "tie down global to local", a proper approach to design a digital repository infrastructure needed to be explored.

5.2 An approach to address the challenges found in the current situation.

In discussing issues on technology in education, Borko, Whitcomb and Liston describe "wicked problem" as one that contains "a large number of complex variables—all of which are dynamic, contextually bound, and interdependent" (2009, p.3). Lane and Woodman. (2000) warn that "large, complex and long projects suffer from requirements volatility", and state that many (development) projects often fail to recognize the need of flexibility by "demanding fixed requirements at the start of a project". Roberts (2000) states that "Wicked problems cannot be tackled by the traditional approach in which problems are defined, analysed and solved in sequential steps", and proposes three strategies to cope with, or to tame wicked problems: Authoritative, by vesting the responsibility for solving the

problems in the hands of a few people; Competitive, by pitting opposing points of view against each other and choosing the best one; and Collaborative, by engaging all stakeholders in order to find the best possible solution for all stakeholders. Rittel (1972) hints at a collaborative and intuitive approach; noting among the first three points that "The knowledge needed in a planning problem, a wicked problem, is not *concentrated in any single head*"; "... *nobody wants to be planned at*"; and "The more control you want to exert and the better founded you want your judgment to be, the more intuitive you have to be" (p. 394, 395). Although these authors were mostly referring to construction planning challenges, this collaborative and intuitive approach seemed appropriate to apply to the interrelated challenges of introducing ICT in an institution located on a SIDS. There were also several organizations that had shown intentions to directly or indirectly support or collaborate with this project in the future, making a collaborative approach a requirement to face these challenges. This research therefore defined initial requirements collaboratively first, as a basis to propose a preliminary design. The design was improved through iterative development of a prototype. Adaptations of the prototypes and requirements were based on observation of the stakeholders, intuition and local developments.

5.3 Designing a Preliminary Initial Digital Repository infrastructure.

The initial requirements were based on a collaborative approach with experts. The first section presents an initial list of user requirements, which was drafted from information acquired from chapter 3. This is followed by the formulation of the initial functional and non-functional requirements in collaboration with the coordinator of Digital Learning Resources Team, and the IPR that applies to the publications and digital educational resources, based on information from the copyright expert at the LRS.

5.3.1 The Initial list of User Requirements.

Development and management of local digital resources for the LRS and the LOFO involved different issues, such as development of a repository for source material, a repository for teaching and learning resources, introduction of ICT in education, digitization of source material and development of digital learning resources. Compliance with the expectations and user requirements was of great importance for the acceptance of the design. Most stakeholders, however, had a vague idea of the repository infrastructure, and some did not have any idea at all due to the lack of experience working with repositories. The initial user requirements were drafted in table 3, from the goals, desires, needs, challenges and opportunities identified in chapter 3, and using the concepts that were defined in chapter 4.

5.3.2 The Initial Functional and non-Functional Requirements.

The asset repository should comply with the DAM functions as reported by Sawarkar (2001) in section 4.1. Since two repositories were being considered, different sets of requirements were defined; one for the LOR and one for the IR. For the LOR, Mrs. Greijmans advised using the required metadata fields from NL-LOM, which is the IEEE LOM version used in the Netherlands. Since the education system in Curaçao is similar to the Dutch, using the NL-LOM fields would enable use of metadata specific to educational resources, and ensure compatibility with repositories in the Netherlands. Appendix 9 provides an overview of all the IEEE-LOM elements (Koutsomitropoulos et al., 2010), and those of the NL-LOM (Frijns & Roes, 2011). The researcher, together with Miss Greijmans, adapted an existing list of LOR requirements (Texas Center for Digital Knowledge College of Information, 2010), and used the Functionalities - Usability - Reliability - Performance - Supportability (FURPS) model as a method to classify the functional and non-functional quality attributes (Eeles, 2005;. Grady & Caswell, 1987).

Initial user requirements of internal stakeholders
Institutional Repository; a Digital Library with Institutional Source material
Institutional resources: theses, publications, courses, streaming, etc
Cultural resources: digitized books, oral history, etc.
Research support: local research articles, data sets, etc.
Harvest local source material by using web crawlers
Separate library repository with own cataloguing system
Digitization management and workflow support
Offers possibilities available at dLOC (e.g. full-text search, advanced search)
Intellectual Property Rights management; hides copyright protected files
All files (with or without copyright protection) visible on library premises
Manage digitization workflow, master files and derivatives of master files
Only authorized person can have access to master files
Learning Object Repository; a Digital Library with Educational Resources
Digital learning resources of different levels
Digital teaching resources of different levels
Search on education / course-specific metadata
External schools can contribute to content
Draft and final versions control
Multiple languages; Papiamentu and Dutch are important
Simple, clear, easy, highly visual and user-friendly layout
Provides help, links, templates
Multiple types of resources (lesson plans, complete courses)
Heterogeneous file types: text, pictures, video, audio, presentations, etc.
Collaboration Possibilities with External Stakeholders and the Community
Collaboration with multiple external stakeholders (schools)
Collaboration with multiple internal departments: LRS, other faculties.
Integration with current systems
Shares resources with community (downloading multiple stakeholders)
Obtains resources from community (uploading multiple stakeholders)
Deposit resources at dLOC
Obtain critical mass through harvesting, crawling the net
Digitization according to Metamorfoze standards for interoperability and preservation

Table 3: Initial User Requirements Based on the Current Situation Stakeholders

Combined with the Must - Should - Could - Would (MOSCOW) technique used in agile software development projects, the importance of each requirement was indicated (Kosztján & Kiss, 2010; Basili, Heidrich, Lindvall, Münch, Regardie, Rombach, ... & Trendowicz, 2014). Table 4 shows a list of the requirements and Table 5 provides an explanation of the MOSCOW obligations. Appendix 10 contains the complete specifications of the initial functional and non-functional requirements for the LOR. For the IR, the researcher used the requirements that were formulated by the Digital Initiatives Subcommittee (DISC) after an investigation to identify the current and future needs of the digital libraries that formed part of the Florida Council of State University Libraries (CSUL)^x for a collaborative digital library (DISC, 2011). These initial digital library requirements are shown in Appendix 11, and are divided into Architecture; Content; Metadata; Ingest; Search and Retrieval; Display and Use; Export; Management and Reporting; and Budget.

5.3.3 Intellectual Property Rights for Digital Resources.

For requirements concerning IPR, local copyright expert Mr. I. Korstjens constructed a legal framework containing policy and procedures for source material and digital educational resources for the project (Korstjens, 2013). This section contains information found in this framework. The copyright of Curaçao was formed by the Author's Regulation Act (Auteursverordening) of 1913 and the Berner Convention act of Rome in 1928, supplemented by local, Dutch, and international jurisprudence. In contrast to the Dutch copyright laws, the local laws have not been adjusted to the technological developments and to subsequent copyright treaties through the years. For an assessment of what is permissible in the case of unregulated situations, the Dutch copyright laws in combination with international copyright treaties should be consulted.

FUNCTIONALITIES	O	USABILITY	O	RELIABILITY	O
Functional availability of DLR-items	M	Discovery	M	Up time	M
DER run time	W	Attractiveness	M	Security	M
Data integrity	M	Actuality	M	Redundancy	M
Offering of DER	M	User-Friendly	M	Back-up	M
Uploading DER	M	Participation	C	Failure Mail	M
Downloading DER	M	Help-function	S	FTP-connection	M
Metadata	M	Errors	M		
Metadata import and display	M	Proper display	M		
DER design and composition	W				
Cross-device	C				
Cross-device DER	W				
Identifiers	M				
Administrator	M				
Roles	M				
Registering account	M				
Social metadata	S				
Search function	M				
Sort function	M				
Mail function	M				
Subscription	C				

PERFORMANCE	O	SUPPORTABILITY Technical	O	SUPPORTABILITY Content	O
Requests	M	Maintainability	M	Maintainability	M
Optimization	M	Testability	M	Testability	M
Data Transfer	M	Compatibility	M	Compatibility	M
Through Put	M	Configurability	S	Configurability	M
		Ease of installation	M	Ease of installation	M
		Portability/flexibility	S	Portability/flexibility	M

Table 4: Initial Functional Requirements, based on requirements of G.Greijmans

Letter	Meaning	Description
M	MUST	Describes a requirement that must be satisfied in the final solution for the solution to be considered a success.
S	SHOULD	Represents a high-priority item that should be included in the solution if it is possible. This is often a critical requirement but one which can be satisfied in other ways if strictly necessary.
C	COULD	Describes a requirement which is considered desirable but not necessary. This will be included if time and resources permit.
W	WON'T	Represents a requirement that stakeholders have agreed will not be implemented in a given release, but may be considered for the future. (note: occasionally the word "Would" is substituted for "Won't" to give a clearer understanding of this choice).

Table 5: MoSCoW obligations (Brennan & International Institute of Business Analysis, 2009)

The copyright protection period begins the year following the year of the author's death, and in Curaçao, it expires after 50 years^{lxi}. In many other countries this period has been extended to 70 years. In Curaçao the copyright regulations are:

- 50 years after the decease date of the author,
- 50 years after the decease date of the author who lived the longest,
- 50 years after the first publication of a work that has been published after the death of the author,
- 50 years after the first publication of a work of an anonymous author,
- 50 years after the first publication of a work of a legal entity,
- Translations of local publications; 10 years after the year of publication,
- Translations of publications from a work that has been published in a country affiliated to the Berner Convention; 50 years after the year of publication.

After this period, the work belongs to the public domain, and is available for use provided that it is cited properly. According to Korstjens (2013), the probability for acquiring approbation of the author of a work for public dissemination depends greatly on the following factors: the year of publication, the motive for publication (commercial or altruistic), if it is still being reprinted, and if the whole work or part of the work is to be released publicly. Korstjens (2013) created an overview, shown in Table 6, indicating the likelihood of obtaining permission from the authors. The ones that should preferably be selected for digitization projects have been highlighted in the table by the researcher. Absolute certainty, however, can only be obtained by inquiring the copyright holders. Given the fact that the project is based on sharing and re-use of digital materials, it is essential that both the source materials and the learning materials created have an open license for use and adaptation by others. For digital educational resources, Mr. Korstjens advised to use a Creative Commons^{lxii} (CC) license, where the copyright owner grants certain rights to others.

Publicatie	Commerciële uitgever		Stichting met ideëel doel	
	heel werk	beperkt deel	heel werk	beperkt deel
Jonger dan 10 jaar met herdrukken	zeer klein	middel	klein/middel	middel/groot
Jonger dan 10 jaar zonder herdrukken	klein	middel/groot	middel	groot
Ouder dan 10 jaar met herdrukken	middel	middel/groot	groot	zeer groot
Ouder dan 10 jaar zonder herdrukken	middel	groot	zeer groot	zeer groot

Table 6: Copyright evaluation for books to be digitized (Korstjens, 2013)

Unlike the IPR for publications discussed earlier, CC licenses are not restricted to a certain period of time, but reducing the license terms afterwards is always possible. The minimum CC license advised is: Attribution-NonCommercial-ShareAlike. The procedure to acquire the licence can be seen in Appendix 12. The meaning is explained in Figure 5, and the full version of the license is available at their website^{lxiii}. It is also possible to attach metadata and additional information to the license, enabling search engines to automatically acquire certain information. The copyright education exception makes it possible to use short parts of publication that are still under copyright for educational purposes. The online availability of the copyrighted source materials, however, remains an important restriction. The Creative Commons (CC) license system offers a solution to easily regulate the sharing of the copyright that the creators of the educational material receive on their material. The complete legal framework (Korstjens, 2013) also provides an explanation of several other legal issues that need to be considered.



Attribution-NonCommercial-ShareAlike

You are free to Share — copy and redistribute the material in any medium or format— and **Adapt** — remix, transform, and build upon the material— as long as you abide by the **following** the license terms.

Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

NonCommercial — Licensees may not use the work for commercial purposes, unless they get the licensor's permission.

ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.

No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

Figure 5: Creative Commons license to be used for digital learning resources

5.3.4 A Preliminary Digital Repository Infrastructure Based on Initial Requirements.

A collaborative digital repository infrastructure was desired, which took the limitations of SIDS into account. The stakeholders needed a repository that could assist them with developing and managing digital resources that provided support for 21st century education at all levels, facilitated knowledge management and research, advanced local cultural development, and showcased resources that were produced by the university. The challenges the UoC was facing were predominantly those being encountered by SIDS due to their small size, limited capacity and limited resources. The realization that most of these

challenges were related to the limitations of being a SIDS made it clear that a solution had to be developed that took both the challenges and the opportunities of the local situation into consideration.

The LRS had envisioned an internal repository platform containing the digital resources for the UoC community, and an external repository platform containing the resources that were available for the community (figure 5). An analysis of the initial requirements revealed several problems regarding the implementation of this design when considering the challenges SIDS face.

The repository infokit (JiscInfonet, 2010) made it clear that for each repository, several management and technical issues must be addressed. There was not enough capacity at the LRS or the FoA to manage these repositories; neither could the ICTS support the two interacting platforms with their respective databases. The amount of digital resources in either platform would not be enough to justify the effort and the costs.

Furthermore, SobekCM was a candidate platform that could be adapted and used by the LRS, but no customizable or open source multi-lingual repository that supports NL-LOM was found for the FoA. Wikiwijs (now WikiwijsLeermiddelenplein) was the closest candidate, having NL-LOM and educational resources as well as source materials for lower and secondary education, but it did not support Papiamentu or full-text search, and the Dutch educational system was slightly different than that in Curaçao. Developing a local LOR would result too expensive, take too long to complete and pose issues with integration and maintainability.

There was also a problem concerning the development of the digital resources to advance culture, education and research. The LRS wanted to digitize the local publications according to the guidelines of Metamorfoze in order to preserve the source materials and maintain interoperability on an international level, but this required advanced equipment and

skills. A virtual meeting with the developer of the guidelines of Metamorfoze, Mr. van Dormolen, which was also attended by LRS and ICTS, made it clear that preservation according to these guidelines was not attainable at the UoC in this project. The scanning equipment at the LRS was not appropriate to digitize for preservation according to these guidelines. The necessary color test cards were not available at the UoC, and the skills needed, for example to measure the colors, were not present either. The LRS wanted to develop a system to automatically crawl the web for local digital research and source material in order to acquire a critical mass, but the necessary knowledge and skills were not available. Development of digital educational resources at the FoA also posed a problem, since none of the staff members at the LOFO had enough time or capacity to be placed in charge of guiding this process.

Collaboration on national, regional and international levels using technology had been identified as an important means in the international conferences, resolutions and PoAs to overcome the barriers SIDS face regarding sustainable development. Collaboration, integration and convergence have also been identified as current trends in digital repositories, which is very difficult for larger universities given the amount of resources produce, and the number of stakeholders they must take into account (Armbruster & Romary, 2010; Jisc Infonet, 2011). The limited amount of resources in Curaçao, however, could be considered as an opportunity to converge all functionalities in one repository at the UoC. This is also in line with the study of Martin and Bray (2011). According to this study, Curaçao would be placed as a SIDS in quadrant 3 as "small and very small states with traditionally low levels of regional collaboration" and the authors recognized that in such SIDS "the trend of creating national universities manifests itself even more strongly since there are few regional opportunities for university-level tertiary education" Martin and Bray (2011). For such SIDS,

Martin and Bray (2011) stipulated that "multi-purpose and multi-level (public) institutions appear as the most cost-effective solutions".

The trend is such that educational institutions are increasingly building digital repositories with multiple types of services, especially as they should contain openly accessible material. Convergence in one platform would imply integration on the metadata level (Dublin core and LOM), the resource level (culture education and research), the repository level (IR and LOR), and the UoC could position itself as the party with a national repository for the different institutions that use or collaborate with the development of digital resources. Development and management of such an integrated repository, however, would be difficult (Jisc Infonet, 2011), therefore an appropriate approach had to be used to obtain the desired results.

Since the coordinator of dLOC had offered to provide its web application platform for customization, and it already contained most of the other requirements that had been formulated by the users (SobekCM features: <http://www.dloc.com/sobekcm>), the researcher queried the developer of SobekCM on the possibility of adding NL-LOM and the Papiamentu and Dutch languages to SobekCM. dLOC indicated that the web-application software had not been used by individual institutions yet, and since it wanted to extend the possibility to develop the software as an open source application, the UoC could serve as a test-case. The dLOC members, B.Wooldridge of Florida International University^{lxiv} (FIU), L.Taylor from University of Florida (UF)^{lxv}, and M.Sullivan, developer of the SobekCM platform, have indicated that they are very interested in providing a customized version of SobekCM, and committed themselves to providing support in using the platform for this purpose and customizing it to the local needs. This would enable the project to be used as a knowledge creation opportunity, by designing and developing a digital repository platform that consisted of a high degree of convergence which is difficult to accomplish with high volume digital

resources and large number of stakeholders. The infrastructure consisted of providing one repository with LOR functionalities, IR functionalities and a digitization workflow function, and it also combined resources for culture, education and research.

The researcher further investigated the suitability of SobekCM in providing the requirements adopted for the IR. DISC evaluated various digital libraries and a number of digital library software systems, including SobekCM, the software that is used by dLOC (For more information concerning all the documents related to the DISC research, see [http://ufdc.ufl.edu/contains/?t=%22Digital+Initiatives+and+Services+Committee+\(+DISC+%22&f=AU\)](http://ufdc.ufl.edu/contains/?t=%22Digital+Initiatives+and+Services+Committee+(+DISC+%22&f=AU)). The DISC research showed that the SobekCM platform resulted as one of the best for a common digital university platform, scoring better than the other repositories, as can be seen in the comparison table shown in Appendix 13. The fact that there was only one developer for SobekCM, however, was considered a serious sustainability, which is why SobekCM was not chosen for this project.

For the USONA project, however, a partnership with dLOC and using SobekCM as the development platform resulted as the best choice for designing a prototype infrastructure of a collaborative, integrated repository. A highly integrated repository would be easier to maintain at the UoC, since this would encourage convergence, uniformity, integration and a single search in multiple collections, with international technical and infrastructural assistance. It is a comprehensive system that qualified well compared to other software programs for libraries which contained more options than initially required. That which was missing would be included, it was open source and customizable, through separation in collections each institution had control over its own collection and metadata schema, international management and technical support were available at no additional cost, and there was already a relationship of mutual trust and collaboration between the organizations. The fact that there was only one developer and that there was no community for support

remained points of concern, but given the innovative nature of the project, and the fact that a prototype was being developed to acquire capacity, this risk was accepted. The LRS became a sustaining partner of dLOC, which entailed a small annual contribution.

A preliminary design of the digital repository infrastructure was conceived by the researcher, and it is shown graphically in figure 6. The repository at the UoC would consist of one community platform, which is supported by dLOC and developed using the SobekCM application. The repository would integrate functions and resources for multiple disciplines, each in its own collection, with its own metadata structure, and managed by a certain department at the UoC. Depending on the collection, collaboration with external stakeholders would take place in a certain department. The collections would be

- Culture: LRS can place source material in this collection by digitizing local books. Digitization for preservation is not attainable at this moment at the UoC, and it needs to be explored. Digitization of source materials can be performed according to guidelines advised by dLOC (<http://dloc.com/dloc1/manual>). Figure 7 shows an initial digitization workflow, and table 7 shows the recommended image specifications during scanning. LRS can thus work with cultural institutions, and catalogue the resources in this collection with the appropriate metadata.
- Research: The LRS can include local research in this collection, which can be collected in digital form. The SobekCM application supports Open Archives Initiatives (OAI) harvesting techniques which need to be explored.
- Education: The FoA should take care of the digital educational resources on multiple educational levels. Stakeholders, such as schools, could acquire the right to upload their resources in this collection. The FoA should control the quality of these resources before making them publicly available.

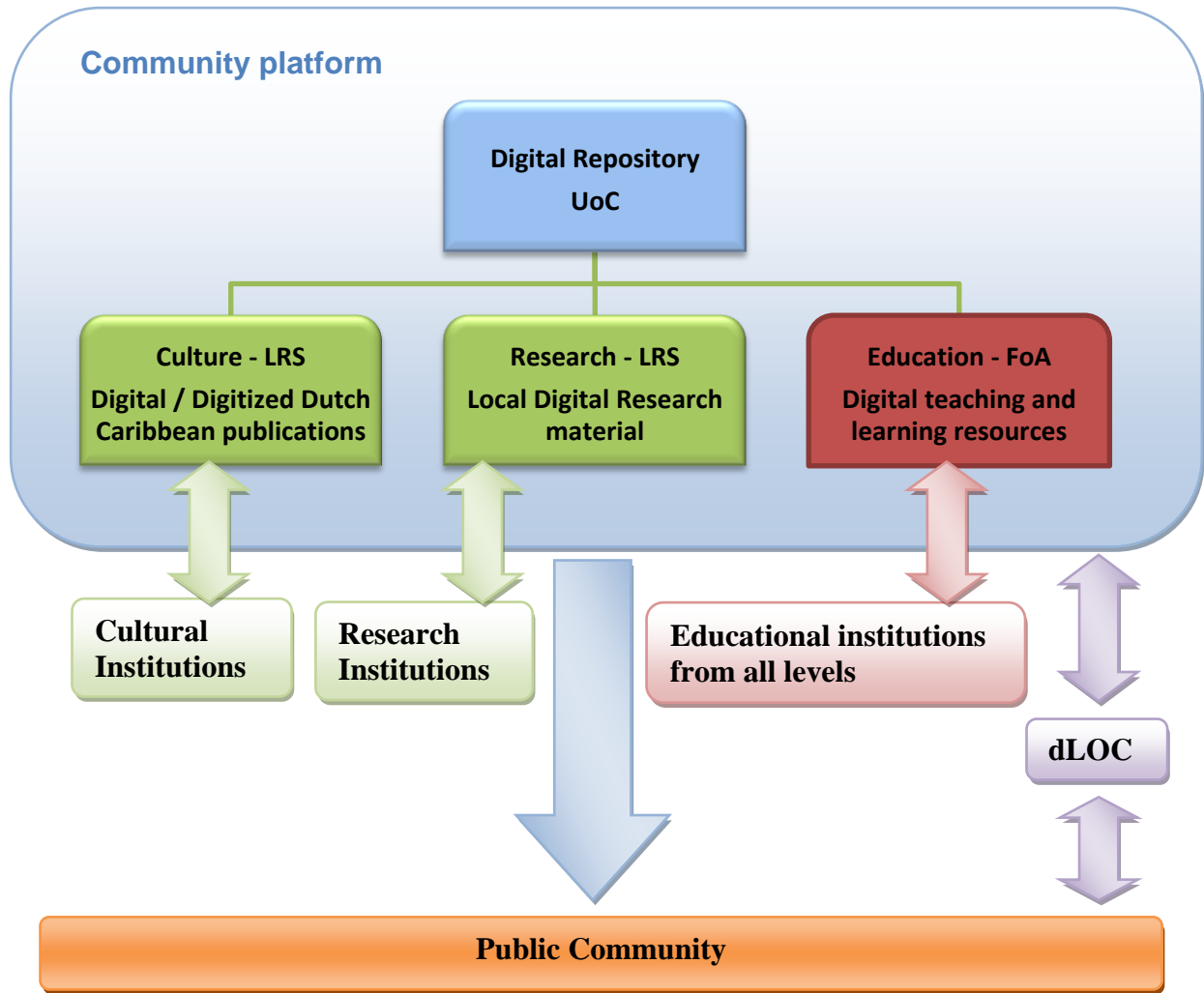


Figure 6: The Design Structure of the Digital Repository

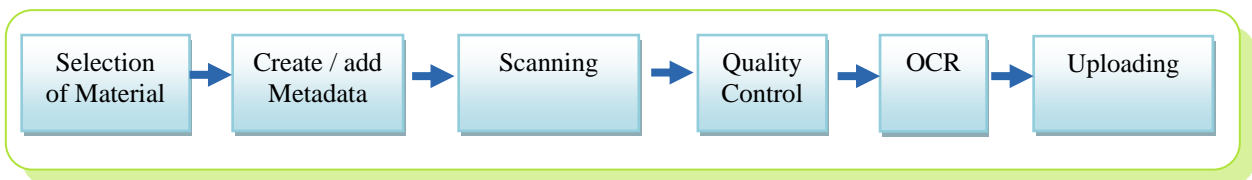


Figure 7: The digitization process

File Saving Format	.TIFF (uncompressed)
Resolution	Use for
300 pixels per inch (ppi) Or 118 pixels per centimeter (ppc)	Printed text with normal sized fonts Oversized documents and maps Manuscripts with legible scripts
600 pixels per inch (ppi) Or 236 pixels per centimeter (ppc)	Printed text with detailed images Photographs and select graphic arts Printed text with very small fonts Manuscripts with difficult scripts
Image Type	Use for
24-Bit Color (True Color)	Pages with only images Printed text with colored images
8-Bit Grayscale	Pages with text only Black and white photos

Table 7: Digitization Standards used

5.4 Considerations for Designing a Digital Repository Infrastructure on Curaçao.

Besides the digital repository requirements and considerations for sustainable development found in literature, the development of an initial repository infrastructure on Curaçao showed that the UoC would be the ideal initial location. The LRS is the only academic library on the island and the FoA is the only institution that develops teachers on each educational level. Using existing collaboration formed a good point of departure, but further research is advised before a decision is taken. In this case, the SobekCM platform was chosen regardless of sustainability issues, given that it was a prototype and research showed that the benefits in this case outweighed the disadvantages. Furthermore, it became evident that is appropriate to start using a collaborative approach with initial requirements if the concept is very new to the participants. Finally, it is important to capitalize on the benefits of being a SIDS, in this case making use of the small scale to adhere to requirements found in literature, being collaboration and integration in this case.

STAGE 2: BUILDING, INTERVENTION AND EVALUATION (BIE).

At this stage of the ADR framework, the building, intervention and evaluation of a prototype digital repository infrastructure are addressed. The BIE encompasses an IT dominant form, since the initial knowledge-creation target involves an integrated, collaborative repository with convergence on multiple levels. The repository should integrate functions of an IR with a LOR, integrate resources of culture, education and research, integrate multiple levels of education and provide a collaborative environment for development of digital resources by the community. The BIE stage corresponds to the validation phase in the design cycle of Wieringa (2014). Guidelines of the TAR were used to perform an empirical research in this stage. Multiple BIE iterations were performed with the researcher as a helper of the client, which will be grouped in two cycles.

The first cycle relate to the period in which the USONA project took place, and the second cycle concerns the period during which the researcher was contracted as the functional manager of the repository at the LRS. In each cycle validation took place through interviews, workshops and/or presentations, but the results of the TAM questionnaires will be the focal point of analysis in this thesis. The BIE cycle also served as an opportunity for capacity building of the stakeholders by working with the artifact and contributing to an improved design for the repository infrastructure. Each cycle therefore also examines the re-design of the infrastructure in the respective period.

6. The Design, Development and Validation of a Prototype

This chapter discusses the results of the fourth research question:

What insight can be obtained from the stakeholders to improve the sustainability of the design, with development of, interaction with and evaluation of a prototype digital repository containing sample resources?

The iterative development a prototype repository infrastructure is grouped in this chapter in two BIE cycles, served to validate and the design, to build capacity of the stakeholders, and to obtain insight to improve the design. The first section discusses insights acquired through the initial development of the repository, interventions, and evaluations that took place during the first BIE cycle. The second section discusses developments that led to the next BIE cycle and includes an overview of the most important repository features, and insights acquired with the re-design of the infrastructure by the researcher as an internal consultant and as the functional manager of the repository. The chapter concludes with aggregated results of the TAM questionnaires and insight acquired from the development and validation of the repository by multiple stakeholders, answering the fourth research question.

6.1 Building the Digital Education Innovation in the Caribbean (DEdICa) Prototype.

The first BIE discusses the development of the repository with sample resources during the USONA project, which was based on the preliminary design of the researcher as coordinator of the Digital Source Materials and Database Team. This section discusses the design and development process, the interventions and the validation by the LOFO students and the advisory committee members. Developments that led to the next BIE cycles are then briefly discussed.

The BIE stage was initiated by envisioning development of an innovative integrated repository infrastructure, based on an improvements to the new open source SobekCM system. The repository had to contain at least 150 digitized books, an undefined number of research articles and digital learning resources. A mock-up of the repository was built using the program Mockup builder^{lxvi}, of which an interactive PowerPoint presentation was made. This was presented in the second advisory committee meeting for validation. The non-functional prototype was considered as a good proposal, but no detailed questions or contribution through insightful comments were obtained, which was probably because of the "newness" of the concept. This was observed by the researcher through comments that indicated that the advisory committee wanted to see a working replica. This process thus entailed developing a functional prototype iteratively to develop capacity, and in doing so adapt the preliminary design.

The author of this thesis named the prototype DEdICa, which stands for **D**igital **E**ducation **I**nnovation in the Caribbean, which in Papiamentu means "to dedicate" or "dedicated", to indicated the vision that with dedication, innovative changes could be made in local education, which could extend to other parts of the Caribbean islands.

The SobekCM package was downloaded from the dLOC site (<http://www.dloc.com/software/download>) and installed on a laptop to test the software, the digitization workflow and the samples of digitized books based on the standards that have been defined. The Digital Source Materials and Database Team started with documentation from the beginning of the installation, since there were so many different components that needed to be installed. Since the application had not been installed and used by individual users before, several options that did not work and bugs that were discovered were resolved incrementally in cooperation with the developer. Due to the fact that the on-line digitization workflow option was not working properly, the Digital Source Materials and Database Team

developed a separate database to keep track of the digitization activities in order to obtain indicators for future digitization projects. Using this database, the researcher could keep track of the resources, record the time of individual assistants for each process and then record the time of the digitization process.

Three assistants digitized 202 books selected for primary education and another assistant harvested approximately 2,000 research studies of the islands of the Dutch Caribbean from the internet and research databases. Upon checking the quality of the digitized books in the Quality control (QC) stage, the assistants realized that several pages had been skipped inadvertently, and images of several pages had bled through into the other side of page. Re-scanning the missing pages meant that all the subsequent pages had to be renumbered, which was done with features of Picture viewer and Windows explorer. For Pages that had bled through, a white paper was placed between the pages. Table 8 shows the digitization indicators per activity. On the left, indicators of total time with other activities per book and per page. On the right, the logistics (enter in database, pick up books etc.), which correspond to the workflow which was shown in Figure 7, were calculated and placed in percentage of the total time. Table 9 shows a checklist made by the main assistant of issues that were encountered during digitization, and actions that needed to be taken to correct them.

The repository was migrated from the stand-alone laptop to a server, and the necessary adaptations that were identified were documented and discussed with the developer. The mock-up prototype was elaborated on and served as a guide for the developer of SobekCM to provide remote assistance in the further development of the prototype. The developer M. Sullivan came to Curaçao to help in adapting the platform and adding the pages in the repository and also to fix the remaining bugs. The corporate edition of the Optical Character Recognition (OCR) program ABBYFineReader^{lxvii}, which includes a "Hot folder" that automatically gathers files in bulk for OCR processing, made text files of the images.

	Activity	Hours per book	Minutes per page		Activity	Hours per book	Minutes per page
Total time per activity	Scanning	2.31	1.46	Logistics	Scanning	1.97	1.42
	QC	0.50	0.37		QC	0.73	0.46
	Total	2.81	1.83		Total	2.70	1.88
Total time including logistics	Scanning	4.28	2.88	Logistics in % without logistics	Scanning	85%	97%
	QC	1.23	0.83		QC	146%	124%
	Total	5.51	3.71		Total	96%	103%

Table 8: Time indicators during digitization

Page images:	Yes	No
Are all pages scanned? Even blank pages?	✓	Scan (blank) page(s)
Are all the scanned pages straight?	✓	Rescan the page(s)
Are the scanned pages in the correct order?	✓	Fix page order
Are all scanned pages chronologically numbered?	✓	Rename the pages. Use Microsoft Office Picture Manager to easily rename the files
Is the reflection of another page visible?	✓	Place a blank page under the page to be scanned to reduce reflection
Is there too much shadow effect visible?	✓	Press the book harder on the scanner bed, making as much contact with the scanner bed as possible
Are all pages properly cropped?	✓	Do not crop too much or too little. Remember that scanned images must represent the actual pages
Are pages cropped too much?	✓	Rescan page(s) and crop properly
Are all pages saved as (uncompressed TIFF) files?	✓	Rescan page(s) in (uncompressed TIFF) file format
File and Folder Names:	Yes	No
Does the folder name contain both the BibID, and VID?	✓	Add the BibID and VID to the folder name
Does each file name (scanned image) contain the BibID, VID and its sequential number?	✓	Add the BibID and VID to the file names. Use Microsoft Office Picture Manager to rename the files.
Do all scanned image files of a book have the same BibID and VID?	✓	Add the BibID and VID to the file names

Table 9: Quality control checklist, J. de Jesus

Using the free available Zotero (www.zotero.org), which also gathers the metadata, these PDF files were exported with the RIS tag format (used by bibliography managing tools) to hard disks for import into the repository. The RIS format could not be read automatically, and the 2,000 research articles were handed over to the developer to incorporate an automatic import feature for these resources into repository.

The coordinator of the Digital Learning Resources Team, had difficulties in obtaining staff at the FoA to guide the process of developing digital learning resources. The researcher came into contact with Mrs. E. Alake-Tuenter, a senior teacher and researcher in pedagogy and educational sciences at a high school in the Netherlands, who also coordinates tutoring of Dutch interns for several pre-service teacher training high schools in their practical period abroad in a program called Interactum. Mrs. Alake-Tuenter, together with the researcher, the dean of the FoA, and the manager of the LRS formulated a plan to expand the existing relationship between the LOFO and the student-exchange program to structurally recruit interns with the specific task of developing digital educational resources for Curaçao during their internship here.

Figure 8 shows the collection page of the DEDiCa repository prototype, with the separate sub-collections Antiana for source materials, Digital Learning Resources for the learning material, and Research Collection for local research files. Links for the Papiamentu and Dutch languages were added in the banner, to allow information on the pages to be displayed in the respective languages. The developer would send the text on the web pages at a later stage for translation. The developer added the Creative Commons licence page with the attributions as recommended by the IPR expert for the learning resources, as shown in figure 9. A template with the required NL-LOM attributes which were also added to the SobekCM system as a result of the research project, as shown in figure 10. Appendix 9 provides further explanation of the metadata that should be inserted in the NL-LOM fields.

Intervention took place through presentations and workshops, followed by evaluation through discussion and observation. A presentation and workshop to the whole LRS staff revealed a great interest in the prototype and in ways in which it could be used. Seeing the books in digital form and being able to search in the books provided an appreciation of the work of the digitization process.

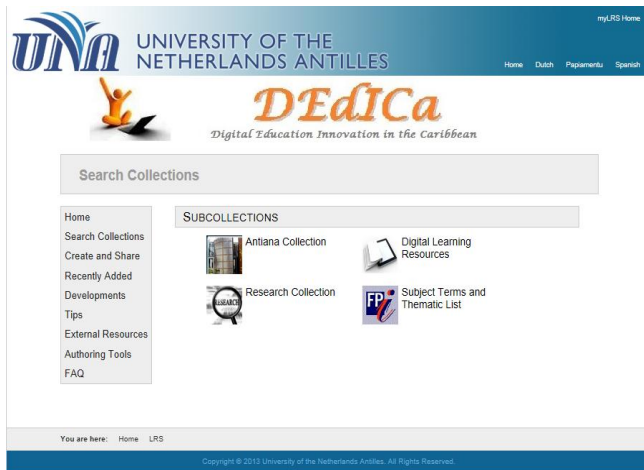


Figure 8: The Creative Commons page for Digital Learning Resources

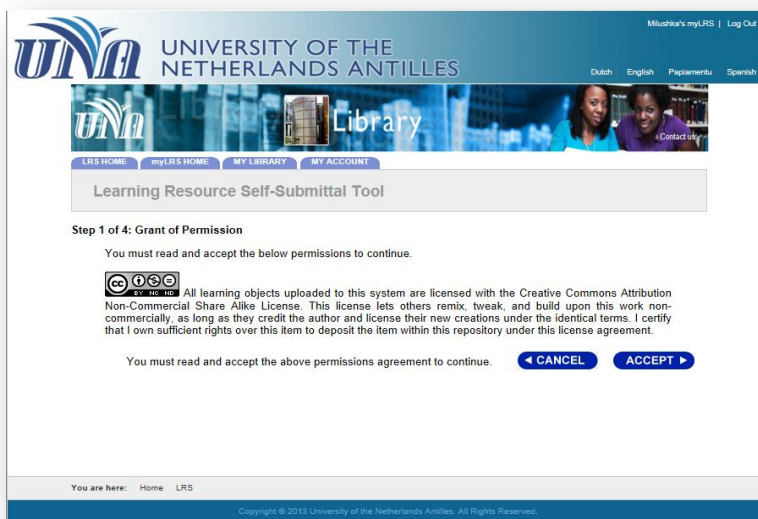


Figure 9: Collections of the DEdICa repository prototype

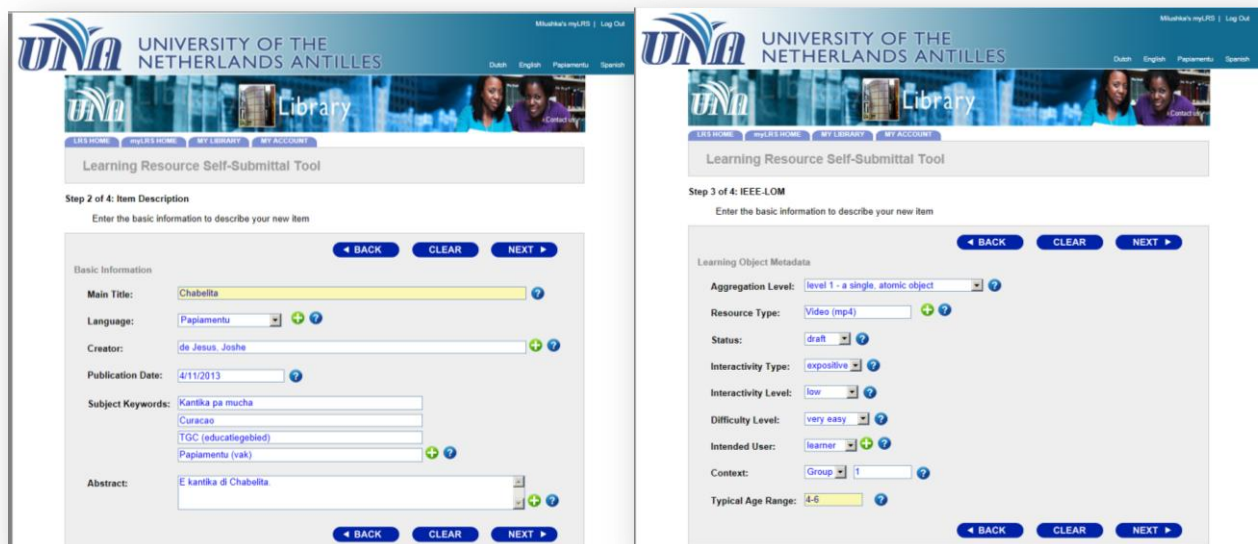


Figure 10: The Required NL-LOM attributes

During the workshops the LRS staff was impressed by the possibilities the infrastructure provided. The LRS manager realized that as much as possible, the resources should be openly accessible. The "page turner" option, a visual option where the user can "flip" through the pages like a book, was highly esteemed. The user can zoom in for easier reading or jump to the desired page by entering the page number in the textbox, as shown in figure 11. Another highly appreciated feature was the Full-text search, an option to search on (a combination of) words within the text of all resources.

Figure 12 provides an example, using a search term "kabritu" (goat in Papiamentu). This provides the user with a list with the titles that contain the searched term(s), and by clicking on one of these, e.g. "Mi buki di bestia", the user is presented with the separate pages where this term appears. The possibility to narrow the results through the "facets" by filtering the contents is shown in figure 13. The system will automatically show all items containing the search term, and the user can drill down until the desired result is obtained.

Series, such as multiple issues of a publication or multiple lesson plans for one topic, can also be created as an aggregation and uploaded separately under the same title. Each resource acquires its own metadata, but will be virtually grouped under one title. Figure 14 shows an example of aggregation of multiple resources under one title.

Another intervention was organized for the LOFO in the form of a three-day workshop. Given the fact that the LOFO staff had indicated that they were unable to attend on those days, the students of the LOFO were targeted. The students contributed with sample digital resources they had developed in the workshop, using the CC attribution, non-commercial, share alike licence and the NL-LOM attributes. Figure 15 provides a view of the page to upload the resource files. Multiple files, e.g. a lesson plan, a video and images, can be uploaded under the same title



Figure 11: Page turner view

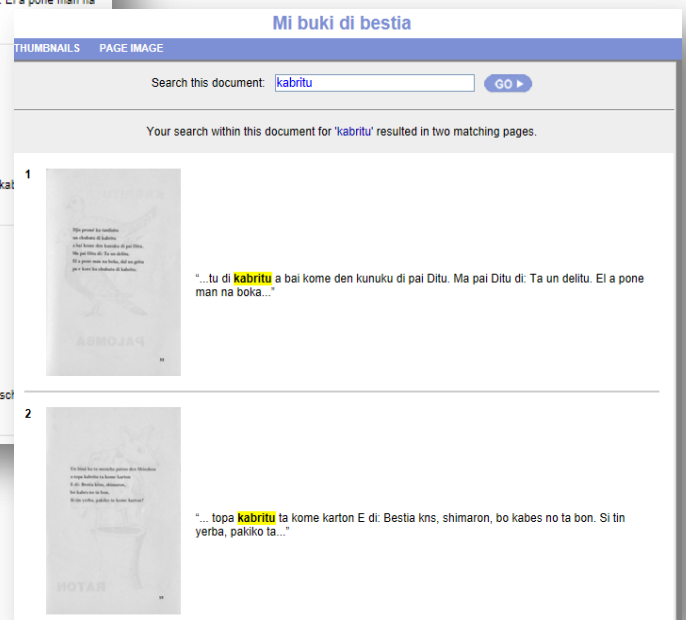
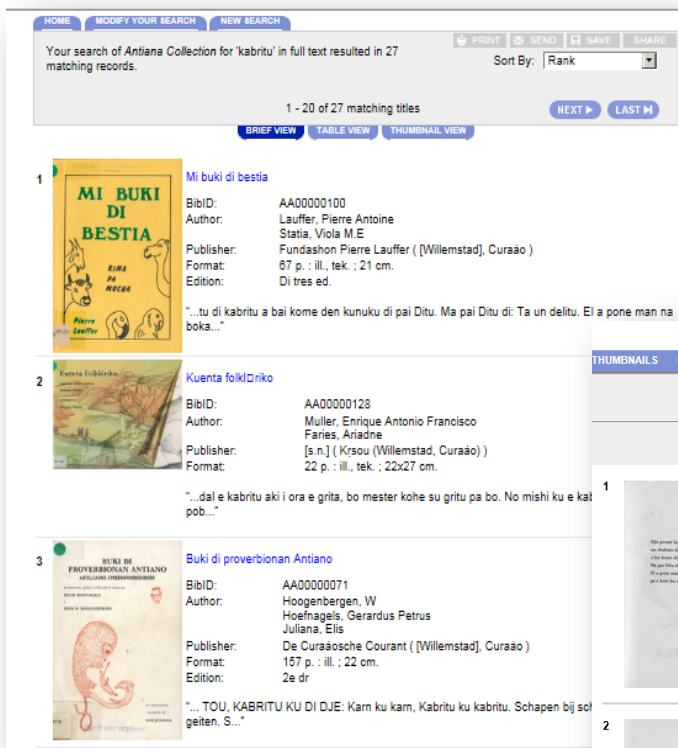


Figure 12: Full Text Search Result Pages

The screenshot shows a search results page for 'All Items'. The left sidebar, highlighted with a red box, contains 'NARROW RESULTS BY:' filters for Language, Subject: Topic, Publisher, and Publication Place. The main area displays five search results, each with a thumbnail, title, and metadata.

Language	Count
Papiamentu	111
Dutch	59
English	13
Spanish	5

Subject: Topic	Count
Literatura	24
Literature	24
Literatuur	24
Geschiedenis: Curaao	22
Papiamentu	22
Leesboeken: Papiamentu	15
Papiamentu: leesboekjes	15
Geschiedenis: Nederlandse Antillen	14
Kinderverhalen	14
Schoolboeken	12

Publisher	Count
De Wit	19
Departamentu di Enseansa [etc.]	11
Boekhandel St. Augustinus	10
Stinapa	6
De Curaaosche Courant	5
Territorio Insular di Krsou	5
Editorial Nilo E. Kleinmoedig	3
Sede Antia	3
Van Dorp	3
Centrale Drukkerij	2

Publication Place	Count
[Willemstad], Curaao	76
[Oranjestad], Aruba	26
[Willemstad], Curaao	19
Krsou [Willemstad], Curaao	13
Amsterdam	4
[Willemstad], Curaao [etc.]	3
Zeist	3
[S.]	2
[Willemstad], Curaao	2
Assen	2

Title	BibID	Author	Publisher	Subject
1. Al, mi dushi, bunita kaptan.	AA0000041	Ecury, Nydia Maria Enrica	Territorio Insular di Krsou (Krsou [Willemstad, Curaao])	Jeugdletteratuur; Nederlandse Antillen Kinderverhalen; Nederlandse Antillen
2. ALADIN	AA0000119	Mansur, Jossy M	Edicionnan Clasico Diario ([Oranjestad], Aruba)	Kinderverhalen Sprookjes; Nederlandse Antillen
3. ALBUM SOUVENIR de CURAAO	AA0000032	Costa Gomez, da, J	Gomez "El Louvre" [etc.] ([Willemstad], Curaao)	Geschiedenis; Curaao
4. ALBUM CURAAO	AA0000172	J.W.F. Sluyter (Soerabaja [etc.])		Geschiedenis; Curaao
5. Ali	AA0000165	Vedder, Paul Kook, Hetty Bautista Geert, van, Paul	Fundashon KONDESA (Krsou [Willemstad, Curaao])	

Figure 13: Filtering The Results

The screenshot shows two search results. The first result, 'Het tot leven komen van Curacao_niveau 1_dieren in je omgeving', has a thumbnail of Curacao and is linked to 2 items. The second result, 'Het tot leven komen van Curacao_niveau 2_dieren komen naar het eiland', has a thumbnail of a landscape and is linked to 2 items. Below the second result, there are three sub-links for related titles.

Title	Creator	Source Institution
1. Het tot leven komen van Curacao_niveau 1_dieren in je omgeving	Seinhorst, Eline Schrader, Alysha	University of Netherland Antilles
2. Het tot leven komen van Curacao_niveau 2_dieren komen naar het eiland	Seinhorst, Eline Schrader, Alysha	University of Netherland Antilles

[Het tot leven komen van Curacao_niveau 1_dieren in je omgeving \(2 items \)](#)
[Het tot leven komen van Curacao_niveau 2_dieren komen naar het eiland \(2 items \)](#)
[Het tot leven komen van Curacao_niveau 2_dieren komen naar het eiland](#)
[Het tot leven komen van Curacao_niveau 2_ontstaan eiland](#)

Figure 14: Aggregation of files belonging to one title as serials

UNIVERSITY OF THE NETHERLANDS ANTILLES

Admin's myLRS | Log Out

Dutch English Papiamentu Spanish

Library

Upload the related files for your new item. You can also provide labels for each file, once they are uploaded.

Add a new file for this package:

The following page images are already uploaded for this package:

FILENAME	SIZE	DATE UPLOADED	ACTION
mainthm.jpg	15 KB	4/10/2013 11:33:05 AM	

Label:

The following files are already uploaded for this package and will be included as downloads:

FILENAME	SIZE	DATE UPLOADED	ACTION
chabelita.mp4	1 MB	4/10/2013 11:32:53 AM	(delete)

Label:

Once all files are uploaded, press SUBMIT to finish this item.

You are here: Home LRS

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Figure 15: Uploading Resources in the DLR Collection

The image that the user wishes to show as a thumbnail to identify the resource can also be uploaded here with the name "mainthm", as shown in figure 15. After uploading a resource, the possibility exists to add more metadata from for example Dublin core, Electronic Theses and Dissertations (ETD), etc.

The workshop, which was optional in nature, was well attended. Of the 32 students that registered, 28 attended the first day, 25 the second and 21 the third day, and 16 of last day indicated that they wanted to be informed of the future developments. The interest and participation were high, and the participants indicated that more students would have attended if it would have been organized in a less hectic period. On the third day of the workshop, the LOFO students filled out the TAM questionnaires. Out of 21 students, 5

questionnaires were not correctly filled in, which resulted in 16 usable forms. Appendix 14 shows the results of the LOFO students for the categories Perceived usefulness, Perceived ease of use and Intention to use, with indications on values that were not filled in or had additional comments. Items in the categories were defined in Appendix 5 and could be rated between 1 and 5, with 1 being completely disagree and 5 being completely agree. Table 10 shows the averages for each category for each student. The X mark indicates that students did not fill in any value for that category. With a score of 3 being defined as neutral, scores above 3 were considered to indicate that the repository was accepted. An overall score of 3.6 was calculated, with Perceived usefulness being the highest and Intention to use being the lowest. Since we were dealing with a prototype which did not already have many digital educational resources, contrary to the LRS, this could explain the fact that the Intention to Use was the lowest. Each category was accepted and with the exception of one student, the repository as a whole was accepted by all. Table 11 shows information of the file sizes after the items were inserted into the collections, and some digital education resources were uploaded during intervention.

For the third and last advisory committee meeting, a one-day workshop was organized to validate the repository. Appendix 15 shows the results of the TAM questionnaires. Items in the categories were defined in Appendix 6. Besides the TAM questions, the stakeholders were asked to provide a grade between 1 and 10 for the whole prototype, and also for individual components or the prototype. Of the nine members of the advisory committee, only four attended the workshop.

Table 12 shows the stakeholders' averages for the categories Perceived usefulness, Perceived ease of use and Intention to use, with an X where no value was filled in. The overall average for Intention to use of the stakeholders was higher than that of the LOFO students. Each category was accepted, and the repository as a whole was also accepted by all.

LOFO students	Perceived Usefulness	Perceived Ease Of Use	Intention To Use	Overall averages per student
1	3.5	3.2	3.0	3.3
2	3.8	3.2	4.0	3.5
3	3.0	3.0	2.0	2.8
4	3.7	3.8	4.0	3.8
5	4.0	3.7	4.0	3.9
6	3.8	3.5	4.0	3.6
7	3.7	3.5	2.0	3.4
8	5.0	4.0	3.0	4.3
9	3.5	3.7	3.0	3.5
10	5.0	4.0	4.0	4.4
11	4.0	3.8	4.0	3.9
12	3.8	4.0	4.0	3.9
13	3.0	3.0	X	*3.0
14	3.8	4.0	4.0	3.9
15	3.8	4.0	4.0	3.9
16	4	3	3	3.4
Overall averages per category	3.8	3.6	*3.3	3.6

Table 10: Average Results of the LOFO students on the TAM questionnaires

In Archived folder (master files): 195 GB				
Type	Qty	Size in GB	Avg GB	General
TIFF files of the books	202	195	0.97	1 GB per book

In web folder (derivatives): 15.4 GB				
Type	Qty	Size in MB	Avg MB	General
Research items(pdf, text, xml)	25	953	38.13	40 MB per pdf
Digital learning resources	60	156	2.61	2.5 MB per dlr
202 Books (jpg, jp2, text, xml)	202	1,4340	70.99	71 MB per book

Table 11: Size indicators when placed on the server; date March 27, 2014

Table 13 shows the individual scores for each stakeholder for the prototype repository as a whole, and for individual components of the prototype. With a 7.5, the repository overall showed a high acceptance, with the views and search possibilities receiving the highest individual scores and the navigation the lowest score.

Averages per category	Perceived Usefulness	Perceived Ease Of Use	Intention To Use	Overall averages per stakeholder
Teacher	4.3	4.3	4.0	4.1
FMS	3.7	3.7	4.0	3.7
CCUNA	3.3	3.3	3.0	3.7
FoA	3.0	3.0	X	*3.5
Overall averages per category	3.9	3.6	*3.7	3.7

Table 12: Results of the Advisory committee on the TAM survey

Individual scores	Teacher	FMS	CCUNA	FoA	Average
Dedica overall	8	7	7	8	7.5
Individual components					
Navigation	8	6	6	6	6.5
Layout	8	7	7	7	7.3
Searches	8	7	7	7.5	7.4
Views	8	7	7	7.5	7.4
Download	7	7	X	7	* 7.0
Upload	7	7	X	7	* 7.0
Other	7	7	7	7	7.0
Averages per stakeholder	7.6	6.9	*6.8	7.1	7.1

Table 13: Results of additional questions to the Advisory committee

The repository manager indicated that action had to be taken to place more openly available books on-line, since the ones that were digitized should remain hidden to the users until the authors have been contacted. This is a very time-consuming process, which requires development of new procedures to handle this issue. The Dean of the FoA acknowledged that, with the functional prototype, she has a much better view of all its possibilities, and a better appreciation of what the repository could mean for the FoA. The LOFO coordinator was also very positive about the result of the project, but indicated that her staff could not manage the process without help. She furthermore indicated concern for the continuity and sustainability of the repository now that the USONA project had come to an end.

As the USONA project came to an end, the Digital Source Materials and Database Team delivered the documentation of each phase to the FoA (for delivery to USONA) and to the LRS. These documents contained a detailed description of all meetings and activities performed during each development phase of the prototype repository infrastructure. These were Phase 1: Preliminary Research, Phase 2: Design, Phase 3: Realization, and Phase 4: Use and Management.

A list of pending issues concerning the repository and roles of the stakeholders was also delivered to the manager of the LRS. Pending issues for the repository included, among other things, the bugs that were not yet resolved, the research files that needed to be imported into the repository and a template within the platform to allow development of digital educational resources. Concerning the internal stakeholders, pending issues included policies that needed to be developed by the LRS which are indicated in the framework (JiscInfonet, 2010), a support system that needed to be put in place for the FoA, and the new role that the ICTS needed to assume to further develop and manage the repository. Converting the repository to an IR also meant that several issues needed to be discussed with the management concerning strategic positioning of the repository at the UoC, policy and workflow development and implementation strategies. A comprehensive documentation of the many options and functionalities of the repository was developed by the researcher and her main assistant, and delivered to the LRS. This document included a list with Frequently Asked Questions (FAQ) and guidance for general users, administrators, collection managers and digitization staff with about 140 images, making it a highly visual document.

6.2 From DEdICa to the Dutch Caribbean Digital Platform (DCDP) Alpha version.

Given the large number of pending issues and the need for support, the LRS contracted the researcher as an internal consultant. The objective of the second BIE cycle

involved improving the functionalities of the repository prototype for use by the LRS and the other UoC departments, and providing a more sustainable environment for the repository infrastructure by supporting the LRS in building capacity to carry out the management and technical activities that needed to be performed.

A few presentations were conducted at the UoC to propagate the idea of the repository upon termination of the USONA project. A presentation to the LOFO staff was well visited, with active participation of the attendees. Particular interest was shown in the MimioTeach Interactive System^{lxviii} that was used for the presentation; it is a smaller, less expensive and more mobile alternative to an IWB. A presentation of the repository to the other faculties, however, was not well visited and only one faculty member was actively engaged and seemed to envision the possibilities the technology could offer for her faculty.

The researcher obtained the impression that the faculty members regarded the repository as a project of the LRS, and that it had no implications for their faculty. This formed the impetus for redesigning the repository in order to provide a more personalized experience for the other user groups. Several developments took place during the re-design period of the repository structure, further shaping the adapted concept.

At the beginning of this period, the researcher and the copyright expert at the LRS attended a two-week workshop organized by dLOC in Florida, which provided new insights through several presentations and practical workshops at several universities, libraries, museums and archival departments in multiple locations (<http://ufdc.ufl.edu/AA00016149/00001/>). A presentation of the DEdICa platform was given to the other SIDS partners in the Caribbean, and none were aspiring to take on the challenge of developing their own repository and integrating educational resources. A presentation at the staff members of the Florida International University (FIU), resulted in interesting discussions and also interaction with teachers who were also pursuing more development of

digital learning resources. The developer of SobekCM also provided a workshop, where he announced a new version of SobekCM and presented some of the new features. One of the features was a recommendation of the researcher to simplify the installation by enabling the installation process to be executed with a MSI installer; an executable Windows Installer file that installs the whole package using a wizard (see <http://ufdc.ufl.edu/software/download>).

The researcher also had a better appreciation of the advantages and disadvantages that both being a large institution and being a small institution entails. Interactions with the other Caribbean SIDS revealed that they had the same issues and limitations as Curaçao, and sometimes even worse. While in Curaçao the collection is in a hurricane-proof, temperature controlled environment, some SIDS did not have these resources, and vital cultural heritage resources were deteriorating at a rapid pace. Visits to several large universities, museums and archival institutions, provided insight into digitization of multiple resources in large quantities. This included standards and good practices used in digitizing large maps, 3-D artifacts, and analogue audio resources like gramophone records. Large universities, for example, had several specialized departments, which enabled the repository managers to draw on the expertise of several faculties. Collaboration and integration on the other hand were difficult due to the fact that interests of a large number of stakeholders had to be taken into consideration, which obstructed agility and flexibility in changes. The researcher also noticed that some university departments adhered to lower resolutions of 300 dpi, while at a collective library institution, digitization of all the resources was done at a high resolution of 600 dpi, in order to be prepared for changes in the future. Being small on the other hand, with a limited number of stakeholders and a limited amount of resources to digitize increased the flexibility and collaborative development, but the human capacity and expertise was not freely available. To get the best of both worlds, the researcher realized that LRS needed to collaborate with big, international universities and institutions as well.

Inspired by the dLOC approach, the researcher provided an initial redesigned concept to the LRS staff, which entailed a separate page and collection for different user groups. Using the more interactive and freely available mockup program JustInMind Prototyper^{lxxix}, a collaborate environment was created during the re-design phase where the stakeholders could test the prototype on-line and provide comments or suggestions for adaptations. A separate collection was made for UoC and its faculties, providing the functionalities of an IR more explicitly. The LRS manager indicated the desire to separate the USONA project from the IR nature of the repository. Therefore, DEdICa became a separate collection, containing educational resources for different education levels. A separate sub-collection for each external stakeholder was made in the Partners collection, targeting mainly institutions that were represented in the advisory committee. The LRS also wanted a separate location to place data sets of research. Therefore, a separate Research collection was designed. Figure 16 shows the re-designed structure of the repository. The researcher and her main assistant developed the different pages, collections and sub-collections with appropriate images and banners. A separate page was assigned to each partner, similar to the dLOC approach. The prototype repository was named **DCDP** by the director of the LRS, an acronym for **Dutch Caribbean Digital Platform**. Figure 17 shows the layout of the Home page and figure 18 shows the structure with the different collections in alphabetical order. The repository was migrated from the server to a virtual server architecture by the ICTS and acquired a new URL. This caused challenges communicating with the database, serving files for automatic bulk OCR in the Hot folder, and troubleshooting options that were not working properly.

A presentation to a larger group of external stakeholders, included representatives of the Amigoe^{lxx}, the S.A.L. (Mongui) Maduro foundation^{lxxi}, FPI, Jurdoc^{lxxii}, Stichting Monumentenfonds Curaçao^{lxxiii}, The Central Bureau of Statistics Curaçao^{lxxiv} (CBS) and the National Archaeological - Anthropological Memory Management^{lxxv} (NAAM).

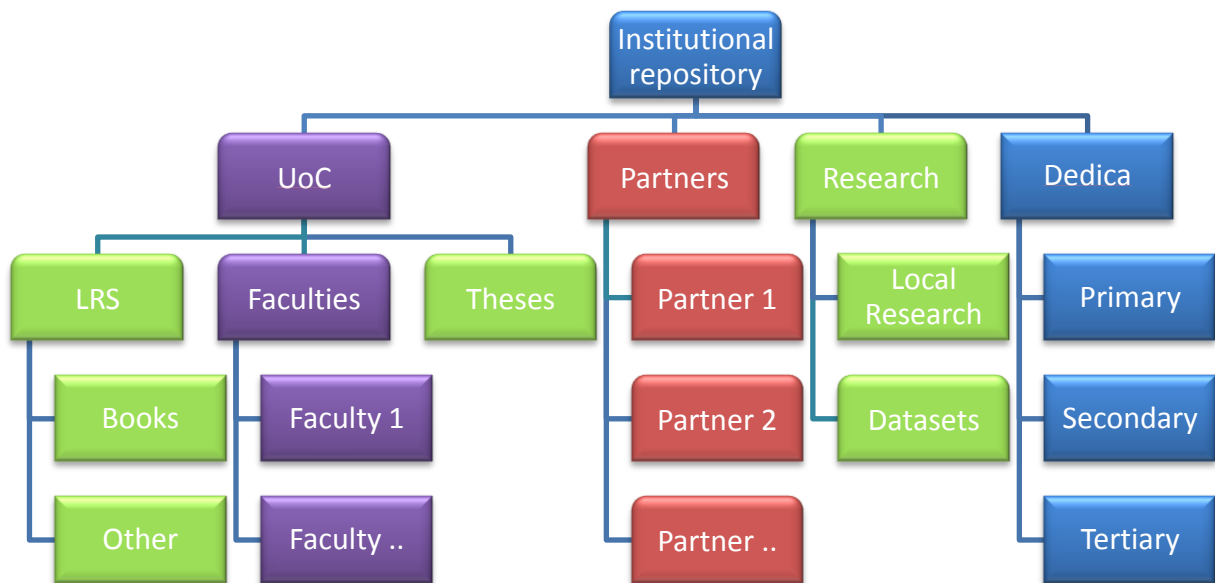


Figure 16: Layout of the adapted prototype Dutch Caribbean Digital Platform

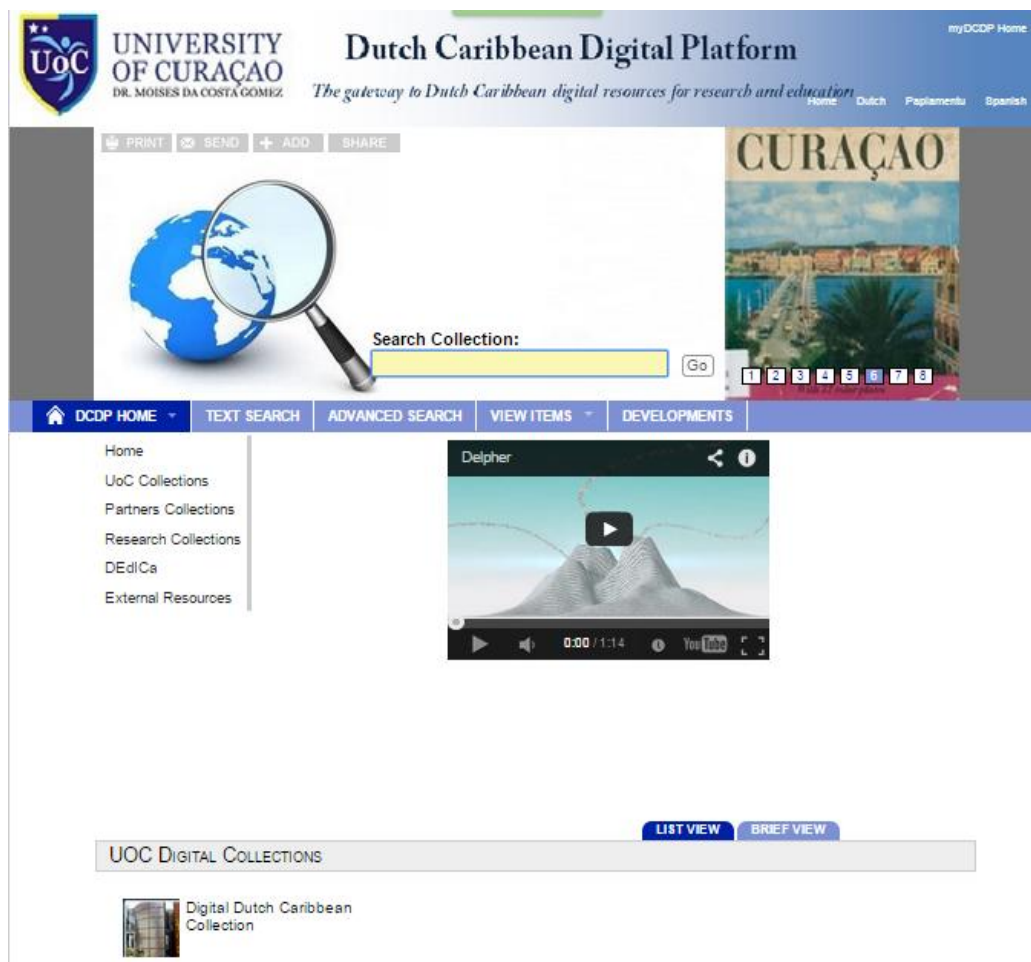


Figure 17: Layout of prototype Dutch Caribbean Digital Platform

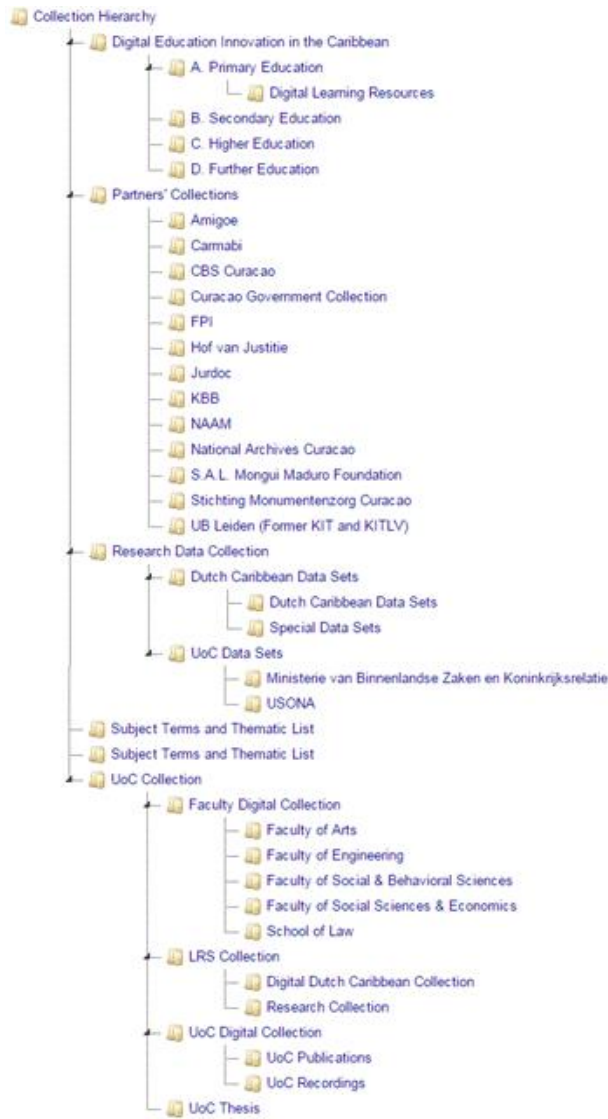


Figure 18: Layout of the structure of the prototype Dutch Caribbean Digital Platform

During the discussion session, the researcher could observe that cross-connections were starting to develop between the different stakeholders. The stakeholders started to realize that placing resources from multiple institutions in one repository allowed searches in multiple collections revealed information and relationships that had been previously hidden.

Stichting Monumentenfonds Curaçao, for example, had detailed information about monuments and country houses (landhuizen), while the Mongui Maduro foundation, which holds records of the Jewish cultural heritage on the island, had a wealth of information on the activities that took place at these monuments over the course of time.

The representative of Monumentenfonds expressed a desire for geospatial data, since they were already charting parts of the island on their own system. Monumentenfonds was also involved in providing education, as a result of which the resources could also be used for developing digital educational resources. The representative of NAAM wanted to know more about the standards that were required, which led to interactions concerning the development of policies to make the infrastructure workable for all stakeholders.

Attending an ICT & Education Curaçao workshop^{lxxvi} reconfirmed the lack the teachers' experience concerning local resources in education. Upon announcing that the UoC was in the process of building a repository infrastructure, this became a central point of discussion, and the teachers indicated that they desired to be informed as soon as this was available to them. In particular, a teacher of children with special educational needs voiced the urgency of resources needed for this group of children.

Upon installing a newer version of SobekCM, new features became available. A Beta version of geospatial mapping possibilities, for example, fulfilled the request that was voiced by the representative of Stichting Monumentenzorg during the presentation. The LRS furthermore delivered the Dutch translations to the developer for inclusion in the next release, and also started with preparations for translation into Papiamentu.

To start building capacity, a three-day digitization workshop was organized for two LRS staff members. At the LOFO, two students of Interactum stayed for three months and developed a series of local digital learning resources^{lxxvii}. This culminated with the students organizing a workshop and presenting the resources to the A.E. Goilo teachers.

During a workshop at the end of the USONA project, the teachers of A.E. Goilo school filled out the TAM questionnaires shown in Appendix 5 to evaluate the repository on the items Perceived usefulness, Perceived ease of use and Intention to use. Out of 20 teachers, 18 forms were filled in, and Appendix 16 shows the results of the Goilo school teachers.

Goilo teachers	Perceived Usefulness	Perceived Ease Of Use	Intention To Use	Overall averages per teacher
1	5.0	3.0	X	4.0
2	1.7	3.0	2.5	2.4
3	3.8	3.7	3.0	3.5
4	4.2	4.5	3.5	4.1
5	4.8	3.2	5.0	4.3
6	4.8	3.2	5.0	4.3
7	4.2	4.0	3.5	3.9
8	5.0	5.0	4.5	4.8
9	4.5	4.5	4.0	4.3
10	4.0	3.8	4.0	3.9
11	3.0	3.0	X	3.0
12	3.8	3.2	3.0	3.3
13	5.0	3.0	5.0	4.3
14	2.0	3.0	2.5	2.5
15	3.3	3.3	3.5	3.4
16	4.0	3.0	4.0	3.7
17	3.0	2.5	3.0	2.8
18	4.2	4.0	3.5	3.9
Overall averages per category	3.9	3.5	3.7	3.7

Table 14: Averages and overall averages of TAM results of the Goilo school teachers

The items could be rated between 1 and 5, with 1 being completely disagree and 5 being completely agree. Table 15 shows the averages for each category for each teacher. With a score of 3 being defined as neutral, averages above 3 were considered as accepted. The X mark indicated that a teacher did not fill in any score for a certain category. An overall score of 3.7 was calculated, with Perceived usefulness being the highest and Perceived ease of use being the lowest. Perceived usefulness acquired a high score of 3.9, indicating furthermore the need for such a repository infrastructure for the teachers of local schools. All categories for the repository were accepted, and with the exception of three teachers the teachers accepted the repository. Compared to the other results, more users rejected the repository infrastructure, and the lowest average of 1.7 was obtained for Perceived

usefulness. An informal conversation with a teacher also revealed that some have indicated that they are not willing to share their resources with other teachers.

The manager of the LRS filled in the TAM questionnaire shown in Appendix 6 as repository manager, and received additional questions to elaborate on the categories. Appendix 17 shows the results of the questionnaire. Table 16 shows the results with the averages calculated per category. The repository manager provided the highest score of 4.6, and she indicated that the lower scores indicate the difficulties she expects the LRS will confront in executing the relative activities. The high score also results from the fact that the LRS has been working with the system for a while already, and the questionnaire is furthermore not anonymous. For validation purposes of the repository, however, this is the most important result. The LRS's responses to additional questions are also shown in appendix 17. The LRS manager finds the repository very user friendly and indicates that the full text search is one of the most useful features, but that a clear distinction between the multiple search possibilities is necessary. The quantity of available resources is another important factor that contributes to the usefulness of the repository, but for the LRS to be able to achieve sufficient quantities, a new repository infrastructure and workflow needs to be designed for partners with selected materials and bulk material. Incorporating an appropriate method of disclosure in the form of quality metadata and abstracts, particularly for non-textual resource formats, is an important issue that needs to be considered for achieving usefulness; therefore, improved guidance for filling out the appropriate metadata is desired.

The LRS desires to be able to develop the repository more as a digital library for the LRS as well as an IR with open access of the institution and the place for researchers who wish to investigate local issues and cultural heritage. The responses of the LRS manager clearly indicated a need for the development of a new repository infrastructure design.

rep mgr	Categories	scores
Perceived usefulness: 4.5		
PU1	Using the repository in my job/organization would enable me to accomplish tasks more quickly	5
PU2	Using the repository would improve my job/organization performance	5
PU3	Using the repository would increase my/our productivity	4
PU4	Using the repository would enhance my/our effectiveness on the job	4
PU5	Using the repository would make it easier to do my job/organization	4
PU6	I would find the repository useful in my job/organization	5
PU7	Using the repository will improve my work/ at my organization.	4
PU8	Using the repository will enhance my/our effectiveness.	5
PU9	Using the repository will increase my/our productivity.	4
PU10	I would find the repository a useful tool in my work/organization.	5
Perceived ease of use: 4.5		
PEOU1	Learning to use the repository is easy for me	5
PEOU2	I find it easy to get the repository to do what I want it to do	4
PEOU3	My interaction with the repository is clear and understandable	4
PEOU4	I find the repository to be flexible to interact with	4
PEOU5	It is easy for me to become skilful at using the repository	5
PEOU6	I find easy to use the repository	5
Intention to use: 5.0		
ITU1	I would use the repository to do a task whenever it has a feature to help me perform it	5
ITU2	I would use to use the repository in as many cases as possible	5
Average		4.6

Table 15: TAM results of the LRS manager

6.3 Reflection on the development and validation of the repository.

Reflecting on the two BIE cycles, it can be concluded that the ADR approach contributed in improving and making the repository infrastructure much more sustainable despite all the interrelated challenges encountered at the beginning of the project. With the knowledge acquired through literature, the SobekCM platform was enhanced with the requirements of the stakeholders, such as the minimum attributes of the NL-LOM as part of the IEEE-LOM, were incorporated as part of the existing application profile, adding a template to choose from these attributes by default when the user chooses to upload a learning resources, and facilitate the IPR issues by adding an appropriate CC licence page by

default for the DER. Adding these options made it possible to converge development and management of learning resources in the digital library software, which was indicated as a current trend in chapter 4. The ADR approach also enhanced the skill and experience by interacting with the repository, which provided insight in, inter alia, scanning indicators for future projects and the understanding that as much resources as possible in the repository should be free of copyright restrictions. Evaluation and validation as part of the ADR approach provided insight in acceptance of the repository infrastructure, as well as important issues that must be considered. The averages and overall averages of the TAM questionnaires by the different groups have been synergized into one table, which is shown in Table 16. The averages for the categories indicate that the repository is considered useful, easy to use and that the respondents intend to use it. An overall average, based by the group averages, would result in a score of 4.0. The lowest average was recorded by the LOFO students for the category Intention to use, which indicates that adherence to the suggestion by the LOFO coordinator to integrate the use of the repository in the curriculum of the program is advised. The lowest average recorded by the advisory committee members, as well as by the teachers of the A.E. Goilo school, was for the category Perceived ease of use. This could indicate that appropriate documentation, workshops and support should be offered to the external stakeholders that want to participate in the contribution of digital local resources using the infrastructure designed. The additional questions to members of the advisory committee, indicated that individual components of the repository were accepted, as well as the repository as a whole. Some teachers indicated that they were not inclined to share their resources. According to the literature, this is not uncommon, and appropriate measures need to be put in place to bring about a change in culture before introducing the repository infrastructure at schools. A collaborative approach should be used to evaluate whether certain adjustments need to take place for certain teachers.

Code	Indicators	16 LOFO students	4 Advis. Comm.	18 Goilo teachers	1 Rep Mgr	Grand Total Avg
Perceived usefulness Grand averages		3.8	3.9	3.9	4.5	4.1
PU1	Using the repository in my job/organization would enable me to accomplish tasks more quickly	3.6	3.8	4.1	5.0	4.1
PU2	Using the repository would improve my job/organization performance	3.6	4.0	4.0	5.0	4.2
PU3	Using the repository would increase my/our productivity	3.9	4.0	3.7	4.0	3.9
PU4	Using the repository would enhance my/our effectiveness on the job	3.9	3.8	3.7	4.0	3.9
PU5	Using the repository would make it easier to do my job/organization	3.9	3.3	3.8	4.0	3.7
PU6	I would find the repository useful in my job/organization	4.1	4.0	4.0	5.0	4.3
PU7	Using the repository will improve my work/ at my organization.		3.8		4.0	3.9
PU8	Using the repository will enhance my/our effectiveness.		4.0		5.0	4.5
PU9	Using the repository will increase my/our productivity.		4.0		4.0	4.0
PU10	I would find the repository a useful tool in my work/organization		4.0		5.0	4.5
Perceived ease of use Grand averages		3.6	3.6	3.5	4.5	3.8
PEOU1	Learning to use the repository is easy for me	3.3	4.0	3.5	5.0	3.9
PEOU2	I find it easy to get the repository to do what I want it to do	3.6	3.3	3.4	4.0	3.6
PEOU3	My interaction with the repository is clear and understandable	3.7	3.3	3.3	4.0	3.6
PEOU4	I find the repository to be flexible to interact with	3.5	3.5	3.5	4.0	3.6
PEOU5	It is easy for me to become skilful at using the repository	3.8	4.0	3.7	5.0	4.1
PEOU6	I find easy to use the repository	3.8	3.5	3.5	5.0	3.9
Intention to use Grand averages		3.3	3.7	3.7	5.0	3.9
ITU1	I would use the repository to do a task whenever it has a feature to help me perform it	3.1	3.7	3.7	5.0	3.9
ITU2	I would use to use the repository in as many cases as possible	3.4	3.7	3.8	5.0	4.0
Overall averages per group		3.6	3.7	3.7	4.6	4.0

Table 16: Overview of the group averages and overall averages of the stakeholders

The lowest averages recorded by the LRS manager were for Perceived usefulness and for Perceived ease of use. The results of the additional questions made it apparent that the LRS staff needed additional guidance as well as a new infrastructural design in order to cope with the amount of work that needed to be performed to keep the repository operational. The BIE stage made it clear that collaboration on a national, regional and, especially on international level was an important factor when developing a digital repository infrastructure in a SIDS, which is in line with the requirements in the POAs of the UN.

STAGE 3: REFLECTION AND LEARNING AND INITIAL FORMALIZATION

The last part of the thesis discusses the two final stages that contributed in providing insight to answer the main research question.

In the reflection and learning stage, the guided emergence of an infrastructural design for the stakeholders that desire to contribute to local digital resources is discussed by analyzing the results of the BIE according to stated goals. A collaborative preliminary design emerges at this stage as an initial attempt to formalize the learning into a framework for stage four of the ADR framework. This can be used as a basis upon which further BIE cycles can build in order to improve the design. This will allow external practitioners to start using and validating the design and continue to develop the framework in such a way that it provides options for all stakeholders to easily create, manage, use and access all types of digital resources in the Dutch Caribbean.

7. A Digital Repository Infrastructure for the Dutch Caribbean

This chapter discusses ways to improve the digital repository infrastructure design.

The central research question which is answered in this chapter is:

How can a digital repository infrastructure for Dutch Caribbean recourses be designed and developed for the stakeholders in order to attain a more sustainable development for Curaçao as a Caribbean SIDS?

The first section reflects on the insights gained from the BIE stage and gives an overview of the new developments, which indicated the need for an adaptation of the design of the digital repository infrastructure., The second section presents an initial generalized framework for the Dutch Caribbean SIDS, based on these adaptations. The third section discusses the conclusions that are drawn from the research, providing answers to the research questions and specifying the contribution the initial framework can provide on a local, regional and international level. The fourth section provides recommendations for the next development phase of the DCDP platform, as well as for other stakeholders who wish to develop their own platform in a way that supports a sustainable digital repository infrastructure. The thesis ends with limitations of this research, and provides indications for further studies.

7.1 Towards a new Digital Repository Infrastructure Design for the LRS.

This section provides an analysis of the validation of the different stakeholders and the need for a new infrastructural design. The proposed design by the LRS is analyzed, and forms the basis for the development of a generalized design by the researcher, based on the theories discussed in previous chapters.

The end of the second BIE stage also marked the end of the period for which the researcher was contracted to support the LRS with the repository. This meant a transfer of the researcher's responsibilities to the staff of the LRS. Several developments followed at a rapid pace in this period, which were also reflected in the validation of the LRS director, and influenced the design of a new infrastructure for the repository.

The developer of SobekCM founded an organization independent of dLOC, named Sobek Digital^{lxxviii}, which provided hosting solutions for clients using SobekCM. Given the fact that the LRS was understaffed, the researcher inquired about hosting possibilities at Sobek Digital, which resulted in a very competitive offer that included technical assistance. The transfer to Sobek Digital was accomplished in a short period of time, and the process to acquire an additional staff member to provide support with the responsibilities towards the repository management was started. An intern started with the development of a technical framework (Jisc Infonet, 2010) at the LRS, and an external consultant started with the development of a new logo for the repository. Figure 19 shows the adapted layout of the DCDP platform, which can be found at <http://uoc.sobeklibrary.com>.

The closure of KIT and KITLV and migration of their resources to the university library of UB Leiden^{lxxix}, led to a digitization project funded by the Netherlands with the objective of providing more than 3,000 publications pertaining to the colonial period of the Dutch Caribbean as cultural heritage. The KB and other institutions also joined to contribute with more publications of the Dutch Caribbean. Given the fact that the DCDP platform could provide options than the repository of UB Leiden did not contain, such as full-text search, the decision was made to place these digital resources here. Furthermore, the UoC management committed itself to strive for the completeness of the cultural heritage collection of the Dutch Caribbean in the DCDP repository. These large amount of resources and responsibilities would result in much more work for the LRS than the staff could handle.

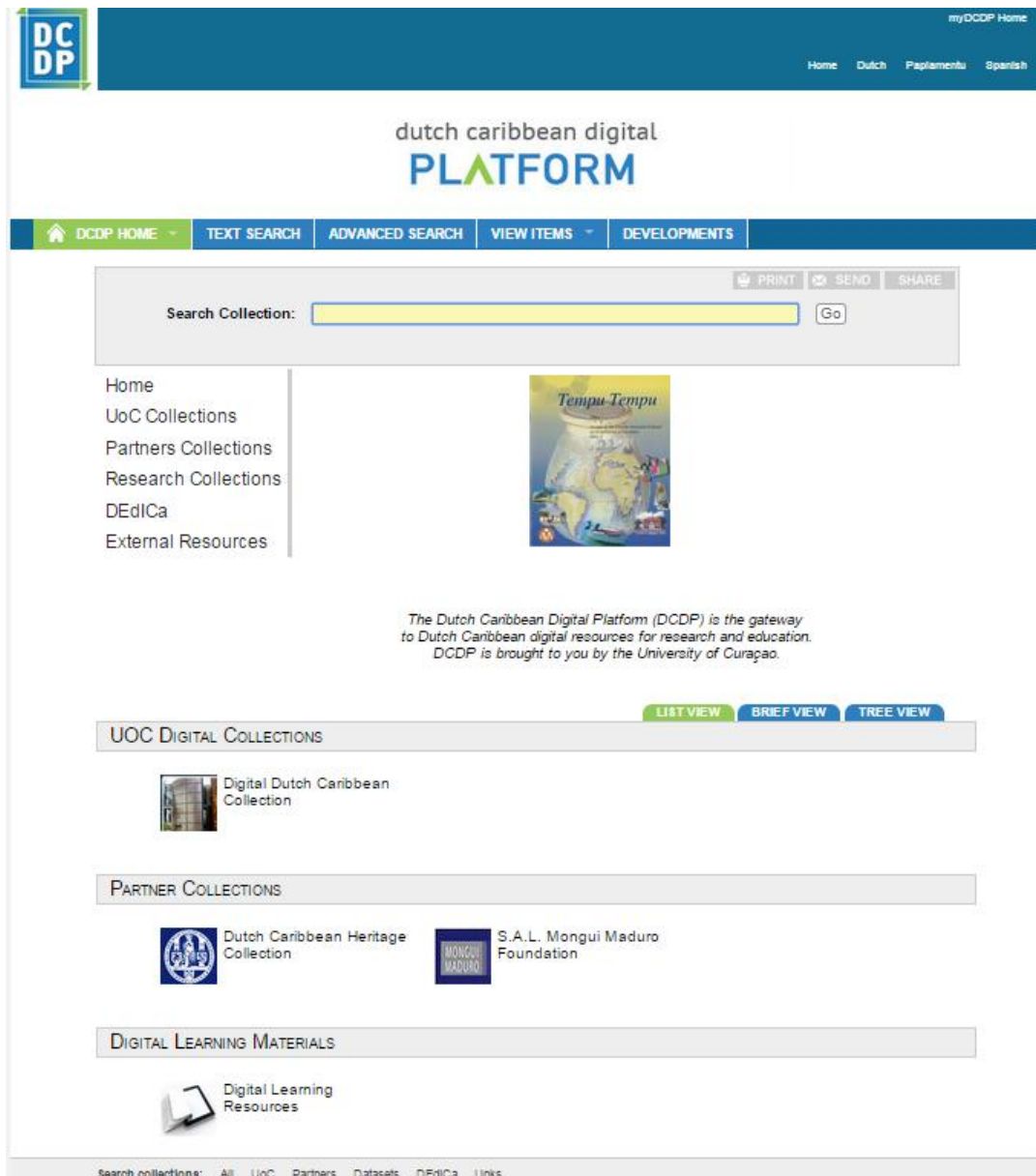


Figure 19: Layout of the adapted prototype Dutch Caribbean Digital Platform

Additionally, the external stakeholders also needed help to manage their digital resources. The Stichting Monumentenfonds, for example, was seeking a solution for the unmanageable number of digital resources it possessed, which consisted in great part of pictures of monuments. The researcher therefore contacted the developer for information about hosting options for local individual institutions and possibilities for providing interconnectivity between institutions that would be using the SobekCM platform.

A highly reduced rate was offered by the developer for local institutions that collaborated with the LRS, which also included technical assistance. During a meeting with external stakeholders, it became even more apparent that the LRS needed an infrastructure that made it possible for its staff to serve internal stakeholders at the UoC, but that could also assist the external partners, and that interconnectivity amongst the stakeholders with their own repositories would be highly efficient. With the acquired insight, the LRS manager designed an infrastructure, which involved the researcher as an external consultant on demand, and that differentiated supporting partners with small and large collections. The design is shown in figure 20, and appendix 18 provides the explanation.

With this design, the LRS could support partners with small collections with training and provide them with the possibility to upload their collections directly in DCDP free of charge, thus providing them with the opportunity to build capacity in developing and managing digital resources as well as the opportunity to learn to work with the application. Partners with large collections would be offered support through a qualified consultant appointed by the LRS, in this case the researcher, who would take care of all the arrangements to assist these stakeholders with their particular needs, and include the collection in the DCDP repository.

The design of the LRS manager formed the basis for the researcher to adapt the design to include the different types of stakeholders and international support, as is shown in Figure 21 and explained further in Appendix 19. This design elaborates on different types of external stakeholders, including stakeholders that already have their own repositories or want to develop their own repositories. This design for the LRS also includes international collaboration as has been advised in the PoAs, in the form of technical support of Sobek Digital.

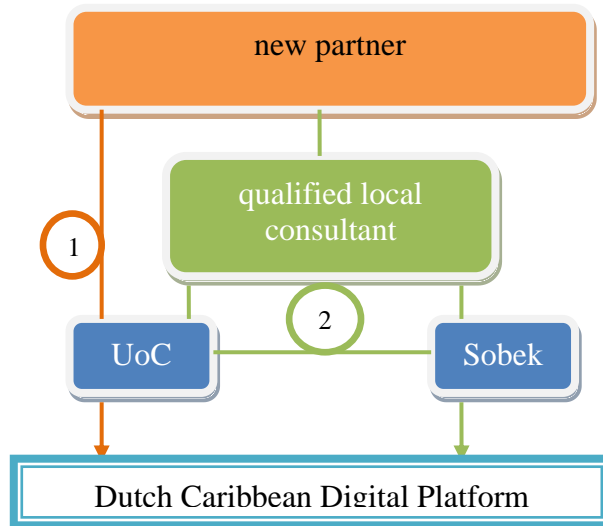


Figure 20: Collaboration Design for Dutch Caribbean Digital Platform, M. Groenewoud

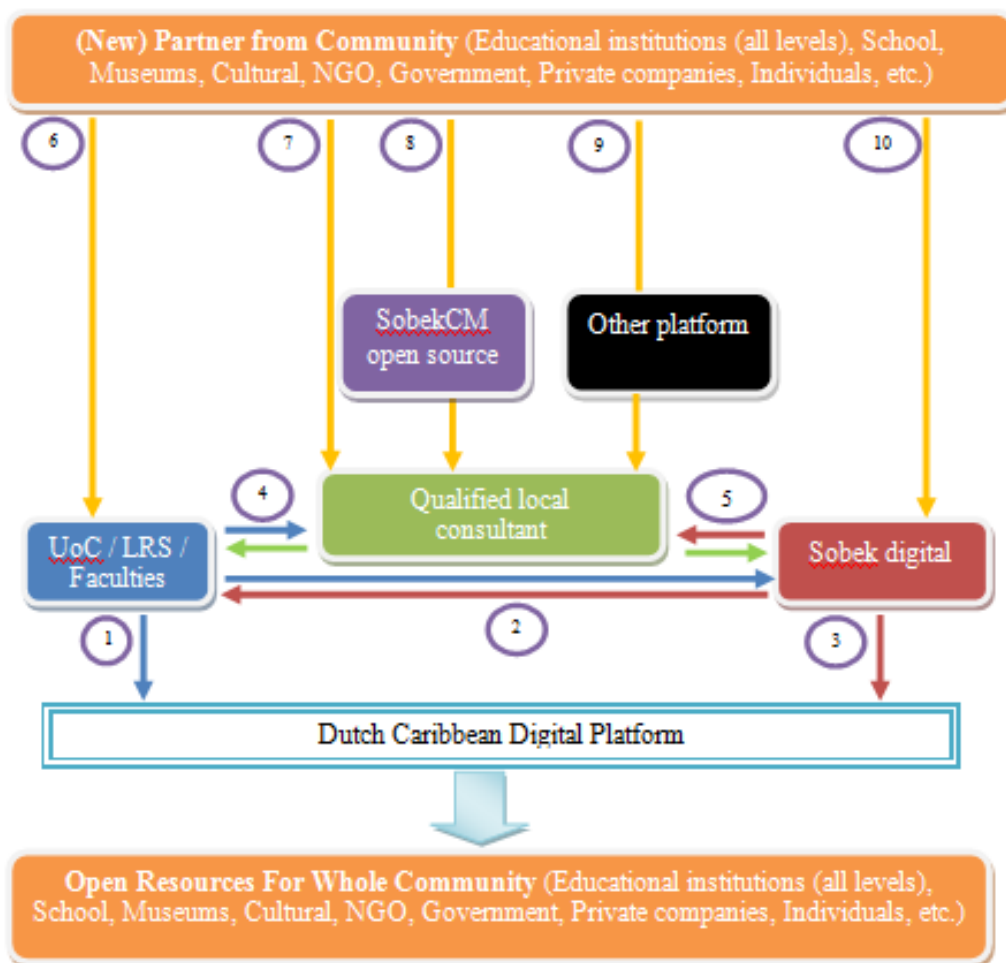


Figure 21: Collaboration Design for Dutch Caribbean Digital Platform, Y.Aniceta

7.2 Initial Formalization into a National Community Digital Repository Framework.

The LRS has proven to be exemplary in its dedication to look for a collaborative solution, and it has gone a long way in this respect with the establishment of the Dutch Caribbean Digital Platform (DCDP). It is a fact, however, that development is the first, and actually the easiest, step in setting up and managing a repository.

Recent international conferences point out that to overcome their limitations, developing countries should collaborate, form international, regional and national partnerships, and make use of technological development to promote inclusive innovation (United Nations, 2014; International Telecommunication Union, 2014). An integrated digital repository such as DCDP, that supports collaboration between stakeholders, that provides multiple types of digital assets, and that allows convergence of systems, functions and services, can help to overcome these limitations by, inter alia, reducing duplication of effort, sharing limited resources and exchanging expertise between the partners (Mhongole, 2015). Armbruster and Romary (2010) mention that size, quality and service matters in repositories, and they address the problem LRS is facing in their article, namely the challenge of the increasing volume of publications, and the need to deliver highly useful services to its designated community. Armbruster and Romary (2010) consider developing national repositories as one of the ways to overcome these barriers.

Having attended several presentations and meetings, the researcher had noticed that institutions that have the means would rather develop their own repository. This was also the case with the LRS, which embarked on a mission to develop its own repository while improving the SobekCM software, resulting in a great opportunity to acquire thousands of resources which will also be shared with the community. This approach turned out to be advantageous for the LRS, for dLOC and for Sobek Digital, but also for the community. The management and technical difficulties the LRS is facing, combined with the interrelated

challenges of SIDS, however, make it necessary to initiate the development of a generalized infrastructure, which can be used by any stakeholder on whichever Dutch Caribbean island.

To provide a generalized design for all stakeholders of the Dutch Caribbean, the researcher used validation of international experts on the design of the LRS manager, which is summarized in Appendix 20. Based on these suggestions and insights, an initial national community digital repository framework was designed, that can be seen in Figure 22.

As SIDS are confronted with many limitations to digitize their resources and manage these in a digital repository, collaboration, partnerships and support are vital to address these challenges. With this framework, SIDS institution on any island of the Dutch Caribbean could acquire international, regional and local support for technical and management challenges. Institutions – such as schools, museums, cultural institutions or any other institution – have several options to contribute to the national or regional collection directly or indirectly, build capacity by partnering with other institutions, or develop their own repository and submit resources to the national repository, making more local resources available through the platform.

To promote sustainability, management and technical support is needed on multiple levels: locally, institutionally, nationally, regionally and internationally. The remainder of this section provides a brief explanation of the framework, and appendix 21 provides a more detailed explanation of the figures, flows and numbers used in the framework.

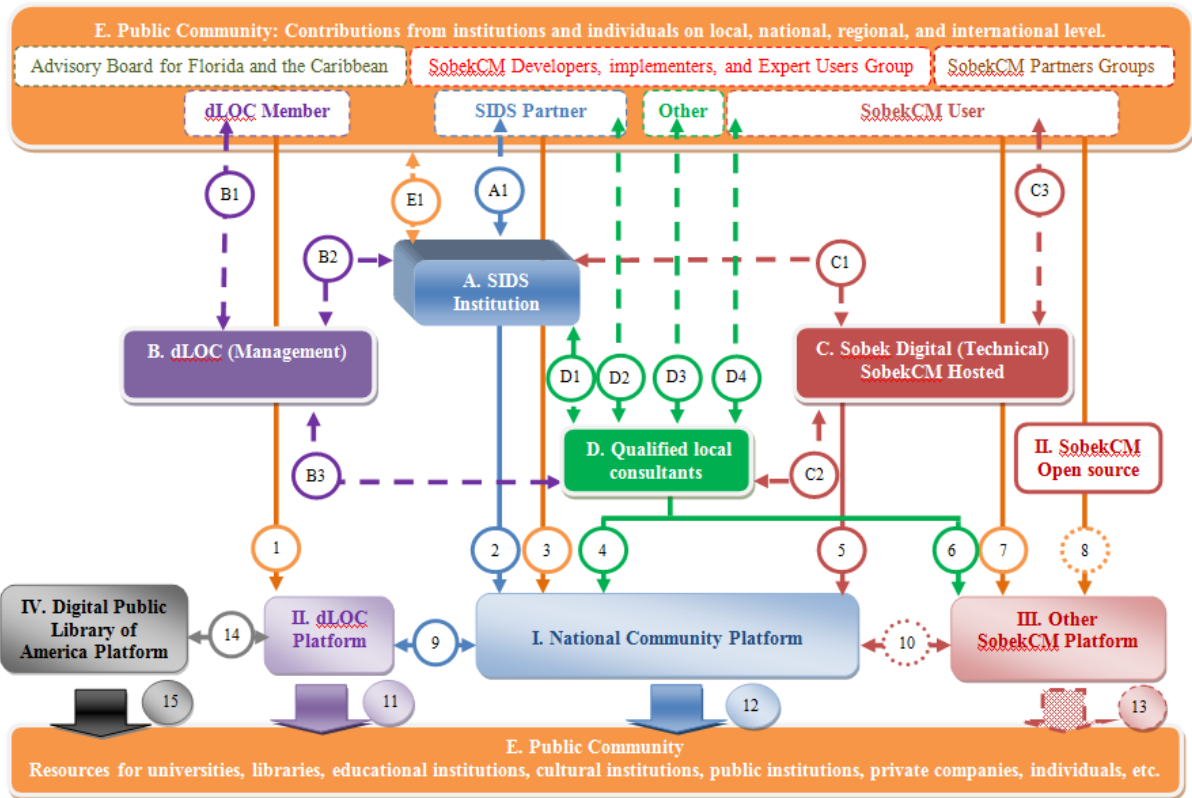


Figure 22: A Digital Community Repository Infrastructure for the Dutch Caribbean SIDS

Explanation of the symbols

- Dashed lines are two-way communication flow of resources, information and support
- ⊕ A# Flow of resources, information and support
- Solid lines indicate only the one-way flows of digital resources to a platform
- ⊕ # Contributes with resources to platform
- ⊕ # Shares resources with Public Community
- ⊕ # May or May not Contribute with resources to other platforms
- ⊕ # May or May not share resources with Public Community
- ⊕ # Shares resources automatically with other SobekCM platforms
- ⊕ # May or May Not share resource automatically with other SobekCM platforms
- ⊕ # Ways the community can obtain open resources

Flow of resources, information and support.

A# Partners of the SIDS institutions interact directly when transferring resources, information and support.


B# dLOC can play an important role as a resource and support the difficult task the institutions face in managing the repository and developing plans, policies, metadata, controlled vocabularies and all that is necessary to promote the repository and to let it grow. Given its experience, dLOC can also provide support in managing digitization efforts. Benefits for dLOC include the acquisition of new resources, and becoming one of the main resources for the ongoing effort to manage and promote repositories in the Caribbean.


C# Sobek Digital can play an important role as a resource and support for the technical implementation and maintenance challenges of digital repositories institutions in SIDS. This builds capacity in the institution, enabling it to serve other institutions which eventually may become new clients of Sobek Digital.

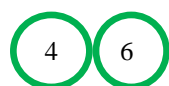
D# Given the fact that the institutions in SIDS also confront unique challenges, local consultants that have experience working with bulk upload on the platform can provide additional support, which is much needed in very small communities that are heavily understaffed. dLOC and Sobek Digital can also provide management and technical support to the local consultants. The benefits are beneficial for the consultant, as it can provide better service, but also for dLOC and Sobek Digital, as they can obtain a better view of how they can provide better service to their communities. Furthermore, qualified local consultants can assist the institutional partners to gain experience working with the SobekCM platform at the institution (which serves as an incubator), and support them in setting up their own installation. Depending on their preference, this could be a hosted instance at Sobek Digital, or one hosted by themselves using the open source SobekCM.


The flow of resources


As a result of their limitations, SIDS often experience a lack of local (digital) resources, which are eminent for facilitating, for example, modern education, research and cultural development, which supports sustainable development.

 The LRS contributes with resources for the Public Community. Resources that are restricted can be viewed on premises at the library. The library also provides services and limited storage place on its instance to contributors with small collections. Furthermore, it serves as an incubator for institutions with larger collections, allowing them to use the platform as a stepping-stone before establishing their own separate platform.

 Individual organizations and users can contribute directly to their collection(s), relieving the institution's staff of some work. An additional advantage is that these contributors can provide more complete metadata if the resources are of a specific discipline (e.g. monument infrastructure, teaching material, etc.)

 If the institution cannot or does not want to perform certain operations internally, or needs help with large quantities of resources, local qualified consultants can provide the services requested. These consultants can also guide the institutions in acquiring their own hosted or open source SobekCM solutions.

 Problems that neither the institution, nor the consultants can solve or certain specific issues are addressed directly by Sobek Digital

 Sharing digital resources between Sobek CM platforms or other OAI compliant databases



Several ways are possible for sharing digital resources with the community. This is provided in a manner such that other small institutions in small communities in the region can consider using this design when planning to join an existing or establish their own digital repository. do provide a set of options which stakeholders in the Dutch Caribbean can use to contribute, find, manage, access, and develop digital resources and options to join other repositories or develop their own repository.

7.3 Conclusions.

Introducing ICT in SIDS institutions require considerable investment of time, human, financial and technological resources, which are scarce assets on SIDS. Considered as "wicked problems", the ADR framework enabled the stakeholders to provide meaningful and innovative contributions to the design of the digital repository infrastructure through an increasing exposure to the repository and a decreasing involvement of researcher. Data analysis provided a deeper understanding of and insight into the acceptance of the design and influential factors which emerged during the interaction, making the artifact more useful, easier to use, and able to achieve a higher probability of actual use.

With its limited staff, the LRS now has an initial design that balances an improved provision of digital services to its internal stakeholders, while building critical mass by facilitating external stakeholders with the provision of a free service for capacity building and storage space to small collections. Through a local external consultant and international technical and management support, affordable assistance can also be provided to stakeholder with larger collections. Initial generalization of the design enables all types of stakeholders from the Dutch Caribbean to contribute to a national community repository, by interconnecting individual repositories within the community. This fosters collaboration amongst institutions and individuals in the community as well as convergence on multiple

levels, thereby facilitating "tying global to local" and adhering to requirements for sustainable developments of SIDS defined in the PoAs, as well as current digital repository trends encountered in literature. This technical infrastructure (<http://uoc.sobeklibrary.com>) provides an alternative that encourages development, usage and management of local resources, which promotes the sustainable development of these Caribbean SIDS. This could reduce the lack of local resources, and also improve the quality through a collaborative approach. This approach included allowing the stakeholder to introduce a design and adapting it with knowledge from literature and action research; strengthen capacity through international, regional, national collaboration and partnerships; following the trend of convergence, integration and interoperability of repositories; and encouraging Open Access of resources.

With new digital resources coming in from multiple stakeholders, the management and further development of the repository are the next challenges. Recent development at the LRS made it clear that stakeholders need to work collaboratively to attain the next level of a sustainable repository infrastructure, where the workload is shared, policies are set in place, and way is devised to handle copyright permissions effectively, ultimately leading to a certified trusted digital repository.

7.4 Recommendations for a Dutch Caribbean National Community Digital Repository.

The framework and prototype that resulted from the research project provide a good starting point for further discussion of the different collaboration styles and a successful future development in providing any institution or individual an affordable way to consume or produce local digital resources. With the acquired insights and reflection on the BIE stage and a sharpened focus concerning the development and management of the DCDP as an IR with Dutch Caribbean collection, the LRS is in the process of change to provide services and support to multidisciplinary partners.

As the amount of resources grows, and especially on topics where the UoC is not focussing for its designated community, a national repository would become increasingly necessary. Armbruster and Romary (2010) indicated that it is challenging for IRs to help scholars in navigating large amount of published knowledge, and that this could be mitigated if they are aggregated in a national repository that cooperates with other subject repositories. Using the DCDP as a base, this can be integrated together with subject repositories of other stakeholders, to form and/or complement a national repository. The researcher recommends that a continuation on developing a digital repository infrastructure should be based on the insights gained from the theoretical and practical aspects of the research.

The following recommendations are proposed to the stakeholders in Curaçao concerning the design and development of a sustainable digital repository infrastructure for the Dutch Caribbean resources.

1. Use the Alpha version of the DCDP to proceed with the Beta version in the next BIE cycle to develop into a sustainable, trusted IR for the UoC, with local, regional and international partnerships and support.
2. Use the Alpha version of the DCDP to start a new ADR to design and develop an interconnected national community repositories for Dutch Caribbean resources

The first recommendation refers to the next stage the LRS must enter to improve the design and repository infrastructure. Rittel and Webber (1973) indicated that "large, complex and long projects suffer from requirements volatility", and that many projects often fail to recognize the need of flexibility by "demanding fixed requirements at the start of a project". The initial requirements of this project also changed in time, and the LRS should adjust the requirements based on a large group of internal stakeholders. Now that the Alpha version of the DCDP is in place, the LRS can conduct a new BIE cycle to further design the

infrastructure with requirements of the internal stakeholders, and develop the Beta version as shown in figure 23. The LRS is planning for a soft launch of the repository in September 2015 at the beginning of the academic year 2015-2016 and an official opening at the end of the year 2015. The researcher recommends the LRS to use this opportunity to include the community of the IR – the management, the scholars, the teachers and the students – and elicit the requirements for each group.

The second recommendation is to initiate the development of a national repository in tandem with the development of the Beta version of the DCDP for resources that fall out of the scope of the LRS, such as the DER of all schools. Developing a national repository will be complicated, especially given the fact that there is no ICT policy for Curaçao yet. The researcher therefore recommends a phased development using the Alpha version of the DCDP as a stepping stone. The national repository can be an interconnected repository of all the national stakeholders, combined with a repository specifically for the government. It is recommended that the local policymakers, starting with the MOSCW, use the DCDP as a starting point, and in parallel with the development of the Beta version, develop the Alpha version of the national repository, as shown in figure 24. Multiple research warns that developing and managing such a converged repository is challenging, and combined with the interrelated problems of SIDS and the unique case of Curaçao, the approach needs to be studied carefully. Starting a new ADR project supported by multiple stakeholders to design and develop an interconnected national community repository can contribute with addressing the complex issues of structural introduction of ICT in education. Having the other Dutch Caribbean islands also participating in this process in due time will benefit the national repositories even more by providing more integration and convergence, but it is recommended to obtain proper support of the Netherlands.

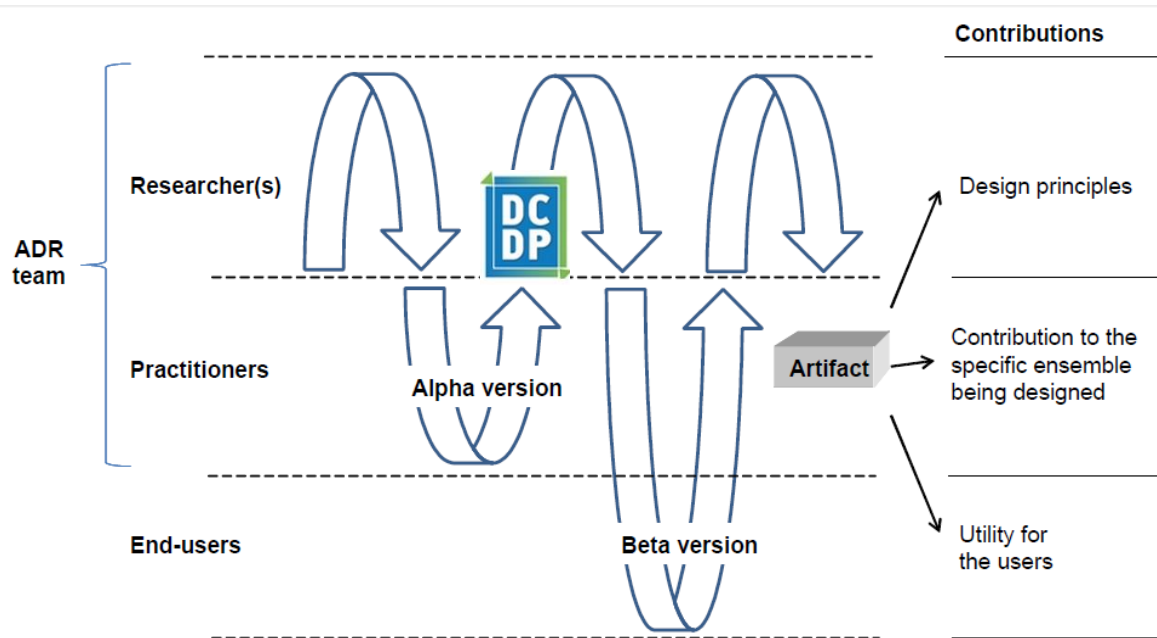


Figure 23: IT-Dominant BIE strategy for the LRS to proceed with the Beta version of a community institutional repository at the UoC

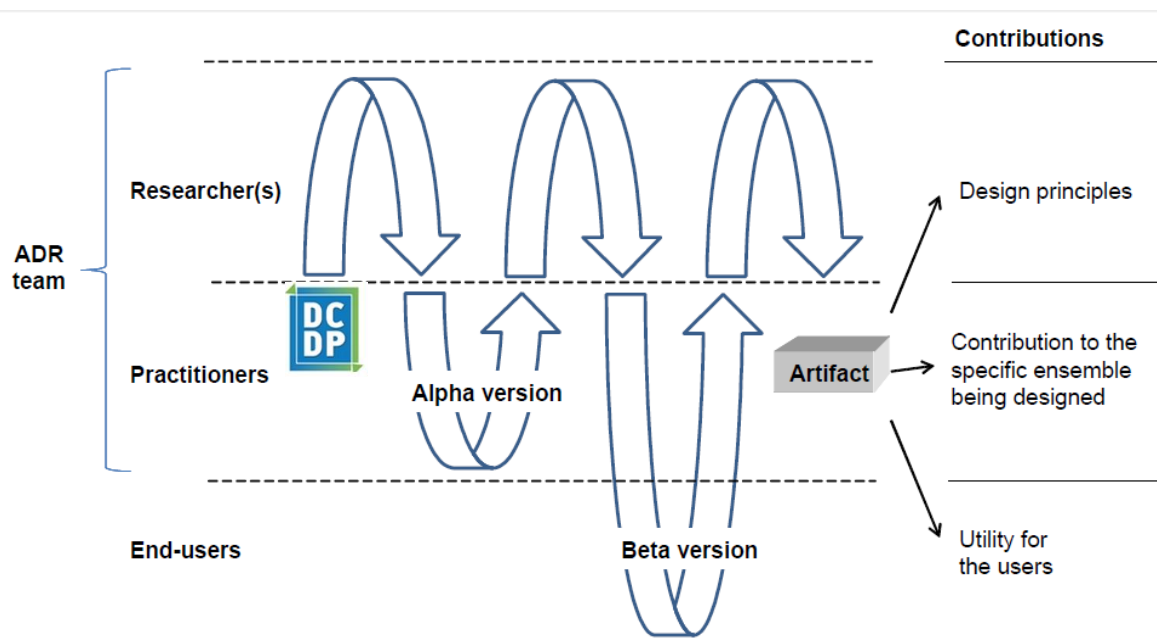


Figure 24: IT-Dominant BIE strategy for designing and developing an interconnected Dutch Caribbean community repository

7.5 Limitations and Further Studies

One of the limitations of the study was that, due to the nature of the subject, only initial requirements were elicited to develop the prototype. A thorough requirement elicitation process needs to be performed, before continuing with further development at the LRS.

Another limitation was that a limited number of stakeholders were consulted. All stakeholders need to be identified and consulted to acquire a more complete view of what must be developed.

Lack of necessary resources and skills limited the proper development of digitization for preservation purposes. Further study in the specific scanners, test cards and development of color measuring skills and working with Photoshop are some factors the LRS must pay attention to.

Although the LOFO was an important stakeholder during the USONA project, development of capacity and resources for the LOFO remained limited. Studies showed that it is not the technology in itself but the role of teachers and transformation of the pedagogy which are determinant factors in pedagogical revolutions. An in-depth study should be conducted on how to build the necessary competencies of the teachers (UNESCO, 2011a.).

For a sustainable development of SIDS, the three pillars of economic, social and environmental development should be considered. This research focused on a small part of social development, but much more could, and should be done on partnering with stakeholders that contain economic, and environmental resources for a more sustainable development of Curaçao.

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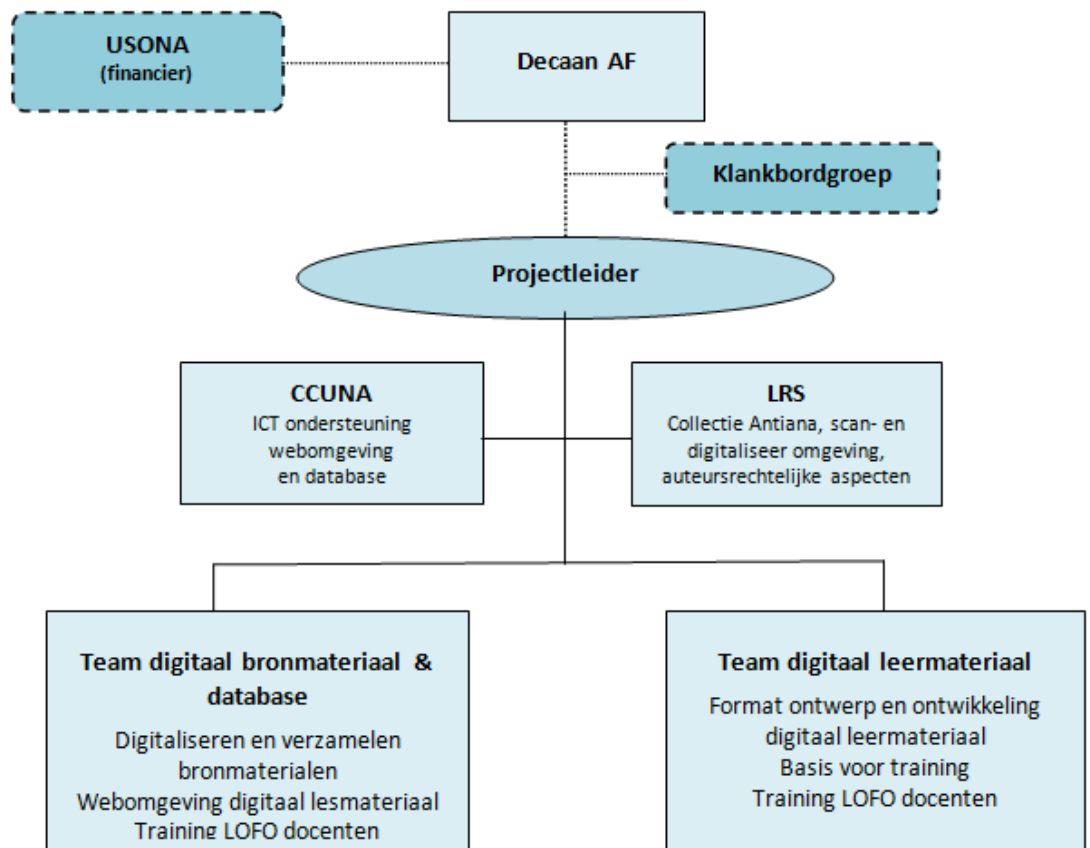
Appendices

Appendix 1: Background of the 'LOFO Project Digitaal Lesmateriaal (USONA 085)'.

The USONA project named 'LOFO Project Digitaal Lesmateriaal (USONA 085)' is a section of the USONA Project 2004171 named 'Beleids- en Invoeringsplan Nieuw Opleidingsonderwijs'.

The project manager was the director of the LRS, M. Groenewoud. Personnel of the LRS, represented by I. Korstjens, provided the necessary information for the source material and copyright issues. The dean of the FoA, E. Echteld followed by D. Manuel, and LOFO personnel, represented by O. Resida, were responsible for providing information on the teaching and learning resources. An advisory board with representatives of important stakeholders was formed and provided advice in major decisions during the development of the repository, reflection on and validation of the prototype. The IT department ICTS, represented by L. Pengel, was in charge of IT support. A team named Digital learning Resources, coordinated by G. Greijmans, was responsible for the creation of digital learning and teaching materials and the establishment of a structured basis for the development hereof at the LOFO. Another team named Digital Source Materials and Database Team, coordinated by the author of this thesis, had the task of providing a repository for digital source material and digital learning and teaching resources, a web environment to access the repository, digitization of source material and harvesting digital source material. The complete documentation of the Digital Source Materials and Database Team was delivered on June 7, 2013 and forms the basis for this thesis, augmented with developments that followed after the project.

The following figure in the project plan provides a schematic representation of the structure (Groenewoud, Korstjens, Aniceta, & Greijmans, 2012, p.7).

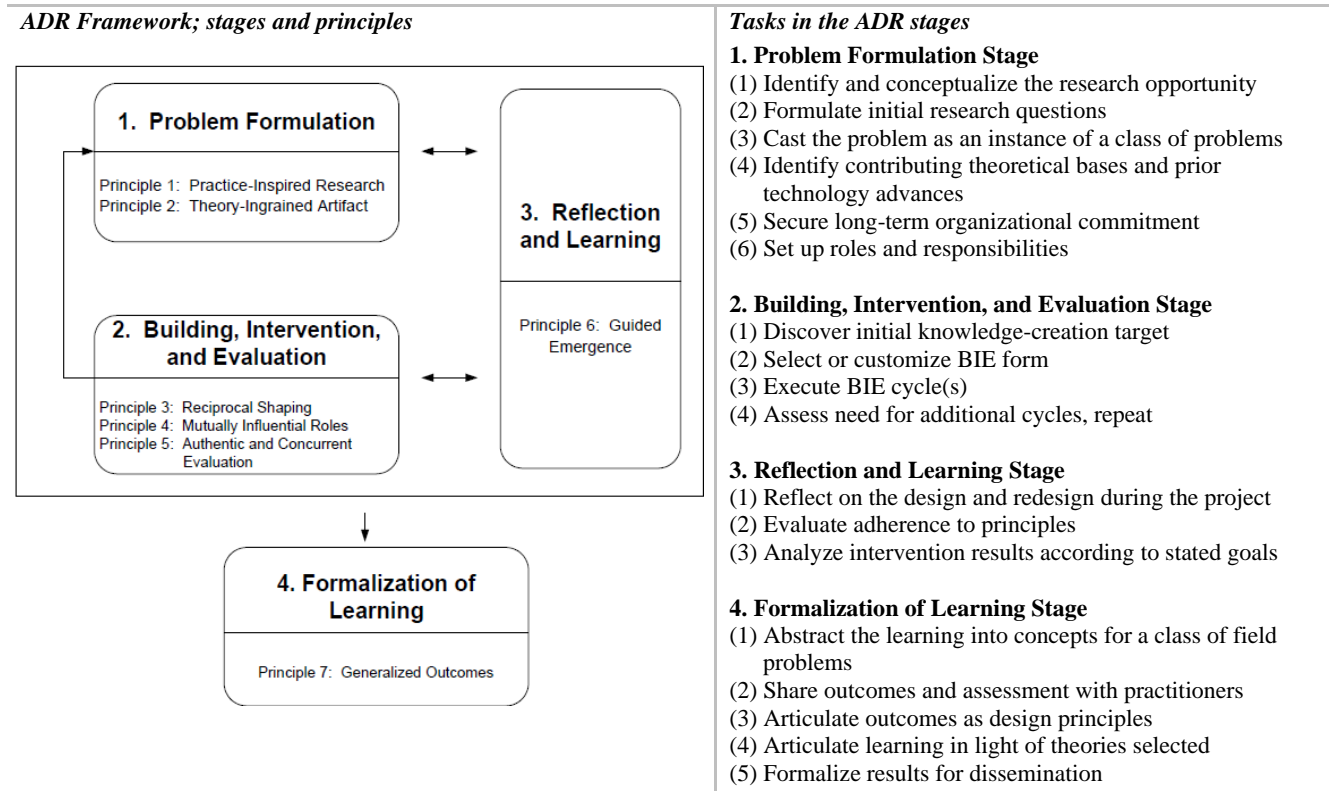


Source: Groenewoud, M., Korstjens, I., Aniceta, Y., & Greijmans, A. (2012, May).

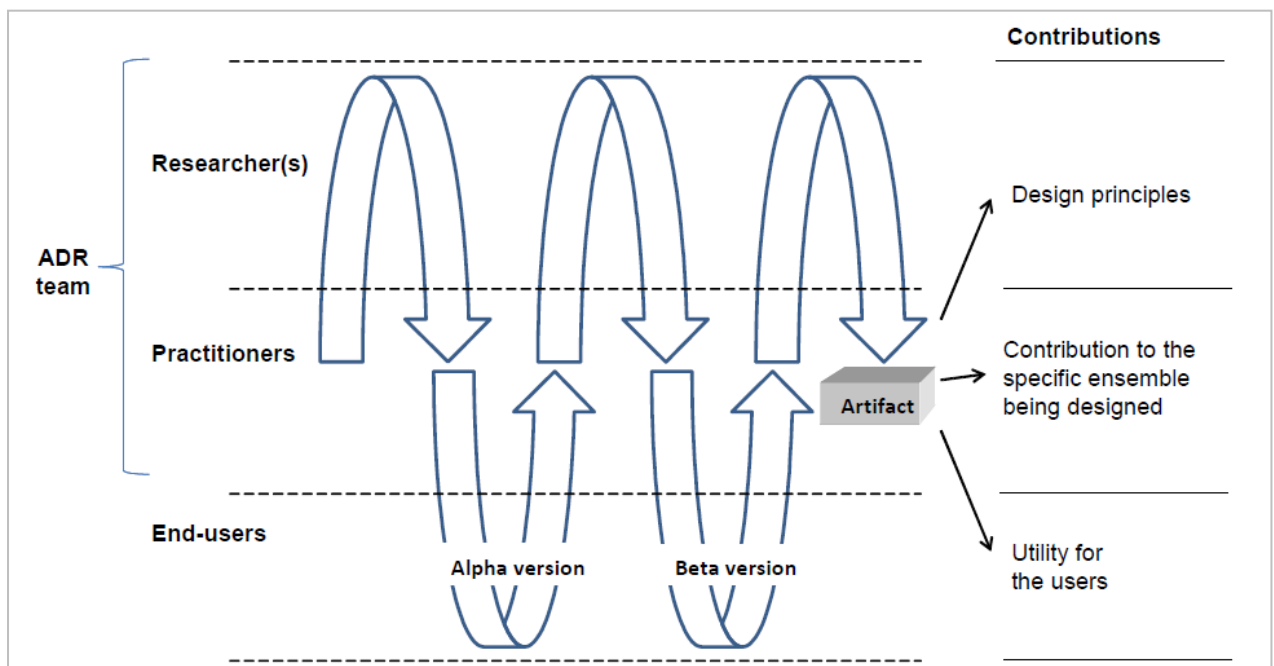
LOFO Project Digitaal Lesmateriaal (USONA 085): Plan van Aanpak, Versie 3. University of the Netherlands Antilles. Curaçao.

Appendix 2: Action Design Research Methodology; the Framework and BIE Schema.

Action Design Research: Stages, Principles and Tasks (Sein et al, 2011)



Generic schema for IT-Dominant BIE (Sein et al, 2011)



Appendix 3: Sources for Empirical data during the USONA projet.

05-Apr-12	Bespreking project aanpak faculteit-LRS
11-May-12	Kennismaking Brooke Wooldridge (dLOC) met Francis de Lanoy (Rector Magnificus UNA)
18, 23-May-12	Overleg Fundashon Planifikashon di Idioma (FPI)
22-May-12	Overleg Fundashon Material pa Skol (FMS)
31 mei 2012	Concretisering activiteiten van de teams en de LOFO
27-Jun-12	Knowledge Platform Curaçao 27 juni “Connect & Co-operate”, presentatie projectleider Margo Groenewoud
28-Jun-12	Network lunch with speakers of Florida International University that participated at the “Connect & Co-operate” conference.
31-Aug-12	Overleg decaan AF
Aug - Oct 12	Wekelijkse bijeenkomst (plaatsvervangende) coördinator, Team Digitaal bronmateriaal & database en Team Digitaal leermateriaal
28-Sep-12	Overleg decaan AF en stafleden LOFO
28-Sep-12	Eerste informatie sessie en aanmelding voor studenten
08-Oct-12	Overleg coördinator LOFO
09-Oct-12	Eerste overleg met stafleden LOFO
12-Oct-12	Evaluatie Fase 0
15-17 Oct 12	ICT conferentie: Mindshift towards 21 st century education Genodigden voor netwerklunch ivm ICT conferentie (Min. v. Onderwijs, Florida International University, e.a.)
22 okt. 2012	Overleg met mw. S. Isabella, kwaliteitscoördinator van de UNA
25 okt. 2012	Overleg Fide i.v.m. presentatie UNA voor volgende conferentie

- Oct.12 - Jan. 13 Wekelijkse bijeenkomst uitvoerend projectleider, Team Digitaal bronmateriaal & database en Team Digitaal leermateriaal
- 07, 08- Nov-12 Workshops ASP it, NA-SCI als gevolg van Grassroots project
- 15-Nov-12 Overleg Fide i.v.m. input UNA voor volgende startconferentie in augustus voor Funderend Onderwijs; presentatie eindproduct LOFO project digitaal leermateriaal
- 20-Nov-12 Overleg met mr. J. Schmidt i.v.m. toekomstplannen IT infrastructuur CCUNA
- 06 ,13-Dec-12 Overleg met decaan AF i.v.m. wensen en eisen webapplicatie
- 19 -Dec-12 Overleg met directrice LRS i.v.m. metadatering Antiana publicaties
- 31-Dec-12 Mail contact met L.Taylor i.v.m. bijstand dLOC locale database en website
- 09-Jan-13 Technische bijstand CCUNA
- 10-Jan-13 Mail contact met Koninklijke bibliotheek personeel (KB) voor technische bijstand en standaarden digitaliseren
- 07-Jan-13 Overleg met directrice LRS i.v.m. planning project
- 10-Jan-13 Overleg met directrice LRS i.v.m. criteria webapplicatie en digitalisering
- 15-Jan-13 Overleg met directrice LRS i.v.m. evaluatie Fase 1
- 17-Jan-13 Eerste klankbordgroep bijeenkomst
- 19-Jan-13 Gesprek met John de Freitas werkzaam bij Carmabi over toegang biodiversity website
- Gesprek met studenten LOFO Bonaire
- 22-Jan-13 Bezoek bij FPI voor materiaal: boek “Fiesta di idioma” volume A1 en A2 gekregen
- 04-Feb-13 Gesprek en Offerte aanvraag Kuki&ko, Rianne Hellings
- 05-Feb-13 Gesprek met Hans van Dormolen over Criteria Metamorfoze

- Overleg met project Leider
- 07-Feb-13 Skype meeting met Mark Sullivan, SobekCM Developer
- Gesprek met IT Support Coördinator bij UNA over de Infrastructuur, ICT beleid UNA, Vervolg uitleg project, Aanschaffing Learning Content Management Systems(Blackboard, Sharepoint, Blackboard Collaborate), Outsourcing servers
- Afspraak contact persoon van LOFO, Rudsel Martinus
- 25-Feb-13 Gesprek met IT Support Coördinator bij UNA over Infrastructuur SobekCM
- Gesprek met Anna Titawana, medewerker RKCS, in verband met gebruik digital leermateriaal in RKCS
- 22 Feb-1Mar-13 FPI mini conferentie met Katrien Depuydt van het Nederlandse Lexicon instituut. Doel: het bouwen van een corpus Papiamentu in een database en deze koppelen aan de webomgeving
- 04-Mar-13 Tweede klankbordgroep bijeenkomst
- 06-Mar-13 Meeting met Raily Goedgedrag
- 08-Mar-13 Meeting met Muriel Meyer, gastdocent van Papiaments LOFO in verband met het maken van meer oefeningen voor Digitaal Leermateriaal
- 09-Mar-13 Meeting met Ester Alake-Tuenter, coördinatrice van Impactum, die Nederlandse stagiaires op Curaçao begeleidt
- 12-Mar-13 Meeting met Ester, Liesbet Echteld, Gracia Greijmans (coördinator Team A) en Margo Groenewoud (project leider)
- 13-Mar-13 Meeting Mark via go2meeting
- 15-Mar-13 Contact met Mark Sullivan in verband met vragen over webomgeving
- 19-Mar-13 Meeting met LOFO staf

- 20-Mar-13 Mark Sullivan op Curaçao; aanpassingen aan DEDiCa
- 21-Mar-13 Mark Sullivan op Curaçao; aanpassingen aan DEDiCa
- 21-Mar-13 Contact met PABO stagiaires Impactum om te helpen bij de workshops
- 22-Mar-13 Mark Sullivan op Curaçao; aanpassingen aan DEDiCa
- 26-Mar-13 Meeting met Mark Sullivan via Go2meeting
- 02-Apr-13 Workshop Les 1 LOFO
- 04-Apr-13 Contact Orsine in verband met het maken van een vak Digitaal
Leermateriaal voor studenten om files te uploaden
- 09-Apr-13 Workshop Les 2 LOFO
- 15-Apr-13 Impatum PABO stagiaires instructie geven over DEDiCa
- 16-Apr-13 Workshop Les 3 LOFO
- 18-Apr-13 Presentatie aan Lysandro Ignacio van IT Vision, die ICT ondersteu geeft
aan AF
- 22-Apr-13 Presentatie gedelegeerden Maestro Kompas Nederland; professionalisering
docenten Ned Antillen
- 24-Apr-13 Presentate en evaluatie AF decaan
- 26-Apr-13 Presentatie en evaluatie LRS personeel
- 26-Apr-13 Presentatie en evaluatie rector magnificus De Lanooy
- 03-May-13 Presentatie aan TF docent Eliza
- 07-May-13 Presentatie en evaluatie LOFO leiding
- 14-May-13 LRS digitaliseringsteam: Workshop Les1 overdracht digitaliseren
- 14-May-13 Presentatie website aan Acuril leden
- 15-May-13 Evaluatie van Orsine in verband met project produkten
- 17-May-13 Evaluatie Desiree Manuel in verband met project produkten
- 27-May-13 LRS digitaliseringsteam: Workshop 2 overdracht digitaliseren

- 28-May-13 3de presentatie klankbordgroep en evaluatie
- 30-May-13 LRS digitaliseringsteam: Workshop 3 overdracht digitaliseren
- 30-May-13 LRS overdracht en evaluatie
- 30-May-13 CCUNA overdracht en evaluatie; Jeffrey
- 07-Jun-13 Overdracht Voortgangsrapportage aan decaan AF, L. Echteld

Appendix 4: Additional Information Concerning the External Stakeholders.

This section presents a summary of empirical data gathered through encounters with the stakeholders and attending conferences, which are listed in appendix 2. Interviews and meetings with the stakeholders served to obtain information on the problems they are facing with using, producing and/or managing local digital educational resources and the causes thereof. To place the project in a larger context, conferences were visited and the project plan was presented at these conferences to acquire feedback of the participants of the conferences.

Fundashon Planifikashon di Idioma.

Fundashon Planifikashon di Idioma (FPI) is the official foundation that promotes the relevant languages in our community — mainly the local vernacular Papiamentu, but also Dutch, English and Spanish — and regulates the linguistic condition in our community.

The director of FPI, Dr. R. Severing, who also maintains a chair at the FoA, gave a demonstration of their colorful books and educational resources for Papiamentu, which covers all educational levels. Mister Severing explained the long and elaborate process the materials must go through from inception to publication, involving a high degree of interaction between different local and international professionals.

Their IT work concerning development of educational resources is outsourced and the digital sources reside in the Netherlands. Due to the fact that Papiamentu is a small language, educational resources in the local vernacular is expensive to develop and to reproduce, and therefore limited in quantity. Mister Severing also indicated that since Papiamentu is a young language, it is in constant development, and new or revised spelling is part of the process to maturity. This however means that part of their educational resources become outdated as soon as an adaptation occurs, and new versions then needs to be published. With the planned closure of USONA in the near future, FPI will have a problem to continue providing

materials, since it is USONA that funded all their operations for the recent years. Only some of their works are on CD and mister Severing sees great opportunities in making a digital version to accompany of all his publications. This will make their resources more sustainable, modern, interactive, easy to adapt and to reproduce.

Besides providing resources and services on Curaçao, the director of FPI declared that they work in close cooperation with Bonaire and Aruba. Aruba has a slightly different version of Papiamentu, called Papiamento, as their official language. FPI also has some of the oldest books in Papiamentu in a small library on their premises. Mister Severing declared that they desire to digitize their collection but they do not have the expertise nor the resources to do this. Furthermore, the amount of publications they possess is too small to set up a digital repository of their own.

Fundashon Material pa Skol.

Fundashon Material pa Skol (FMS) is the institute in charge of developing, producing, distributing and implementing educational materials for all educational levels. In an interview with interim director of FMS mister E. Alexander, he expressed that practically their whole collection is in analog format. There is great interest to be able to start providing more local resources digitally to modernize their collection, but they do not have the expertise to make digital educational resources. They have initiated the work on an educational CD with miss A. Titawana, a teacher at the Roman Catholic school, but the resulting application had bugs and was never completely finished for distribution.

Dienst Openbare Scholen, Rooms Katholiek Centraal Schoolbestuur and Vereniging Protestant Christelijk Onderwijs.

Contact with ICT coordinators and teachers of the three main school denominations for primary and secondary education Dienst Openbare Scholen (DOS), Rooms Katholiek Centraal Schoolbestuur (RKCS), Vereniging Protestant Christelijk Onderwijs (VPCO) during the plenary sessions of the ICT workshops (detailed in the section Conference "Integratie van ICT in onderwijs- en leerprocessen"), revealed the great need for local resources, the struggle of the teachers concerning development of educational resources, and the importance for a structured introduction of ICT in education. In recent years, all educational institutions have been acquiring IWBs to make more use of ICT in education, but there has not been a structured instruction program for the teachers on how to work with them. RKCS is far ahead in this process, having an IWB in almost every classroom and providing ICT support and ICT courses to professionalize their teachers. The VPCO has IWBs in their computer rooms and in some classrooms, and the DOS has the least technical resources and IWBs. There is no integral ICT policy and each school defines how they use technology in the classroom. Development of local digital resources is currently done by those that have experience, skills or are interested to work with these tools. There is no place to store or manage the developed digital resources, which makes it difficult for teachers to acquire examples or to re-purpose resources that have already been made to fit their needs.

Ministerie van Onderwijs, Wetenschap Cultuur en Sport.

The vision of the Ministry of Education, Science, Culture and Sport (MOWCS) is for Curaçao to have an education system in which each citizen has the right and the opportunity to follow high level of education in order to function in this modern technological community (<http://www.gobiernu.cw/web/site.nsf/web/D89CE2767CF135850425782B0073CBE8?open>)

[document&language=nederlands](#)). Plenary sessions during the ICT workshops (detailed in the section Conference "Integratie van ICT in onderwijs- en leerprocessen") revealed a high interest of the Ministry to facilitate a more structured introduction of ICT in education.

There is no plan or policy however to guide a structured introduction or use of ICT in education. They are in the process of drafting policies and plans, but as long as there is no funding available they are restricted in doing so, since these policies must be accompanied by a budgetary plan for implementation.

The Conference "Connect & Co-operate".

The conference "Connect & Co-operate", subtitled "The road to a successful Information Society", took place on June 27, 2012. The conference was organized by Knowledge Platform Curaçao (a multi-stakeholder foundation of government ministries and agencies, the university, private businesses and associations) in association with the Ministry of Economic Development^{lxxx}, Stimul-IT now CITI (a government-subsidized ICT foundation), and Bureau Telecommunication & Post. This conference was in extension of the Caribbean ICT Roadshow of 2009^{lxxxi}, where sessions were held to create the framework for a preliminary Master Plan for Curaçao as an Information Society (Bureau Telecommunicatie en Post, 2013), in transitioning to an autonomous country. The purpose of the conference was to gather input of multiple stakeholders to continue with the development of the Masterplan. A presentation of the USONA project plan was given in *Track 4: Improving learning opportunities for everyone*, which led to discussions on the human, technical and financial problems to fully include ICT in education. Multiple collaboration opportunities emerged from the interactions that followed. At the end of the session, the organizers collected input on ways each participant could contribute to solutions concerning the ICT challenges that were discussed in this track.

The Conference "Integratie van ICT in onderwijs- en leerprocessen ".

The ICT conference entitled "Integratie van ICT in onderwijs- en leerprocessen" was held between 15 and 17 October 2012 at the Hilton Hotel en Casino, and was organized by the MOWSC in association with Fundashon pa Inovashon di Enseñansa na Kòrsou (FIdE). Although a considerable amount has been invested in the educational reform in recent years (see USONA documents on its website^{lxxxii}), and the implementation has required much effort of school boards, school leaders and teachers, these did not bring about the changes that were anticipated. The objectives of the conference were to provide support in integrating ICT in the educational field by: stimulating the use of ICT in the elementary education; using ICT as a catalyst to bring about a mind-shift in education; providing ICT tools through which teachers could create a powerful learning environment; and raising awareness of the powerful role that ICT can play in teaching and learning processes. Emphasis was placed on collaboration; on the role of technology in education systems; on the impact of ICT in the economy; and on success factors of ICT skills before going to study in Higher Education. The conference brought forth a better view of the intricate problems that exist in all educational levels for introducing ICT in education. Policymakers that were present indicated that an ICT policy for education was being drafted, and they indicated the difficulties this entails. The USONA project plan was also presented here, and it revealed the possibility of future inclusion of many other stakeholders who participated in the event.

Verwerking enquête en gesprek ICT-managers schoolbesturen (G.Greijmans)

Onderstaande samenvatting en conclusies zijn gebaseerd op de respons van twee schoolbesturen te weten het RKCS en de VPCO.

Beide schoolbesturen geven aan veel tijd en geld te investeren in het verbeteren van de infrastructuur en outillage. Het gebruik van internet wordt steeds beter mogelijk.

Het vergroten van de expertise van de leraren heeft aandacht, echter is niet direct gericht op het maken van DLM. Eerder het vergroten van de computervaardigheden van de leraar. Hier valt ook het leren werken met het digitaal schoolbord onder. De stap naar zelf maken van DLM wordt beschouwd als complex door verschillende factoren. Het gebruik van methodegebonden software heeft steeds meer de aandacht. Dit biedt de leraar een kant en klare oplossing. Echter alleen voor taal (Nederlands) en rekenen wordt dit nu geïntroduceerd.

De managers geven aan dat er voor educatiegebieden Mens en maatschappij, Mens, natuur en technologie onvoldoende materiaal is. Een belangrijke factor is de herkenbaarheid voor onze leerlingen. Ze geven aan dat de taal waarin de DLM wordt aangeboden zeker een rol speelt. Verder zijn er nog altijd te weinig lokale bronnen beschikbaar of de bekendheid er mee is laag. Ook voor Taal, geletterdheid en communicatie is er een groot tekort aan materiaal. Dit geldt zowel voor Papiamentu als Nederlands. Mediawijsheid krijgt aandacht, echter niet structureel. Er zijn weleens ict-projecten. De projecten lopen op een klein aantal scholen.

De managers geven aan dat de beginnende leraar onvoldoende ict-vaardig is. Ze verwachten dat binnen de opleiding meer aandacht zal komen voor het werken met het digitale schoolbord en maken van DLM. Het initiatief van de LOFO, namelijk het opzetten van een repository wordt ondersteund. Voor de uitrol in het onderwijsveld zullen wel de nodige stappen gezet moeten worden o.a.promotie, ondersteuning voor leraren en kwaliteitscontrole. De managers hebben niet de verwachting dat de repository zonder meer gebruikt zal worden.

Appendix 5: TAM Questionnaire for Teachers and Students.

Education group _____
 Gender _____
 Average hours daily computer usage _____
 Owns a computer/laptop _____

Please fill one of these numbers in the boxes in front of the following statements

1 Completely disagree 2 Disagree 3 Neutral 4 Agree 5 Completely agree

Perceived usefulness

- PU1: Using the repository in my job would enable me to accomplish tasks more quickly
- PU2: Using the repository would improve my job performance
- PU3: Using the repository would increase my productivity
- PU4: Using the repository would enhance my effectiveness on the job
- PU5: Using the repository would make it easier to do my job
- PU6: I would find the repository useful in my job

Perceived ease of use

- PEOU1: Learning to use the repository is easy for me
- PEOU2: I find it easy to get the repository to do what I want it to do
- PEOU3: My interaction with the repository is clear and understandable
- PEOU4: I find the repository to be flexible to interact with
- PEOU5: It is easy for me to become skilful at using the repository
- PEOU6: I find the repository easy to use

Intention to use

- ITU1: I always try to use the repository to do a task whenever it has a feature to help me perform it
- ITU2: I always try to use the repository in as many cases as possible

Appendix 6: TAM Questionnaire for Members of the Advisory committee.

Organization/department _____
 Function _____
 Name/email (optional) _____

Please fill one of these numbers in the boxes in front of the following statements

1 Completely disagree 2 Disagree 3 Neutral 4 Agree 5 Completely agree

Perceived usefulness

- PU1: Using the repository in my job/organization would enable me to accomplish tasks more quickly
- PU2: Using the repository would improve my job/organization performance
- PU3: Using the repository would increase my/our productivity
- PU4: Using the repository would enhance my/our effectiveness on the job
- PU5: Using the repository would make it easier to do my job/organization
- PU6: I would find the repository useful in my job/organization
- PU7: Using the repository will improve my work/ at my organization.
- PU8: Using the repository will enhance my/our effectiveness.
- PU9: Using the repository will increase my/our productivity.
- PU10 I would find the repository a useful tool in my work/organization.

Perceived ease of use

- PEOU1: Learning to use the repository is easy for me
- PEOU2: I find it easy to get the repository to do what I want it to do
- PEOU3: My interaction with the repository is clear and understandable
- PEOU4: I find the repository to be flexible to interact with
- PEOU5: It is easy for me to become skilful at using the repository
- PEOU6: I find easy to use the repository

Intention to use

- ITU1: I would use the repository to do a task whenever it has a feature to help me perform it
- ITU2: I would use to use the repository in as many cases as possible

Appendix 7: Requirements for Certification of a Trusted Repository

3 ORGANIZATIONAL INFRASTRUCTURE

3.1 GOVERNANCE AND ORGANIZATIONAL VIABILITY

3.1.1 The repository shall have a mission statement that reflects a commitment to the preservation of, long term retention of, management of, and access to digital information.

3.1.2 The repository shall have a Preservation Strategic Plan that defines the approach the repository will take in the long-term support of its mission.

3.1.2.1 The repository shall have an appropriate succession plan, contingency plans, and/or escrow arrangements in place in case the repository ceases to operate or the governing or funding institution substantially changes its scope.

3.1.2.2 The repository shall monitor its organizational environment to determine when to execute its succession plan, contingency plans, and/or escrow arrangements.

3.1.3 The repository shall have a Collection Policy or other document that specifies the type of information it will preserve, retain, manage, and provide access to.

3.2 ORGANIZATIONAL STRUCTURE AND STAFFING

3.2.1 The repository shall have identified and established the duties that it needs to perform and shall have appointed staff with adequate skills and experience to fulfill these duties.

3.2.1.1 The repository shall have identified and established the duties that it needs to perform.

3.2.1.2 The repository shall have the appropriate number of staff to support all functions and services.

3.2.1.3 The repository shall have in place an active professional development program that provides staff with skills and expertise development opportunities.

3.3 PROCEDURAL ACCOUNTABILITY AND PRESERVATION POLICY FRAMEWORK

3.3.1 The repository shall have defined its Designated Community and associated knowledge base(s) and shall have these definitions appropriately accessible.

3.3.2 The repository shall have Preservation Policies in place to ensure its Preservation Strategic Plan will be met.

3.3.2.1 The repository shall have mechanisms for review, update, and ongoing development of its Preservation Policies as the repository grows and as technology and community practice evolve.

3.3.3 The repository shall have a documented history of the changes to its operations, procedures, software, and hardware.

3.3.4 The repository shall commit to transparency and accountability in all actions supporting the operation and management of the repository that affect the preservation of digital content over time.

3.3.5 The repository shall define, collect, track, and appropriately provide its information integrity measurements.

3.3.6 The repository shall commit to a regular schedule of self-assessment and external certification.

3.4 FINANCIAL SUSTAINABILITY

3.4.1 The repository shall have short- and long-term business planning processes in place to sustain the repository over time.

3.4.2 The repository shall have financial practices and procedures which are transparent, compliant with relevant accounting standards and practices, and audited by third parties in accordance with territorial legal requirements.

3.4.3 The repository shall have an ongoing commitment to analyze and report on financial risk, benefit, investment, and expenditure (including assets, licenses, and liabilities).

3.5 CONTRACTS, LICENSES, AND LIABILITIES

3.5.1 The repository shall have and maintain appropriate contracts or deposit agreements for digital materials that it manages, preserves, and/or to which it provides access.

3.5.1.1 The repository shall have contracts or deposit agreements which specify and transfer all necessary preservation rights, and those rights transferred shall be documented.

3.5.1.2 The repository shall have specified all appropriate aspects of acquisition, maintenance, access, and withdrawal in written agreements with depositors and other relevant parties.

3.5.1.3 The repository shall have written policies that indicate when it accepts preservation responsibility for contents of each set of submitted data objects.

3.5.1.4 The repository shall have policies in place to address liability and challenges to ownership/rights.

3.5.2 The repository shall track and manage intellectual property rights and restrictions on use of repository content as required by deposit agreement, contract, or license.

4 DIGITAL OBJECT MANAGEMENT

4.1 INGEST: ACQUISITION OF CONTENT

4.1.1 The repository shall identify the Content Information and the Information Properties that the repository will preserve

4.1.1.1 The repository shall have a procedure(s) for identifying those Information Properties that it will preserve.

4.1.1.2 The repository shall have a record of the Content Information and the Information Properties that it will preserve.

4.1.2 The repository shall clearly specify the information that needs to be associated with specific Content Information at the time of its deposit.

4.1.3 The repository shall have adequate specifications enabling recognition and parsing of the SIPs.

4.1.4 The repository shall have mechanisms to appropriately verify the identity of the Producer of all materials.

4.1.5 The repository shall have an ingest process which verifies each SIP for completeness and correctness.

4.1.6 The repository shall obtain sufficient control over the Digital Objects to preserve them.

4.1.7 The repository shall provide the producer/depositor with appropriate responses at agreed points during the ingest processes.

4.1.8 The repository shall have contemporaneous records of actions and administration processes that are relevant to content acquisition.

4.2 INGEST: CREATION OF THE AIP

4.2.1 The repository shall have for each AIP or class of AIPs preserved by the repository an associated definition that is adequate for parsing the AIP and fit for long- term preservation needs.

4.2.1.1 The repository shall be able to identify which definition applies to which AIP.

4.2.1.2 The repository shall have a definition of each AIP that is adequate for long-term preservation, enabling the identification and parsing of all the required components within that AIP.

4.2.2 The repository shall have a description of how AIPs are constructed from SIPs.

4.2.3 The repository shall document the final disposition of all SIPs.

In particular the following aspect must be checked.

4.2.3.1 The repository shall follow documented procedures if a SIP is not incorporated into an AIP or discarded and shall indicate why the SIP was not incorporated or discarded.

4.2.4 The repository shall have and use a convention that generates persistent, unique identifiers for all AIPs.

In particular the following aspects must be checked.

4.2.4.1 The repository shall uniquely identify each AIP within the repository.

4.2.4.1.1 The repository shall have unique identifiers.

4.2.4.1.2 The repository shall assign and maintain persistent identifiers of the AIP and its components so as to be unique within the context of the repository.

4.2.4.1.3 Documentation shall describe any processes used for changes to such identifiers.

4.2.4.1.4 The repository shall be able to provide a complete list of all such identifiers and do spot checks for duplications.

4.2.4.1.5 The system of identifiers shall be adequate to fit the repository's current and foreseeable future requirements such as numbers of objects.

4.2.4.2 The repository shall have a system of reliable linking/resolution services in order to find the uniquely identified object, regardless of its physical location.

4.2.5 The repository shall have access to necessary tools and resources to provide authoritative Representation Information for all of the digital objects it contains.

In particular the following aspects must be checked.

4.2.5.1 The repository shall have tools or methods to identify the file type of all submitted Data Objects.

4.2.5.2 The repository shall have tools or methods to determine what Representation Information is necessary to make each Data Object understandable to the Designated Community.

4.2.5.3 The repository shall have access to the requisite Representation Information.

4.2.5.4 The repository shall have tools or methods to ensure that the requisite Representation Information is persistently associated with the relevant Data Objects.

4.2.6 The repository shall have documented processes for acquiring Preservation Description Information (PDI) for its associated Content Information and acquire PDI in accordance with the documented processes.

In particular the following aspects must be checked.

4.2.6.1 The repository shall have documented processes for acquiring PDI.

4.2.6.2 The repository shall execute its documented processes for acquiring PDI.

4.2.6.3 The repository shall ensure that the PDI is persistently associated with the relevant Content Information.

4.2.7 The repository shall ensure that the Content Information of the AIPs is understandable for their Designated Community at the time of creation of the AIP.

In particular the following aspects must be checked.

4.2.7.1 Repository shall have a documented process for testing understandability for their Designated Communities of the Content Information of the AIPs at their creation.

4.2.7.2 The repository shall execute the testing process for each class of Content Information of the AIPs.

- 4.2.7.3 The repository shall bring the Content Information of the AIP up to the required level of understandability if it fails the understandability testing.
- 4.2.8 The repository shall verify each AIP for completeness and correctness at the point it is created.
- 4.2.9 The repository shall provide an independent mechanism for verifying the integrity of the repository collection/content.
- 4.2.10 The repository shall have contemporaneous records of actions and administration processes that are relevant to AIP creation.

4.3 PRESERVATION PLANNING

- 4.3.1 The repository shall have documented preservation strategies relevant to its holdings.
- 4.3.2 The repository shall have mechanisms in place for monitoring its preservation environment.
- 4.3.2.1 The repository shall have mechanisms in place for monitoring and notification when Representation Information is inadequate for the Designated Community to understand the data holdings.
- 4.3.3 The repository shall have mechanisms to change its preservation plans as a result of its monitoring activities.
- 4.3.3.1 The repository shall have mechanisms for creating, identifying or gathering any extra Representation Information required.
- 4.3.4 The repository shall provide evidence of the effectiveness of its preservation activities.

4.4 AIP PRESERVATION

- 4.4.1 The repository shall have specifications for how the AIPs are stored down to the bit level.
- 4.4.1.1 The repository shall preserve the Content Information of AIPs.
- 4.4.1.2 The repository shall actively monitor the integrity of AIPs.
- 4.4.2 The repository shall have contemporaneous records of actions and administration processes that are relevant to storage and preservation of the AIPs.
- 4.4.2.1 The repository shall have procedures for all actions taken on AIPs.
- 4.4.2.2 The repository shall be able to demonstrate that any actions taken on AIPs were compliant with the specification of those actions.

4.5 INFORMATION MANAGEMENT

- 4.5.1 The repository shall specify minimum information requirements to enable the Designated Community to discover and identify material of interest.
- 4.5.2 The repository shall capture or create minimum descriptive information and ensure that it is associated with the AIP.
- 4.5.3 The repository shall maintain bi-directional linkage between each AIP and its descriptive information.
- 4.5.3.1 The repository shall maintain the associations between its AIPs and their descriptive information over time.

4.6 ACCESS MANAGEMENT

- 4.6.1 The repository shall comply with Access Policies.
- 4.6.1.1 The repository shall log and review all access management failures and anomalies.
- 4.6.2 The repository shall follow policies and procedures that enable the dissemination of digital objects that are traceable to the originals, with evidence supporting their authenticity.

4.6.2.1 The repository shall record and act upon problem reports about errors in data or responses from users.

5 INFRASTRUCTURE AND SECURITY RISK MANAGEMENT

5.1 TECHNICAL INFRASTRUCTURE RISK MANAGEMENT

5.1.1 The repository shall identify and manage the risks to its preservation operations and goals associated with system infrastructure.

5.1.1.1 The repository shall employ technology watches or other technology monitoring notification systems.

5.1.1.1.1 The repository shall have hardware technologies appropriate to the services it provides to its designated communities.

5.1.1.1.2 The repository shall have procedures in place to monitor and receive notifications when hardware technology changes are needed.

5.1.1.1.3 The repository shall have procedures in place to evaluate when changes are needed to current hardware.

5.1.1.1.4 The repository shall have procedures, commitment and funding to replace hardware when evaluation indicates the need to do so.

5.1.1.1.5 The repository shall have software technologies appropriate to the services it provides to its designated communities.

5.1.1.1.6 The repository shall have procedures in place to monitor and receive notifications when software changes are needed.

5.1.1.1.7 The repository shall have procedures in place to evaluate when changes are needed to current software.

5.1.1.1.8 The repository shall have procedures, commitment, and funding to replace software when evaluation indicates the need to do so.

5.1.1.2 The repository shall have adequate hardware and software support for backup functionality sufficient for preserving the repository content and tracking repository functions.

5.1.1.3 The repository shall have effective mechanisms to detect bit corruption or loss.

5.1.1.3.1 The repository shall record and report to its administration all incidents of data corruption or loss, and steps shall be taken to repair/replace corrupt or lost data.

5.1.1.4 The repository shall have a process to record and react to the availability of new security updates based on a risk-benefit assessment.

5.1.1.5 The repository shall have defined processes for storage media and/or hardware change (e.g., refreshing, migration).

5.1.1.6 The repository shall have identified and documented critical processes that affect its ability to comply with its mandatory responsibilities.

5.1.1.6.1 The repository shall have a documented change management process that identifies changes to critical processes that potentially affect the repository's ability to comply with its mandatory responsibilities.

5.1.1.6.2 The repository shall have a process for testing and evaluating the effect of changes to the repository's critical processes.

5.1.2 The repository shall manage the number and location of copies of all digital objects.

5.1.2.1 The repository shall have mechanisms in place to ensure any/multiple copies of digital objects are synchronized.

5.2 SECURITY RISK MANAGEMENT

5.2.1 The repository shall maintain a systematic analysis of security risk factors associated with data, systems, personnel, and physical plant.

5.2.2 The repository shall have implemented controls to adequately address each of the defined security risks.

5.2.3 The repository staff shall have delineated roles, responsibilities, and authorizations related to implementing changes within the system.

5.2.4 The repository shall have suitable written disaster preparedness and recovery plan(s), including at least one off-site backup of all preserved information together with an offsite copy of the recovery plan(s).

Appendix 8: Checklist to set up the repository

Start: <http://www.rsp.ac.uk/start/>

This section provides information to help you get your repository set up. It includes advice on planning for your repository, getting the repository software and processes set up, defining policies and making sure that you've considered all the legal implications of the repository and planning the resources you will require in the short and long term.

- A. Before you start Advice on planning for setting up a repository.
- B. Setting up a repository Information on how to get the repository and the processes it requires established.
- C. Policies & legal issues Advices on the policies you may need to define and the legal issues associated with running a repository.
- D. Resourcing for sustainability An overview of the resources, including staffing, that may be required to set up the repository and administer it in the longer term.

A. Before you start

This section provides the information that you will need to know before embarking on the process of setting up your repository. There are five sections to explore:

- What is a repository? This section explains repositories and their different variants.
 - Open access What is Open access in the context of a repository?
 - Benefits This section explains the gains that can be made by various parties through the use of repositories.
 - Changing the culture Creating a successful repository will require changes to the culture of your institution. This section outlines some of the challenges.
 - Planning checklist Our planning checklist will help you to ensure that you have considered all of the relevant questions before launching your repository project.
1. What is an institutional repository and what does it mean to you?
 2. Have you outlined and documented the purpose and drivers for institutional repository establishment in your institution?
 3. Have you defined your vision and initial goals?
 4. Have you decided how to position your institutional repository within your wider information environment?
 5. What is the target content of the repository? This could include research papers and data, electronic theses, as well as teaching and learning resources.
 6. Have you completed a stakeholder analysis? Stakeholders are those people with a vested interest in how the repository represents the institution, and themselves, to the world. In the case of an institutional repository, stakeholders will include senior institutional managers, departmental leaders, and those who are expected to contribute content.
 7. Do you have an institution wide IPR policy?
 8. Have you done a risk assessment?
 9. Considering the type of content your institutional repository will contain have you consulted your academic community to explore their current practice and method of dealing with these materials?

10. Do any of your Departments already have a repository or other digital stores of publications?
How will you manage duplication, transfer of resources and metadata, and, perhaps, the closure of the Departmental repository?
11. Does your institution have an information management strategy?
12. Have you identified and briefed your project champion - a senior member of staff who will support your institutional repository project?
13. Have you established an institutionally representative working group?
14. Have you identified extant skills and personnel within the institution to call upon for advice and input? And have you let them know what you are planning?
15. Have you defined roles and responsibilities for your institutional repository development?
16. Have you made financial arrangements to support institutional repository work in the short/medium/long term?
17. What sort of statistics and management reports will you want from your institutional repository?

B. Setting up a repository planning checklists

This section provides information to help you create your repository and the administrative processes required to maintain it.

- **Technical approaches** This section explains the different options for setting up repository software.
 - **Metadata** Advice on planning how to define and manage the metadata within your repository.
 - **Workflows** Information on planning the administrative processes for the repository.
 - **Launching a repository** Advice on making your repository live and publicising it within your institution.
 - **Planning checklist** Our planning checklist will help you to ensure that you have considered all of the relevant questions before launching your repository.
1. Have you created a requirements document that sets out the specifications you require from the chosen system?
 2. Have you compared repository software to find which best fulfill the requirements?
 3. Which repository software will best serve the identified requirements? Do you want to use open source software, free to obtain but requires local support? Or paid-for repository services hosted elsewhere? Or a mixture of local support and bought custom services as needed?
 4. What are the platform requirements for your chosen software? Must it run on Windows, or is a Linux server supported?
 5. Does the technical support team have any programming requirements? Some repository software has administrator interfaces that reduce programming requirements.
 6. Have you installed and configured your software?
 7. Have you considered how to integrate your software with other systems within the institution?
 8. What other systems and services might the repository be required to share information with? This is often referred to as 'interoperability'. As well as OAI, this is also likely to embrace Web services standards, including Web 2.0, digital library systems and other institutional and personal information systems.
 9. Have you registered your institutional repository with external services to facilitate harvesting?

10. Have you decided if and how you will collect usage and item download statistics for your repository? Will you use a tool built into your chosen repository, or an external tool or repository add-on?
11. Have you decided how your institutional repository users will be authenticated?
12. Have you defined your metadata requirements and set up an appropriate schema?
13. Have you checked your metadata meets the required standards for interoperability?
14. Have you considered the workflows within your institutional repository and set up appropriate mechanisms to deal with incoming content?
15. Is the repository budget sufficient to achieve the technical requirements?

C. Legal and policy issues

This section provides information to help you create the policies that provide the framework for managing the repository and legal compliance.

- **Content policies** Advice on creating policies for defining the type of content that will be stored in your repository.
- **Submission policies** Defining the policies for getting content into the repository.
- **Data re-use policies** Advice on specifying how the content in your repository can be used by others.
- **Preservation policies** Help for considering how you define the preservation approach for your repository.
- **Copyright issues** Handling copyright can be one of the most difficult task for repository manager and administrators. This section provides advice on creating your copyright policies.
- **Take-down policies** It is important for repositories to have a robust policy to deal with disputes over items that have been submitted. This section provides advice on defining take-down policies.
- **Embargoes** Advice on creating policies for content where an embargo has been imposed.
- This planning checklist covers legal and policy issues. Here are the questions to ask yourself:
 1. Have you defined an overall vision for your institutional repository to guide your policy framework?
 2. Have you developed a collection policy for your institutional repository?
 3. Have you defined a submission policy for your institutional repository?
 4. Have you defined the content types that you will be including in your institutional repository?
 5. Have you defined a deposit license and policy for your institutional repository?
 6. Have you defined a re-use license for your institutional repository?
 7. Have you considered how a preservation policy will emerge from your other policy decisions?
 8. Have you decided who will be responsible for checking the copyright status of items coming into the repository?

D. Resourcing for sustainability

This section provides information to help you plan the staffing requirements of your repository.

- Installation & customization Advice on the resources required to set up your repository software.
- Technical maintenance Once installed, what resources will be required to maintain the repository software.
- Content mediation Advice on the resources required to managing mediated submissions to the repository.
- Equipment Help on estimating the equipment required to operate and manage a repository.
- Planning checklist: Our planning checklist will help you to ensure that you have considered all of the relevant questions relating to the resources required for your repository.

1. Have you properly and fully specified the requirements of your repository?
2. Where and who will host the repository?
3. What are the pros and cons of using open source software and is it for you?
4. Have you considered buying in the software and/or the support?
5. What is the anticipated growth of your repository? Does your technical architecture support that growth?
6. Have you considered a service level? Will the repository be available 24/7? Will the users expect it to be?
7. How much do you want to customise the software - look and feel, metadata store & Web interfaces?
8. Are you running a pilot project or a production service? If the former, who, when, if and how will it transfer to a production service?
9. Who will answer support/help desk queries relating to the repository?
10. How will you get data out of the repository when the next best thing comes along?
11. Have you considered how your repository may grow over the next year, 3 years, 5 years, 10 years, and do you have sufficient storage space for such growth, or a means to acquire new storage?
12. Do you have sufficient backup capability and capacity for your repository?
13. Have you considered who has suitable skills to perform a repository installation?
14. Have you considered who has suitable skills to perform a repository customisation (metadata, input forms, collection creation etc)?
15. Have you considered who has suitable skills to perform repository look and feel customisation (graphic skills, corporate branding)?
16. Do you know who has access to the systems that you might want to integrate with (for example local password and authentication systems)?
17. Have you considered how you will document and store your installation and customisation details for future reference?
18. Have you budgeted maintenance time for staff to maintain your repository technical infrastructure?
19. Do you know who will look out for announcements of new versions to test and upgrade?
20. Who will provide ongoing technical support for day to day technical issues that might arise?
21. Which digital formats can the repository commit to preserve in the longer-term? Is the repository collecting author source formats?

22. Is there a viable action plan for monitoring the formats stored in the repository and the preservation risks associated with those formats? Do you know which tools are available to do this?
23. Should the repository look to outsource preservation action services?
24. Does the budget for the repository support all requirements identified for sustainability?

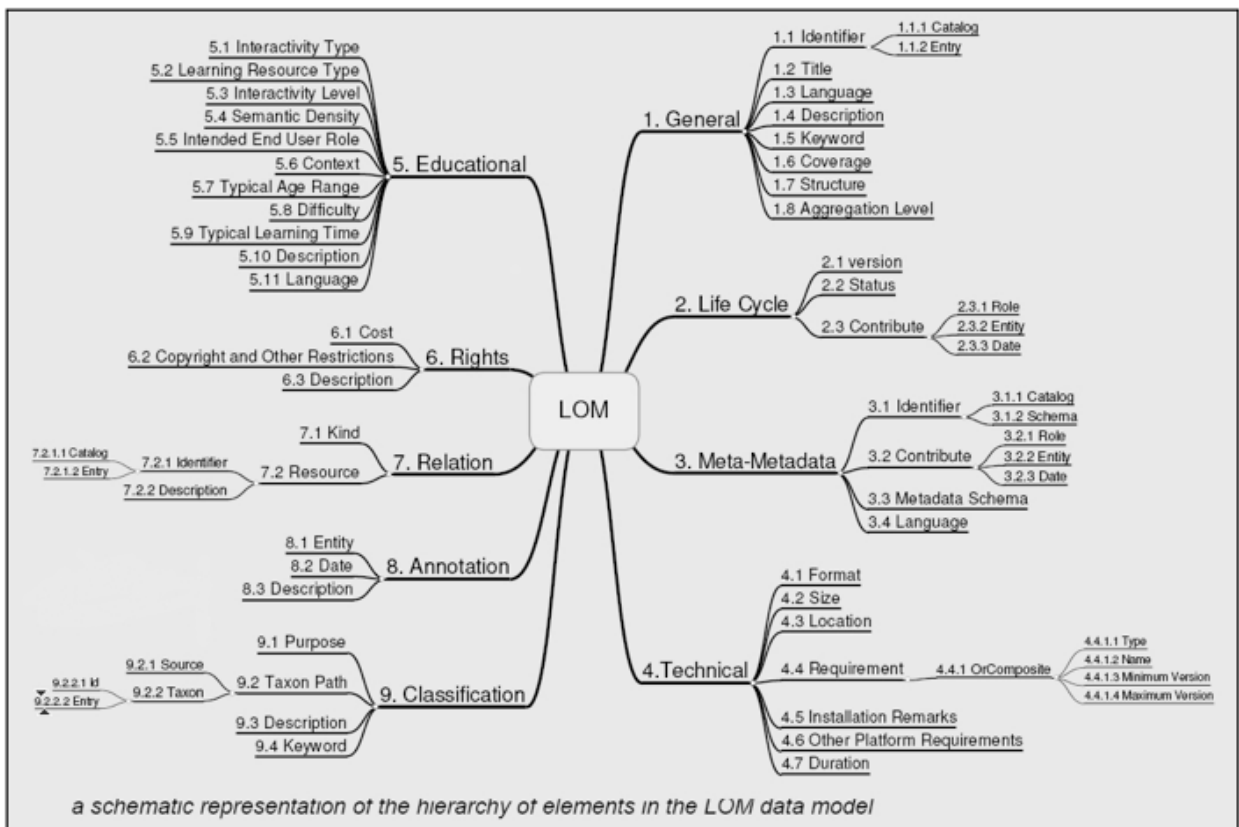
Grow <http://www.rsp.ac.uk/grow/>

See the sections listed here for advice on expanding the content of your repository and increasing its utilisation.

- Advocacy Information on promoting the repository within your institution and increasing deposit rates.
- Initial content Some quick win ideas for getting your repository moving and rapidly increasing deposits.
- Registration Advice on increasing the visibility of your repository outside your institution by registering with specialist services. Also includes details of the machine-to-machine protocols used to automatically populate various directories and services.
- Optimisation Most users will find the content in your repository through the major search engines such as Google. This section contains advice on ensuring that your repository is visible to search engines and optimised for high rankings.
- Measuring success Information on how to benchmark your repository and measure the utilisation of its content.
- Embedding Information on how to integrate your repository into your institutional systems, processes and policies.

Appendix 9: IEEE-LOM elements and the NL-LOM

Source: Koutsomitropoulos, D. A., Solomou, G. D., Papatheodorou, T. S., & Alexopoulos, A. D. (2010). The use of metadata for educational resources in digital repositories: Practices and perspectives. *D-Lib Magazine*, 16(1), 3. Retrieved from <http://www.dlib.org/dlib/january10/kout/01kout.html>



Source: Frijns, M., & Roes, J., (1.0 (13 december 2011). Handleiding voor het geautomatiseerd uitleveren van metadata over leermiddelenpakketten., Versienummer 1.0 .

Retrieved from

http://www.edustandaard.nl/fileadmin/edustandaard/Bestanden/Afspraken/Content_Prijs_Info_rmatie/Handleiding_geautomatiseerd_uitleveren_metadata_over_leermiddelenpakketten.pdf

NL LOM veld		
Veld	Invulling veld ten behoeve van leermiddelenpakketten	Opnemen
Titel	<u>lom.general.title</u> De titel van het leermiddel. Hier kan zowel een titel als een ondertitel worden ingevuld.	Verplicht
Titel gerelateerde omschrijving	<u>lom.annotation.description</u> Bevat een korte omschrijving gerelateerd aan de titel, bijv. een editievermelding ('negende editie' of 'Engelstalige editie'). Er wordt geadviseerd om bij het vullen van dit veld ook de andere velden onder lom.annotation in te vullen.	Aanbevolen
Auteurs	<u>lom.lifecycle.contribute</u> De nam(en) van de auteurs en/of organisatie(s) (of namen personen meegewerkt aan tot standkoming) van het leermiddel.	Aanbevolen
Korte beschrijving of samenvatting	<u>lom.general.description</u> Korte (inhoudelijke) beschrijving of samenvatting van het leermiddel. In dit veld kunnen meerdere beschrijvingen worden opgenomen. Geadviseerd wordt om het karakter van het leermiddel op te geven (bijvoorbeeld competentiegericht/montessorie e.d.) in het description veld.	Verplicht (<i>extra afspraak, in NL LOM aanbevolen</i>)
Trefwoorden	<u>lom.general.keyword</u> Trefwoorden behorende bij het leermiddel.	Aanbevolen
Uniek nummer leermateriaal	<u>lom.general.identifier</u> Uniek nummer voor het leermateriaal welke moet voldoen aan de afspraak Unieke Persistente Identifier voor Leermateriaal en Metadatarecord.	Verplicht
Uniek nummer metadatarecord	<u>lom.meta-metadata.identifier</u> Uniek nummer voor het metadatarecord welke moet voldoen aan de afspraak Unieke Persistente Identifier voor Leermateriaal en Metadatarecord.	Aanbevolen (<i>extra afspraak, in NL LOM optioneel</i>)
Instructietaal	<u>lom.general.language</u> Instructietaal bij het leermiddel. Dus niet de taal van het leermiddel zelf.	Verplicht
Leerniveau	<u>lom.classification.taxon.id/entry</u> (+ <u>lom.classification.taxonpath.source</u> + <u>lom.classification.purpose.value = "educational level"</u>) Specificatie van het leerniveau waarvoor het leermiddel bedoeld is. Voor specifieke doelgroepen (bv cognitief talent) zouden aparte vocabulaires moeten worden aangemaakt die toegepast kan worden in veld 9. <i>Vocabulaire:</i> Voor aangeven van het leerniveau wordt de vocabulaire <i>Algemeen leerniveau</i> gebruikt. NB: De waarde van dit veld moet worden afgestemd met de waarde in het veld <u>lom.educational.context</u>	Verplicht voor aggregatie- niveau '3' en '4'.
Beoogd gebruiker	<u>lom.educational.intendedenduserrole</u>	

	Indicatie of het materiaal is bedoeld voor gebruik door leerling of voor docent. Er is afgesproken om niet meerdere zaken in één veld te combineren. Voor specifieke doelgroepen (bv cognitief talent) zouden aparte vocabulaires moeten worden aangemaakt die toegepast kunnen worden in veld 9. <i>Vocabulaire:</i> Voor het aangeven van de beoogde rol wordt de vocabulaire <i>Beoogde eindgebruiker</i> gebruikt.	Verplicht
Eerste verschijningsdatum	<u>lom.lifecycle.contribute.date...</u> Het jaar waarin het leermateriaal voor het eerst op de markt verscheen. Voor digitaal materiaal is jaar te grofmazig, maar hier mag ook een fijnmaziger waarde woorden ingevuld. In het bijbehorende description veld kan aangegeven worden dat het om de eerste publicatiedatum gaat.	Aanbevolen
Laatste herzieningsdatum	<u>lom.lifecycle.contribute.date.</u> Het jaar waarin het leermateriaal voor het laatst is herzien. Voor digitaal materiaal is jaar te grofmazig, maar hier mag ook een fijnmaziger waarde woorden ingevuld. In het bijbehorende description veld kan aangegeven worden dat het om de eerste publicatiedatum	Aanbevolen
Wel/niet leverbaar	<u>lom.lifecycle.status</u> Een getal waarmee wordt aangegeven of het betreffende leermiddel wel of niet leverbaar is. Metadatarecords die niet meer aangeleverd worden, worden (door dit aan te geven in OAI-PMH) door Edurep verwijderd. Als er toch metadata aangeleverd moet worden over leerobjecten die niet meer leverbaar zijn dan kan dit veld in de metadata worden gevuld met de waarde: "niet beschikbaar" (zie vocabulaire). <i>Vocabulaire:</i> Voor het aangeven van de leverbaarheid wordt de vocabulaire <i>Status</i> gebruikt.	Optioneel (<i>extra afspraak, in NL LOM optioneel</i>)
Locatie leermateriaal	<u>lom.technical.location</u> Locatie van het leermateriaal in de vorm van een URL indien het leermiddel een webgebaseerd leermiddel betreft, niet een link naar een promotionele pagina. NB: Gebruik voor promotionele pagina veld 7 in NL LOM (zie Informatiepagina).	Verplicht bij web-based. Optioneel bij niet web-based.
Informatiepagina	<u>lom.relation.resource.identifier</u> (+ lom.relation.kind="isreferencedby" +lom.relation.resource.description = "webpagina met meer informatie over dit leerobject") Locatie van een pagina in de vorm van een URL waarop meer informatie over het leermiddel te vinden is. Hier kan de link naar een promotionele pagina worden opgenomen. NB: deze waarde dus NIET opnemen in lom.technical.location of lom.general.catalogentry	Verplicht
Wel/niet auteursrechten	<u>lom.rights.copyrightsandotherrrestrictions</u> Geeft aan of op het materiaal wel of geen auteursrechten van toepassing zijn.	Verplicht
Omschrijving auteursrechten	<u>lom.rights.description</u> Omschrijving van de auteursrechten (indien van toepassing). Dit betreft een vrij tekstveld zodat er zowel juridische teksten als de verschillende soorten licenties in kunnen (bv CreativeCommons)	Verplicht
Schooltype (sector)	<u>lom.educational.context</u> Indicatie waarmee aangegeven wordt of het leermateriaal wel/niet bedoeld is voor gebruik binnen primair onderwijs / voortgezet onderwijs / middelbaar beroepsonderwijs en of volwasseneneducatie / speciaal onderwijs of voortgezet speciaal onderwijs. Deze waarden worden ondergebracht in één veld van NL LOM. <i>Vocabulaire:</i> Voor het aangeven van het schooltype (sector) wordt de vocabulaire <i>Context</i> gevolgd.	Verplicht
Vakken- classificatie	<u>lom.classification</u>	

	<p>Waarde uit een van de vakkenclassificaties.</p> <p><i>Voculaires:</i> Voor het aangeven van vakken uit het PO wordt de vocabulaire <i>vakken PO</i> gebruikt.</p> <p>Voor het aangeven van de vakken uit het VO wordt de vocabulaire <i>vakken VO</i> gebruikt.</p> <p>Voor het aangeven van de domeinoverstijgende vakken uit het MBO wordt de vocabulaire <i>domeinoverstijgende vakken MBO</i> gebruikt.</p> <p>Voor het aangeven van de opleidingsdomeinen/studierichtingen uit het MBO wordt de vocabulaire <i>Opleidingsdomeinen/studierichtingen MBO</i> gebruikt.</p>	Aanbevolen (<i>extra afspraak, in NL LOM business rule</i>)
Leeftijd beoogde gebruiker	<u>lom.educational.typicalagerange</u>	
	Leeftijd van de beoogde gebruiker. Voor uitgevers niet altijd relevant omdat er vaak gewerkt wordt met aanduidingen van leerjaren. Echter wel verplicht binnen NL LOM.	Verplicht
Auteurs metadata	<u>lom.metametadata.contribute</u>	
	De identificatie van en informatie over de personen en/of organisaties die aan deze metadata hebben bijgedragen.	Verplicht (<i>extra afspraak, in NL LOM aanbevolen</i>)
Aggregatie- niveau	<u>lom.general.aggregationlevel</u>	
	<p>Lijst met waarden om het aggregatieniveau (korrelgrootte) van een leerobject aan te geven.</p> <p><i>Voculaire:</i> Voor het aangeven van het aggregatieniveau wordt de vocabulaire <i>aggregatieniveau</i> gebruikt.</p>	Verplicht bij schooltype PO, VO, BVE, SO, SBaO en VVE. Aanbevolen bij HBO, WO en beroepsopleiding.
Kosten ja/nee *	<u>lom.rights.cost</u>	
	Indicator om aan te geven of aan het leermiddel kosten verbonden zijn. Keuze: ja / nee	Verplicht
Relaties	<u>lom.relation...</u>	
	<p>Aard van de relatie tussen dit leerobject en het (leer)object waar middels een identifier en eventueel een aanvullende beschrijving naar verwezen wordt.</p> <p>Het is voor de keten belangrijk dat relaties tussen onderdelen van methoden en methoden vastgelegd worden. Om deze reden is er een business rule opgesteld die het gebruik verplicht als methoden en onderdelen van methoden door een uitgever in de keten worden gebracht.</p> <p>Dit veld kan bijvoorbeeld ook gebruikt worden als je de relatie tussen verschillende uitleverformaten tussen leerobjecten wilt vastleggen.</p> <p>Daarnaast wordt het ook gebruikt om een informatiepagina mee aan te duiden.</p>	Verplicht als er zowel methoden als onderdelen van methoden worden aangeleverd door een uitgever. Aanbevolen in alle andere gevallen.
Metadataschema	<u>lom.metaMetadata.metadatascheme</u>	
	Hierin wordt aangegeven welke standaard(en) zijn gebruikt. Dit veld is verplicht in NL LOM, aanbevolen wordt om dit veld automatisch in te vullen.	Verplicht
Studielasturen	<u>lom.educational.typicallearningtime</u>	
	Het gemiddeld aantal studielasturen behorende bij een leermiddel.	Aanbevolen
Druk of versienummer	<u>lom.lifecycle.version</u>	
	Hierin staat de druk of het versienummer (bij software).	Aanbevolen
Gegevensdrager	<u>lom.classification.taxon.id/entry</u> (+ <u>lom.classification.taxonpath.source</u> + <u>lom.classification.purpose.value = "medium"</u>)	
	<p>Verwijzing naar de gegevensdrager.</p> <p><i>Voculaires:</i> Voor het aangeven van de gegevensdrager wordt de vocabulaire <i>gegevensdrager</i> gebruikt.</p>	Verplicht (<i>extra afspraak, in NL LOM optioneel</i>)
Vereist besturings-systeem	<u>lom.technical.requirement...</u>	
	<p>Het besturingssysteem dat nodig is om met het leermiddel te kunnen werken (vb Windows Vista).</p> <p>Naast besturingssysteem kan er nog meer worden vastgelegd, namelijk welke tools er vereist zijn en welke hardware er vereist is. (lom.technical.installationRemarks en lom.technical.otherPlatformRequirements)</p>	Optioneel

Appendix 10: Initial Functional and Non-Functional Requirements for the LOR**BIJLAGE Functionele en niet-functionele eisen aan webomgeving.**

Gebruikte methode: FURPS.

Uitleg O = de obligation.

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
FUNCTIONALITIES			
R1: Functionele beschikbaarheid DLM-items	M	DLM wordt getoond. Van de DLM wordt getoond: <ul style="list-style-type: none"> • Korte omschrijving • Maker • Publicatiedatum. • Format De file kan gedownload worden.	De omgeving is webbased, in de bekende browsers wordt de DLM getoond. De metadata wordt beknopt weergegeven, rangorde. In de toekomst horen mobiele platforms de inhoud van de webomgeving ook te tonen.
R2: DLM-items run time	W	DLM wordt gepreviewd en/of getoond in een player behorend bij het formaat.	
R3: Data integriteit	M	De DLM-files en metadata zijn hetzelfde.	Tussen het maken van backups of mutatie.
R4: Aanbieden van DLM	M	Aanbieden van DLM gaat webbased.	De webbased omgeving werkt conform de door W3C aangegeven huidige specificaties. In de toekomst wordt de DLM ook in formaten die interoperabel zijn omgezet, zoals SCORM. (W) De beveiliging van de site volgens huidige normen. Zoals het aanzetten van HTTPS bij inloggen, down- en uploaden. Met de ISP en host-omgeving wordt gewerkt volgens huidige normen. Er wordt overeengekomen waarvoor de ISP en/of host verantwoordelijk wordt gehouden. De aanbieder is verplicht een lesplan / lesidee mee te sturen.
R5: Het laden van DLM-items	M	DLM-items worden opgeslagen volgens beheersbare structuur. De items kunnen de status hebben gepubliceerd of niet-gepubliceerd. DLM-items moeten verwijderd kunnen worden door de beheerder. De omgeving moet het mogelijk maken zipped folders te unzippen.	De maximale file-grootte is 100 MB. Het is zichtbaar in de console wat het file type is. De console is gebruikersvriendelijk v.w.b. file beheer. Zichtbaar zijn de data van upload, publicatie, verwijdering. Verwijderde items kunnen weer restored worden. In de toekomst zal de geschiedenis van het DLM-item worden vastgelegd.

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
R6: DLM downloaden	M	De DLM bestaat uit een van de volgende formaten. Via de webinterface is het downloaden van het DLM-item mogelijk. Downloaden gebeurt secured. De download-optie is gekoppeld aan een user account. Het IP-adres van de user kan getoond worden. Het aantal downloads per DLM-item wordt opgeslagen.	Gangbare formaten a. Gecomprimeerde folder, zip-folder (of rar..) b. doc, docx, txt, odt, en andere tekstformaten c. xls, xlsx d. ppt, pptx, enz. e. jpg, png en andere afbeeldingsformaten f. Audio- en videobestanden : mp3, mp4, wav en andere g. html, XML, enz h. flv i. flp of ander IWB-formaat NB exe-bestanden vormen probleem. mdb, accdb zullen niet gauw voorkomen.
R7: Metadateren	M	De aanbieder metadataert de DLM volgens de ingebouwde set metadata. De content beheerder kan metadata toevoegen/weghalen.	Volgens huidige normen metadateren. NL LOM wordt gehanteerd i.v.m de uitwisselbaarheid en de uitbreidbaarheid. Er wordt een set gebruikt i.v.m. de consistentie. De interface moet eenvoudig en gebruikersvriendelijk zijn. In de toekomst gebruikers kunnen uitbreiding van de vocabulaires aanvragen.
R8: Metadata importeren en tonen	M	De metadata wordt aan aanbieder getoond. De metadata van het DLM-item wordt getoond en opgeslagen. De metadata wordt in de webinterface overzichtelijk getoond aan de bezoeker. De aanbieder kan de metadata alsnog wijzigen.	NL LOM wordt gehanteerd i.v.m de uitwisselbaarheid en de uitbreidbaarheid. In de toekomst gebruikers kunnen uitbreiding van de vocabulaires aanvragen. Metadata wijzigen gebeurt door tussenkomst of melding aan de contentmanager.
R9: DLM-arrangeren/ontwerpen	W	De maker kan in de webomgeving DLM ontwerpen.	In de toekomst kan de maker een nieuw DLM-item ontwerpen in de omgeving. Ook samen aan een DLM-item werken is mogelijk. Of het samenstellen van een nieuw DLM-item met de bestaande items uit het systeem.ook het samenwerken aan DLM-item mogelijk.
R10: Cross device	C	De webomgeving is benaderbaar voor de verschillende mobiele apparaten.	Multiplatform door cloud services inhuren voor goede display op een mobiel apparaat.
R11: Cross device DLM	W	Er is DLM gemaakt voor de specifieke mogelijkheden van de mobiele apparaten, bijvoorbeeld native apps.	Vooralsnog via andere omgeving te downloaden.

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
R12: Identifiers	M	Zoals gespecificeerd in NL LOM.	Eén metadata-systeem voor unieke toewijzing. Gebaseerd op de IEEE-LOM.
R13: Beheerder	M	Het is mogelijk overzichten van de DLM-items te maken en te exporteren.	Functie voor de contentbeheerder. Exporteren naar .xls of csv.
R14: Rollen	M	Er zijn verschillende rollen: beheerder, bezoeker en accounthouder.	
R15: Aanmelden accounthouder	M	Het is mogelijk dat de bezoeker zich aanmeldt voor een account. De account geeft het recht DLM te downloaden. Bij aanmelding hoort KAPTCHA.	Bij de aanmeldprocedure hoort e-mail-verificatie.
R16: Sociale metadata	S	Sociale metadata wordt opgeslagen. Deze metadata wordt bij bezoeken van het DLM-item getoond.	Bezoekers kunnen de DLM-items een beoordeling geven volgens het 5-sterren systeem.
R17: Zoekfunctie	M	De zoekfunctie kent meerdere lagen. De operatoren AND en OR. Er zijn drie lagen.	Bv groep = "4" AND vak = "Verkeer" AND onderwerp = "voorangsregels".
R18: Sorteerfunctie	M	Sorteren op korte beschrijving, maker of publicatiedatum.	
R19: Mailfunctie	M	Via de webomgeving kan gemaïld worden van beheerder naar accounthouder. E-mail verificatie gebeurt automatisch.	Na het aanvragen van een account wordt er een mail gestuurd naar de aanvrager met een verificatielink.
R20: Abonnement	C	RSS-feed of sociale media links	

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
USABILITY			
R21: Vindbaarheid	M	De domeinnaam en de TLD zijn voor de hand liggend gekozen voor het gebruik op Curaçao.	De domeinnaam gaat bekendheid krijgen. Een enigszins specifieke naam geniet de voorkeur, denkend ook aan het kunnen vinden via zoekmachines.
R22: Aantrekkelijkheid	M	Een sprekende interface voor onderwijs FO	Het inschakelen van een lokale/bekende webdesigner is gewenst.
R23: Actualiteit	M	Ter bevordering van het aantal bezoekers worden actuele zaken aan de content toegevoegd.	Bv onderwijs nieuws, of tip van de dag of school die een post doet.
R24: Gebruikersvriendelijkheid	M	Eenvoudige, overzichtelijke interface met kruimelpad.	Zoekopties duidelijk aanwezig.
R25: Participatie	C	Spelers in het veld participeren met actuele informatie of link naar eigen website.	Te denken valt aan FPI, NAAM, uitgeverijen, boekhandels ..
R26: Help-functie	S	Online help-functie voor handelingen. Geen real time.	Handleidingen zijn te openen of downloadbaar. Ook mailen naar beheerder mogelijk.
R27: Errors	M	Systeem geeft foutmelding, blijft niet zo maar hangen. De bezoeker ziet nummer van error.	
R28: Goede weergave	M	Diakritische tekens worden goed weergegeven. Van groot belang voor Papiamentu	Opm. Bij zoekacties standaard niet match case gebruiken. Het systeem moet "ruim" zoeken

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
RELIABILITY			
R29: Up time	M	De site is voor 99.9% up. De webomgeving is goed bereikbaar, de netwerk congestie is laag.	Er is een meetinstrument hiervoor.
R30: Beveiliging	M	Er is een spamfilter. Er is een IP-block of denial functie. Er is een beveiligings-mechanisme tegen hackers en DNS-hack. Tegen upload virussen en bv exe-files	Exe in een zip??
R31: Redundantie	M	Er zijn meerdere kopieën van de webomgeving en de files.	
R32: Back-up	M	Er is een back-up functie. Er is een recovery-functie.	De procedure moet worden opgesteld.
R33: Failure Mail	M	Het systeem laat middels een mail weten aan de beheerder dat er een fout is opgetreden en welke fout.	
R34: FTP-verbinding	M	Betrouwbare FTP-verbinding voor down- en upload. Error-message wordt getoond wanneer het proces niet goed gaat.	

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
PERFORMANCE			
R35: Requests	M	De site kan 20 bezoekers tegelijk aan. De responstijd is voldoende laag.	20 of meer?? responstijd
R36: Optimalisering	M	De database wordt optimaal gehouden door een optimaliseringstool.	
R37: Data Transfer	M	Het totale dataverkeer kan per maand een grootte van 10 GB aan.	Er is een meetinstrument
R38: Through Put	M	Het percentage succesvol afgeleverde data en boodschappen. De bandbreedte is toereikend.	Er is een meetinstrument
SUPPORTABILITY technisch			
R39: Maintainability	M		Aantal manuren
R40: Testibility	M		
R41: Compatibility	M		v.w.b. draaien in de browser IE, Firefox, Chrome
R42: Configurability	S		Aanpassen aan nieuwe technische omgeving.
R43: Ease of installation	M		
R44: Portability/ flexibility	S		Aanpassen aan nieuwe omgeving

Naam van de eis	O	Beschrijving	Aantekeningen / toekomst (W)
SUPPORTABILITY OF CONTENT			
R45: Maintainability	M	Er is een gebruikersvriendelijke interface met functionaliteiten die het beheer ondersteunen	Updaten, verwijderen, indexeren, sorteren etc van items
R46: Testability	M		
R47: Compatibility	M	De gebruikte bestandsformaten geven dat aan.	
R48: Configurability	M	Flexibiliteit in de instellingen voor de items	
R49: Ease of installation	M	Betreft uploadgedeelte	
R50: Portability/ flexibility	M	De items kunnen los van de omgeving worden opgeslagen en benadred worden.	

Appendix 11: Initial LRS requirements based on DISC common digital library system**Requirements from DISC: FEATURES DESIRED IN A COMMON DIGITAL LIBRARY SYSTEM;**

Created by DISC subgroup for Common Digital Library platform 6/30/2011.

History: Initial document, *Features Desired in a Digital Library System to Replace FCLA'S Textual Collections and Visual Collections*, created by the Florida Center for Library Automation (FCLA) and the Digital Library April 6, 2006 to evaluate DL systems, leading to the purchase of DigiTool in 2006. Revised and prepared for committee review and comment by G. Clement (FIU) and L. Taylor (UF), with additional editing by M. Sullivan (UF) and L. Dotson (UCF), April 30, 2009. Reviewed and approved by the State University Libraries' Digital Initiatives Subcommittee (DISC), September 8, 2010.

Working Definitions

Bibliographic item: All the pieces that together form the basis for a single bibliographic description. Can be a book, map, website etc. Bibliographic items can be simple or compound objects. Even simple objects (a single photograph) will likely have multiple manifestations.

Simple object: a single file or set of related files with no hierarchical relationship between the files; associated with a single descriptive metadata record.

Compound or complex object: a set of files with a hierarchical relationship, associated with a single descriptive metadata record.

Manifestation: version of a given bibliographic item with a specific file format (e.g., PDF, JPEG images, full-text file, etc.)

Collection: A named grouping of bibliographic items based on some common characteristic, such as provenance or subject.

Curator: Somebody who can make changes to the content of a collection.

Administrator: Someone who can change parameters affecting a collection or multiple collections. Administrator has privileges of the Curator by default.

Requirements

A. Architecture

1. Architecture supports multi-site use.
2. User permissions:
 - (a) Architecture allows multiple levels of user permissions, which can be configured based on collections, collection groups, or institutional units, for example.
 - (b) various levels of administrator and staff user permissions are available for institution staff to change system settings and content.
 - (c) simple and secure user (non-administrator) account creation is available for students and faculty to upload files and add metadata.
3. Architecture facilitates library staff in setting up collections and assigning or ingesting items to collections.
4. System does not require users to have a static IP address.
5. There are no conventions that must be followed for naming directories or files, or the conventions are documented, verified, and easy for library staff to follow or create, and/or they are followed through an automated process as part of a tool or application.
6. Collections are logically, not physically, defined; they are easily created, deleted and redefined by library staff. A bibliographic item can easily be added to a collection, assigned to a new collection, allocated to multiple collections, or removed from a collection by library staff.
7. The system can accommodate bidirectional connection between itself and other tools – that is, if a user is directed to a page within the platform from an outside discovery tool, the path back to that tool should be clear and automatic.
8. Text can be stored in Unicode and/or UTF-8.
9. Indexes:
 - (a) Indexes can be updated to include new or changed content without having to reindex the entire database
 - (b) Indexing runs in the background (no downtime for using the system during indexing).
 - (c) New items can be indexed in real time so that they are available to the public immediately.
10. Collections can be created, populated, and viewed by authorized users while remaining invisible to unauthorized users.
11. Customizations can be tested by library staff in a way that is invisible to unauthorized users and that does not affect the rest of the system. Having a test function within the system would satisfy this requirement, as would having a separate test instance of the system.

12. All content from the current PALMM Collections can be imported into the system with no loss of information or functionality. All content in UFDC Sobek, USF Fedora, UCF CONTENTdm, non-PALMM DigiTool, and other current SUS systems can be imported into the system with no loss of information.
13. System support:
 - (a) The system components are affordable, dependable, and supportable by existing staff resources. This includes all software required to run the digital library system in actual operation: database, operating system, digital library software, and support software required in addition to the digital library software itself.
 - (b) Open-source tools will be weighted more heavily because they can be tested, validated, maintained, developed, and budgeted to a more exacting level for more accurate initial requirements and future projections.
14. System natively supports content in multiple languages.
15. The system supports multilingual interfaces For example, automatic support if library staff provides translations; or set search terms already automatically supported with translations already in place.
16. Documentation that is usable accompanies the code including clear and concise comments and examples.
17. Custom configuration settings are available at the collection level for collection- specific behavior and appearance with collection settings overriding global settings.
18. Custom pages allow the creation of collection home pages and other landing pages based on institution, format, topic, etc.

B. Content

1. All of the content from the PALMM and State University Libraries' collections can be supported in terms of file format, file relationships and structure, including multimedia collections.
2. The system must support at least the following formats:
 - (a) TIFF images
 - (b) JPG / JPEG images
 - (c) JP2 / JPEG 2000 images
 - (d) Single-page and multi-page PDFs
 - (e) Text
 - (f) Audio
 - (g) Video
 - (h) Streaming audio / video (URLs to streaming server)
 - (i) Remote content (URL links to externally stored files and embedded viewers as applicable)
 - (j) Files intended for download rather than display (e.g. data formats, spreadsheets)

3. The system supports the following special genres:
 - (a) EAD finding aids (with structured display, links to digitized content, XML to HTML translation and option to also display as PDF)
 - (b) Serial display with hierarchy (for newspapers, journals, and other serials)
 - (c) Audio for simple object (music file alone), and for complex/compound objects (oral history with a transcript that can be displayed while audio is played)
 - (d) Books/monographs (structured table of contents, page turning and "go to")
 - (e) Newspapers (NDNP and METS/ALTO formats, search term and full article segmentation highlighting)
 - (f) TEI-encoded full-text
4. Must allow integrated multimedia collections – can have text, images, audio, video, etc. all in the same collection.
5. Must support related objects, defined as groups of objects with some relation to each other, such that:
 - if one is retrieved, all are retrieved
 - the relationship among the objects is made clear
 - related objects do not have to all be in the same format
 - any number of related objects can comprise a group
6. Must support complex objects with METS structural metadata. Must preserve METS for export.

C. Metadata

1. System has documented, verifiable support for ingest, display, and translation of the primary descriptive metadata in use (simple and qualified DC, MARC21, MODS and VRA Core). System is not solely library-centric or MARC-centric – must work for museums, archives and gallery collections as well.
2. DL System has a readily available easy process and tools for library staff to:
 - (a) input/update metadata
 - (b) add local fields (including administrative fields not shown to the public) (c) ingest existing metadata records
 - (d) edit ingested existing metadata records
 - (e) and export metadata records.
3. Metadata can be created/edited online, or created offline and uploaded.
4. Metadata can be:
 - (a) in the system before an object is in the system and associated with the object when the object is loaded
 - (b) added to the system at the same time as the associated object is loaded
 - (c) added to the system and associated with an object after the associated object is loaded.
5. Has input forms and edit routines for descriptive metadata in:
 - (a) simple Dublin Core

- (b) qualified Dublin Core
- (c) MARCXML
- (d) MODS
- (e) VRA Core

6. Pre-existing metadata in the above formats can be loaded as XML records or as tab-delimited or CSV files with associated mappings.
7. It is possible for library staff to design our own metadata input/update templates.
8. Simple forms for metadata entry can be provided for untrained users (for IR functionality).
9. It is possible to include technical and administrative metadata elements which do not display to the public.
10. It is possible to enable and maintain a controlled vocabulary (standardized or user generated) for any given field. A tool or method is available for making desired changes easily in a manner that meets library staff needs.
11. Bibliographic records from the Aleph library catalog, OCLC records, or any MARC records from anywhere, can be easily imported into the DL system.
12. The system can expose metadata to search engine crawling/indexing to ensure good coverage in major search engines.
13. EXIF and IPTC metadata embedded in JPEG and TIFF images can be automatically extracted. Users may map this metadata to Dublin Core or Qualified Dublin Core fields.

D. Ingest

1. Metadata can be harvested from OAI-PMH accessible collections for inclusion in the DL.
2. The system supports both:
 - (a) manual upload to ingest
 - (b) automatic batch upload to ingest
3. If any translation/conversion is needed prior to ingest, a documented process with a tool/application is available that library staff feel is sufficiently simple and has adequate support for their needs.
4. Provides immediate verification of ingest success or, in the case of ingest failure, provides error messages that communicate to staff what needs to be fixed for successful ingest.
5. Ingest processing is speedy enough to meet library staff needs. (For each DL System under review, discussions over the value of increased speed should consider the benefits of that speed in relation to the costs/delays for staffing, software version upgrades, etc).
6. Thumbnail images can be created at the time of ingest from all image and document formats supported in the system. Default resolution and size can be over-ridden at ingest.

7. Custom thumbnail images created outside of the DL can be:
 - (a) added to the system at the same time as the associated object is loaded
 - (b) added to the system and associated with an object after the associated object is loaded.
8. The system can automatically create multiple file formats from TIFF images. The process should be testable so that library staff can evaluate the process of creating derivatives and products (multiple manifestations created from the TIFF file) for quality and any other needs. File formats available for automatic creation from TIFF include at minimum:
 - (a) searchable full text via OCR
 - (b) JPEG2000 images, with library-defined resolutions (not just a default set that cannot be changed)
9. The system should provide options for how uploaded TIFFs are handled, for example:
 - (a) create derivatives and do not store TIFF
 - (b) store TIFF but do not display to users
 - (c) store and display TIFF to users.
10. The system can automatically index full text from formats including PDF, Word, Open Office, HTML, and XML.
11. When a complex object with manifestations exists in the system, it should be possible to replace a specific file or files without having to re-ingest the entire object.
12. The system can accommodate a single ingest process for universities using ProQuest ETD Administrator (Possible SWORD-like process)
13. System offers an IR mode of ingest, that supports the following functions:
 - (a) non-staff, authorized users can submit content and metadata by a simple process
 - (b) content and metadata are not added to the system (or are added with provisional or non-display status) until reviewed
 - (c) authorized staff are enabled to review and approve, edit or reject metadata and content
 - (d) submitters are notified by email, text message, or other electronic communication about the approval status of the item.

E. Search and retrieval

1. System has a Z39.50 server, equivalent JSON interface, or other documented system-access method.
2. Users have the option to search or to browse. A simple search view (single search) is always available.
3. For serial publications, the user should be able to search for individual articles by author and title. The user should also be able to list and browse the tables of contents of issues, listed in reverse chronological order.
4. The user can choose to search metadata only and both metadata and full text together.

5. Both Google-like simple search (all fields, one search box, all terms OCR'd) and advanced search (choice of specific fields, limits, choice of Boolean operators) are allowed.
6. Users can search and browse:
 - (a) within a single collection
 - (b) across all collections
 - (c) across groups of collections defined by staff
 - (d) across ad hoc groups of collections defined by the user
7. Assistance for search and navigation is provided through:
 - (a) Alternate suggestions when no results found
 - (b) Faceted browsing
 - (c) Clickable links within metadata (author, subject, format, etc)
 - (d) Pre-determined canned searches
8. Hits are displayed in a way that makes sense to the user; it is clear whether an object is a book, photo, recording, etc.
9. The results returned from a search should be sortable by author, title, publication date and relevance:
 - (a) any of these can be set as the default view by the user for that session / account
 - (b) any of these can be set as the default view by staff for general use
 - (c) different default views can be set for different collections
10. The results returned from a search can be represented visually in document space ala AquaBrowser or similar tools.
11. When performing a cross-collection search and retrieving hits from multiple collections, it is clear to the user which collection each hit comes from.
12. A "new additions" feature is available to display the "n" most recently added items.

F. Display and Use

1. An outline or table of contents display is available for complex structured bibliographic items. It is possible to expand and contract any heading in the outline hierarchy.
2. When a textual object is retrieved by a full text search:
 - (a) the number of occurrences of the term in the object is displayed in the list of hits.
 - (b) When the textual object retrieved by a full text search is displayed, the search term is highlighted on the page.
3. When multiple manifestations (e.g. image and full text, audio and transcript) are available, they can be displayed simultaneously on the screen.
4. Branding is obvious, explicit, and restrained as wanted for both collection owning repository (could be library, museum or agency) and the digitizing repository (could be

library, museum or agency). The branding is in place at the collection level and item level (all views).

5. Multiple brands (icons) can be associated with and displayed with an object.
6. All collection items display under a collection specific to the collection-owning repository, as well as in other collections as selected by the collection-owning repository.
7. Users can display, download, print and/or email content (unless these functions are restricted for a particular computer file, bibliographic item, or collection).
8. Restrictions on access and use can be implemented at the computer file and/or the bibliographic item level by password and by IP filter. When an object is restricted, the restriction is clear to the user.
9. Objects and records may be restricted under embargo, ideally with automatic release of the embargo once it expires.
10. There is a portfolio ("my collection") function for end users.
11. The implementation can control display characteristics such as what fields and labels are used.
12. The end user can control some display characteristics such as the number of hits to show on a page and how the results are displayed with options such as thumbnail, citation only, title only, and hierarchical (for newspapers and volume/issue materials).
13. Easy to understand help files and/or tutorials are available to assist users with search, display, and use functions.
14. Interface should be attractive and easy to use.
15. Easy-to-use training materials are available for all user levels – robust user- community involvement a plus especially if the user community has effective input into the design/development process.
16. A “bookmarkable” URL should be displayable for all bibliographic items.
17. Links (URLs) embedded in any field will display as clickable links. The system has a convention for representing anchor text to display as an actionable link instead of the URL.
18. RSS – Really Simple Syndication for user created feeds to search for recently added items, subjects, authors, etc.
19. Share feature – Users can share an item via email, Facebook, Twitter, or other social networking sites.
20. Commenting capabilities – Users can write a comment about the digital item. Moderated comments written about the item can be displayed.

21. Tagging feature – Users can add a tag to describe a digital item. Moderated tags for the item can be displayed.
22. User can save searches.
23. User can see search history.

G. Export

1. The system can export simple objects as files and associated metadata.
2. The system can export both simple and complex objects as packages with METS descriptors.
3. Regardless of the format of origin, bibliographic data can be exported in MARCXML for import into a catalog system.
4. There is an OAI broker capable of exporting all metadata, regardless of the format of origin in oai_dc format. Additionally:
 - (a) Custom OAI sets can be created using a logical search of content.
 - (b) OAI harvesting can be disabled for certain content (test content, incomplete collections, etc)
5. Designated content can be exported from DL to FDA automatically, without additional effort (sending, processing, any manual work) on behalf of library staff.
6. User can export a set of saved items (portfolio) for use by another tool (e.g. Omeka).

H. Management and reporting

1. Ad hoc and canned reports can be run. Documentation is available on existing automatic reports and samples of reports are available for evaluation by library staff for their needs.
2. The system automatically logs usage statistics which can be aggregated for any time period on:
 - (a) number of searches (by collection, by object contributor, and by date/time)
 - (b) materials accessed (by title and aggregated into various categories)
 - (c) users
 - (d) user sessions
3. Sample usage reports are available for review by library staff
4. The system provides counts of objects at both the bibliographic and file level:
 - (a) by collection
 - (b) by contributor
 - (c) created since [date]
5. The system can provide a report of the most popular titles in a specified time period
 - (a) by collection

- (b) by contributor
 - (c) system wide
 - (d) title and single volumes for serial items so that the usage is tabulated for both single issues and for the aggregate of all volumes for the particular serial title
6. The system keeps a count of the number of times each bibliographic item is rendered, and can display this with the metadata for the item in the public interface.
 7. The system can automatically send monthly(?) reports to authors regarding their usage statistics.

I. Budget

1. The DL System has clear cost figures for the existing system and enhancements.
2. When evaluating the DL System, cost considerations should include:
 - licensing cost
 - cost per record
 - costs of additional software for the DL System host
 - costs of additional software/tools for each of the libraries
 - costs of customized programming to accommodate the libraries' needs (staffing costs, with timelines available for review that detail implementation plans)
 - costs of hardware and/or support for hosting the DL System (server space, other equipment, staff)
 - costs related to near-future migration from the software (dependent on defined development path for any selected software, and planned support)

Appendix 12: Procedure to request a Creative Commons license

Procedure to request a Creative Commons license : (<https://creativecommons.org/choose/>)

The diagram illustrates the four-step process for selecting a Creative Commons license:

- License Features:** A panel where users choose options for sharing and commercial use.
 - Allow adaptations of your work to be shared?**
 - Yes
 - No
 - Yes, as long as others share alike
 - Allow commercial uses of your work?**
 - Yes
 - No
- Selected License:** Shows the chosen license: **Attribution-NonCommercial-ShareAlike 4.0 International**. It features icons for CC, BY (person), NC (no dollar sign), and SA (circular arrow). A note states: "This is not a Free Culture License." with a star icon.
- Help others attribute you!:** A form for adding metadata.
 - Title of work:
 - Attribute work to name:
 - Attribute work to URL:
 - Source work URL:
 - More permissions URL:
 - Format of work:
 - License mark:
- Have a web page?:** Provides a preview of the license icon and the HTML code to embed on a website.
 - Preview:

Designing a Digital Community Repository Infrastructure for the Dutch Caribbean From the Perspective of a Small Island Developing State by Yunette N. Aniceta is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

Copy this code to let your visitors know!
 - Code:


```
<a rel="license" href="http://creativecommons.org/licenses/by-nc-sa/4.0/"></a><br /><span xmlns:dct="http://url.org/dct/terms!">
```
 - Options: Normal Icon Compact Icon

Appendix 13: Digital library comparison between Islandora and SOBEK CM

Source: (DISC)

Evaluations of Final Two Systems: Islandora & SobekCM				
		Islandora	Comparison	SobekCM
T	B Content			
	B3b Serial display with hierarchy (for newspapers, journals, and other serials)	o	→	•
	B3c Audio for simple object (music file alone), and for complex/compound objects (oral history with a transcript that can be displayed while audio is played)	•	←	o
	B3d Books/monographs (structured table of contents, page turning and "go to")	•	-	•
	B3e Newspapers (NDNP and METS/ALTO formats, search term and full article segmentation highlighting)	o	-	o
	B3f TEI-encoded full-text	•	←	o
	A	B4 Must allow integrated multimedia collections – can have text, images, audio, video, etc. all in the same collection.	•	-
A	B5 Must support related objects, defined as groups of objects with some relation to each other, such that: - if one is retrieved, all are retrieved - the relationship among the objects is made clear - related objects do not have to all be in the same format - any number of related objects can comprise a group	•	-	•
A	B6 Must support complex objects with METS structural metadata. Must preserve METS for export.	•	-	•
A	C Metadata			
A	C1 System has documented, verifiable support for ingest, display, and translation of the primary descriptive metadata in use (simple and qualified DC, MARC21, MODS and VRA Core). System is not solely library-centric or MARC-centric – must work for museums, archives and gallery collections as well.	•	-	•
A	C2 DL System has a readily available easy process and tools for library staff to:			
A	C2a Input/update metadata	•	-	•
A	C2b Add local fields (including administrative fields not shown to the public)	•	-	•
A	C2c Ingest existing metadata records	•	-	•
A	C2d Edit ingested existing metadata records	•	-	•
A	C2e Export metadata records	•	-	•
A	C3 Metadata can be created/edited online, or created offline and uploaded	•	-	•
A	C4 Metadata can be:			
A	C4a In the system before an object is in the system and associated with the object when the object is loaded	•	-	•
A	C4b Added to the system at the same time as the associated object is loaded	•	-	•
A	C4c Added to the system and associated with an object after the associated object is loaded	•	-	•
A	C5 Has input forms and edit routines for descriptive metadata in:			
A	C5a Simple Dublin Core	•	-	•
A	C5b Qualified Dublin Core	•	-	•
A	C5c MARCXML	o	→	•
A	C5d MODS	•	-	•
A	C5e VRA Core	•	-	•
A	Architecture			
A12	All content from the current PALMM Collections can be imported into the system with no loss of information or			
C	Metadata			
C6	Pre-existing metadata in the above formats can be loaded as XML records or as tab-delimited or CSV files with associated mappings.	•	-	•
C7	It is possible for library staff to design our own metadata input/update templates.	•	-	•
C8	Simple forms for metadata entry can be provided for untrained users (for IR functionality).	•	-	•
C9	It is possible to include technical and administrative metadata elements which do not display to the public.	•	-	•
C10	It is possible to enable and maintain a controlled vocabulary (standardized or user generated) for any given field. A tool or method is available for making desired changes easily in a manner that meets library staff needs.	o	→	•
C11	Bibliographic records from the Aleph library catalog, OCLC records, or any MARC records from anywhere, can be easily imported into the DL system.	•	-	•
C12	The system can expose metadata to search engine crawling/indexing to ensure good coverage in major search engines.	o	→	•
C13	EXIF and IPTC metadata embedded in JPEG and TIFF images can be automatically extracted. Users may map this metadata to Dublin Core or Qualified Dublin Core fields.	•	←	o
D	Ingest			
D1	Metadata can be harvested from OAI-PMH accessible collections for inclusion in the DL.	•	-	•
D2	The system supports both:			
D2a	Manual upload to ingest	•	-	•
D2b	Automatic batch upload to ingest	o	→	•
D3	If any translation/conversion is needed prior to ingest, a documented process with a tool/application is available that library staff feel is sufficiently simple and has adequate support for their needs.	•	-	•
D4	Provides immediate verification of ingest success or, in the case of ingest failure, provides error messages that communicate to staff what needs to be fixed for successful ingest.	•	-	•
D5	Ingest processing is speedy enough to meet library staff needs. (For each DL System under review, discussions over the value of increased speed should consider the benefits of that speed in relation to the costs/delays for staffing, software version upgrades, etc).	•	-	•
D6	Thumbnail images can be created at the time of ingest from all image and document formats supported in the system. Default resolution and size can be over-ridden at ingest.	•	-	•
D7	Custom thumbnail images created outside of the DL can be:			
D7a	Added to the system at the same time as the associated object is loaded	•	-	•
D7b	Added to the system and associated with an object after the associated object is loaded.	•	-	•
D8	The system can automatically create multiple file formats from TIFF images. The process should be testable so that library staff can evaluate the process of creating derivatives and products (multiple manifestations created from the TIFF file) for quality and any other needs. File formats available for automatic creation from TIFF include at minimum:			
D8a	Searchable full text via OCR	•	-	•

D	Ingest	Islandora	Comparison	SobekCM
D8b	JPEG2000 images, with library-defined resolutions (not just a default set that cannot be changed)	•	-	•
D9	The system should provide options for how uploaded TIFFs are handled, for example:			
D9a	Create derivatives and do not store TIFF	•	-	•
D9b	Store TIFF but do not display to users	•	-	•
D9c	Store and display TIFF to users.	•	-	•
D10	The system can automatically index full text from formats including PDF, Word, Open Office, HTML, and XML.	•	-	•
D11	When a complex object with manifestations exists in the system, it should be possible to replace a specific file or files without having to reingest the entire object.	•	-	•
D12	The system can accommodate a single ingest process for universities using ProQuest ETD Administrator (Possible SWORD-like process?)	•	-	•
D13	System offers an IR mode of ingest, that supports the following functions:			
D13a	Non-staff, authorized users can submit content and metadata by a simple process	•	-	•
D13b	Content and metadata are not added to the system (or are added with provisional or non-display status) until reviewed	•	-	•
D13c	Authorized staff are enabled to review and approve, edit or reject metadata and content	•	-	•
D13d	Submitters are notified by email, text message, or other electronic communication about the approval status of the item.	•	-	•
E	Search and retrieval	Islandora	Comparison	SobekCM
E1	System has a Z39.50 server, equivalent JSON interface, or other documented system-access method.	•	-	•
E2	Users have the option to search or to browse. A simple search view (single search) is always available.	•	-	•
E3	For serial publications, the user should be able to search for individual articles by author and title. The user should also be able to list and browse the tables of contents of issues, listed in reverse chronological order.	•	-	•
E4	The user can choose to search metadata only and both metadata and full text together.	•	-	•
E5	Both Google-like simple search (all fields, one search box, all terms OCR'd) and advanced search (choice of specific fields, limits, choice of Boolean operators) are allowed.	•	-	•
E6	Users can search and browse:			
E6a	Within a single collection	•	-	•
E6b	Across all collections	•	-	•
E6c	Across groups of collections defined by staff	•	-	•
E6d	Across ad hoc groups of collections defined by the user	•	-	•
E7	Assistance for search and navigation is provided through:			
E7a	Alternate suggestions when no results found	○	→	•
E7b	Faceted browsing	•	-	•
E7c	Clickable links within metadata (author, subject, format, etc)	•	-	•
E7d	Pre-determined canned searches	•	-	•

E	Search and retrieval	Islandora	Comparison	SobekCM
E8	Hits are displayed in a way that makes sense to the user; it is clear whether an object is a book, photo, recording, etc.	○	→	•
E9	The results returned from a search should be sortable by author, title, publication date and relevance:			
E9a	Any of these can be set as the default view by the user for that session / account	•	-	•
E9b	Any of these can be set as the default view by staff for general use	•	-	•
E9c	Different default views can be set for different collections	•	-	•
E10	The results returned from a search can be represented visually in document space ala AquaBrowser or similar tools.	○	→	•
E11	When performing a cross-collection search and retrieving hits from multiple collections, it is clear to the user which collection each hit comes from.	•	-	•
E12	A "new additions" feature is available to display the "n" most recently added items.	•	-	•
F	Display and Use	Islandora	Comparison	SobekCM
F1	An outline or table of contents display is available for complex structured bibliographic items. It is possible to expand and contract any heading in the outline hierarchy.	○	→	•
F2	When a textual object is retrieved by a full text search:			
F2a	The number of occurrences of the term in the object is displayed in the list of hits.	○	-	○
F2b	When the textual object retrieved by a full text search is displayed, the search term is highlighted on the page.	○	-	○
F3	When multiple manifestations (e.g. image and full text, audio and transcript) are available, they can be displayed simultaneously on the screen.	•	←	○
F4	Branding is obvious, explicit, and restrained as wanted for both collection owning repository (could be library, museum or agency) and the digitizing repository (could be library, museum or agency). The branding is in place at the collection level and item level (all views).	•	-	•
F5	Multiple brands (icons) can be associated with and displayed with an object.	•	-	•
F6	All collection items display under a collection specific to the collection-owning repository, as well as in other collections as selected by the collection-owning repository.	•	-	•
F7	Users can display, download, print and/or email content (unless these functions are restricted for a particular computer file, bibliographic item, or collection).	•	-	•
F8	Restrictions on access and use can be implemented at the computer file and/or the bibliographic item level by password and by IP filter. When an object is restricted, the restriction is clear to the user.	•	-	•
F9	Objects and records may be restricted under embargo, ideally with automatic release of the embargo once it expires.	•	-	•
F10	There is a portfolio ("my collection") function for end users.	○	→	•
F11	The implementation can control display characteristics such as what fields and labels are used.	•	-	•

Appendix 14: Results TAM questionnaires of LOFO students

	PEOU 3.6						PU 3.8						ITU 3.3	
	PEOU1	PEOU2	PEOU3	PEOU4	PEOU5	PEOU6	PU1	PU2	PU3	PU4	PU5	PU6	ITU1	ITU2
1	3	3	3	3	4	3	3	3	4	3	3	5	3	3
2	3	3	3	4	3	3	4	4	4	4	3	4	4	3
3	3	4	3	1	3	4	3	4	3	4	3	1	1	2
4	3	4	4	4	4	4	3	3	4	4	4	4	4	4
5	3	3	4	4	4	4	4	4	4	4	4	4	4	4
6	3	3	4	4	3	4	4	4	3	4	4	4	3	4
7	3	3	4	3	4	4	3	3	4	4	4	4	2	2
8	2	5	4	4	5	4	5	5	5	5	5	5	3	3
9	3	3	5	3	4	4	3	3	3	3	4	5	3	3
10	4	4	4	4	4	4	5	5	5	5	5	5	4	4
11	4	4	3	4	4	4	4	4	4	4	4	4	4	4
12	4	4	4	4	4	4	4	3	4	4	4	4	3	4
13	3	3	3	3	3	3	1	3	3	3	4	4		
14	4	4	4	4	4	4	4	3	4	4	4	4	3	4
15	4	4	4	4	4	4	4	3	4	4	4	4	3	4
16	3	3	3	3	3	3	4	4	4	4	4	4	3	3
AVG	3.3	3.6	3.7	3.5	3.8	3.8	3.6	3.6	3.9	3.9	3.9	4.1	3.1	3.4

Appendix 15: Results TAM questionnaires of Advisory committee

	Teacher	FMS	CCUNA	Dean AF	Avg	Avg per cat
PU						3.9
PU1	4	4	4	3	3.8	
PU2	4	4	4	4	4.0	
PU3	4	4	4	4	4.0	
PU4	4	3	4	4	3.8	
PU5	3	3	4	3	3.3	
PU6	4	4	4	4	4.0	
PU7	4	3	4	4	3.8	
PU8	4	4	4	4	4.0	
PU9	4	4	4	4	4.0	
PU10	4	4	4	4	4.0	
PEOU						3.6
PEOU1	5	4	4	3	4.0	
PEOU2	4	3	3	3	3.3	
PEOU3	5	3	3	2	3.3	
PEOU4	4	4	3	3	3.5	
PEOU5	4	4	4	4	4.0	
PEOU6	4	4	3	3	3.5	
ITU						3.7*
ITU1	4	4	3	x	3.7*	
ITU2	4	4	3	x	3.7*	

Additional questions

Grade 1-10

	Teacher	FMS	CCUNA	Dean AF	Avg
Dedica overall	8	7	7	8	7.5
Individual components					7.1
Navigation	8	6	6	6	6.5
Layout	8	7	7	7	7.3
Searches	8	7	7	7.5	7.4
Views	8	7	7	7.5	7.4
Download	7	7	x	7	7.0 *
Upload	7	7	x	7	7.0 *
Other	7	7	7	7	7.0

Open questions

Appendix 16: Results TAM questionnaires of Goilo school teachers

n=18	PEOU 3.5						PU 3.9						ITU 3.7	
	PEOU1	PEOU2	PEOU3	PEOU4	PEOU5	PEOU6	PU1	PU2	PU3	PU4	PU5	PU6	ITU1	ITU2
1	3	3	3	3	3	3	5	5	5	5	5	5		
2	3	3	3	3	3	3	3	1	1	1	1	3	3	2
3	3	4	4	4	4	3	5	5	4	3	3	3	3	3
4	5	4	4	4	5	5	5	4	4	4	4	4	3	4
5	3	3	3	3	4	3	4	5	5	5	5	5	5	5
6	3	3	3	3	4	3	4	5	5	5	5	5	5	5
7	4	4	4	4	4	4	5	4	4	4	4	4	3	4
8	5	5	5	5	5	5		5		5	5	5	4	5
9	5	4	4	4	5	5	5	5	4	4	4	5	4	4
10	4	4	3	4	4	4	4	4	4	4	4	4	4	4
11	3	3	3	3	3	3	3	3	3	3	3	3		
12	3	4	3	3	3	3	3	4	4	4	4	4	3	3
13	4	3	1*	4	3	3	5	5	5	5	5	5	5	5
14	3	3	3	3	3	3	3	2	1	1	2	3	3	2
15	3	3	3	3	4	4	4	4	3	3	3	3	4	3
16	3	3	3	3	3	3	4	4	4	4	4	4	4	4
17	2	2	3	3	3	2	3	3	3	3	3	3	3	3
18	4	4	4	4	4	4	5	4	4	4	4	4	3	4
AVG	3.5	3.4	3.3**	3.5	3.7	3.5	4.1*	4.0	3.7*	3.7	3.8	4.0	*3.7	3.8

* Indicated a 4 on the survey, but commented that this was with guide from workshop, without guide it would be 1. The lowest number has been inserted in the result.

Appendix 17: Results TAM questionnaires of final results of Repository Manager.

Organization/department	UoC Library & Research Services
Function	Manager
Name/email (optional)	m.groenewoud@uoc.cw

Please fill one of these numbers in the boxes in front of the following statements

1 Completely disagree 2 Disagree 3 Neutral 4 Agree 5 Completely agree

Perceived usefulness

- 5 PU1: Using the repository in my job/organization would enable me to accomplish tasks more quickly
- 5 PU2: Using the repository would improve my job/organization performance
- 4 PU3: Using the repository would increase my/our productivity
- 4 PU4: Using the repository would enhance my/our effectiveness on the job
- 4 PU5: Using the repository would make it easier to do my job/organization
- 5 PU6: I would find the repository useful in my job/organization
- 4 PU7: Using the repository will improve my work/ at my organization.
- 5 PU8: Using the repository will enhance my/our effectiveness.
- 4 PU9: Using the repository will increase my/our productivity.
- 5 PU10: I would find the repository a useful tool in my work/organization.

Perceived ease of use

- 5 PEOU1: Learning to use the repository is easy for me
- 4 PEOU2: I find it easy to get the repository to do what I want it to do
- 4 PEOU3: My interaction with the repository is clear and understandable
- 4 PEOU4: I find the repository to be flexible to interact with
- 5 PEOU5: It is easy for me to become skilful at using the repository
- 5 PEOU6: I find easy to use the repository

Intention to use

- 5 ITU1: I would use the repository to do a task whenever it has a feature to help me perform it
- 5 ITU2: I would use to use the repository in as many cases as possible

Additional questions

Please provide some ways you perceive the repository and the collaborative infrastructure to be useful and /or easy, preferably with practical examples

From an external user perspective: the full text search is the biggest asset. Also the quantity of the available resources adds to the usefulness and attractiveness. For non-text data such as oral history, video and datasets, much would depend on metadata and abstracts.

From an internal user perspective, I only have experience with the newer version, which I find very user friendly.

Please provide some ways you perceive the need of improvement, so that the repository and the collaborative infrastructure could be more useful and /or easy, preferably with practical examples

There should be a minimal guideline to make the user understand the difference between the home page search bar, text search and advance search.

Also invest in good quality metadata and abstracts where needed.

In adding materials, there should be much more guidance (which metadata where).

Also, there should be an infrastructure and process in place for partners that want to add bulk material (full partner collection). This should be done both (1) in close cooperation with the UoC and (2) in a paid service directly with Sobek. This should be done only under guidance of a (3) preferred local coordinator such as Yunette who is knowledgeable and trusted to take care of (1) and (2).

Please elaborate on your intentions to use the repository

External: as researcher, this should be the place to go for all Antiana.

Internal: this will be a library in itself. It should be managed as such. Eg all theses should go there, all open access Antiana, all datasets available from local research, all cultural heritage material.

Please indicate what you would like to use the repository for, which is currently not possible

As institutional repository for all open access resources used and produced.

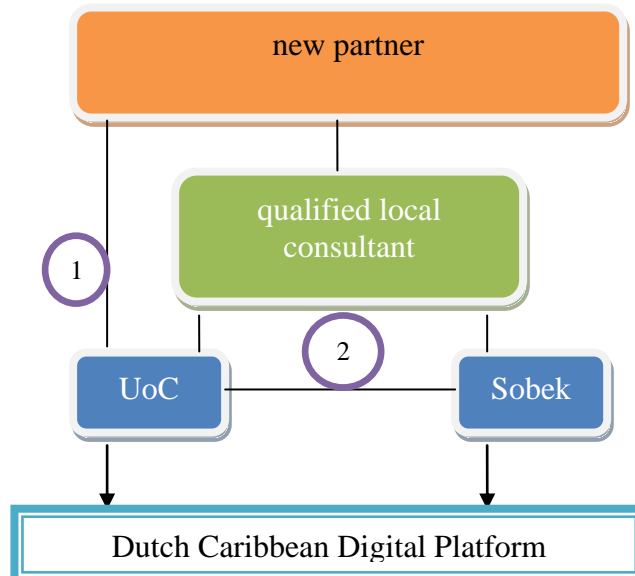
Appendix 18: Initial Technical Infrastructure digital repository for Curaçao as a SIDS

Van	Margo Groenewoud, Library & Research Services
Aan	UoC Repository Partners (SobekCM, dLOC, Yunette Aniceta)
Betreft	Operational & business model for DCDP partner collections
Datum	26 mei 2015

The University of Curaçao is the proud initiator and host of the Dutch Caribbean Digital Platform (DCDP). This repository was developed as SobekCM instance in close cooperation with the Digital Library of the Caribbean (dLOC) and is now hosted at SobekCM. This hosting includes both storage, software upgrades and technical support. Our local consultant is Yunette Aniceta.

DCDP is developed as a community platform. For a Small Island Development State with only 160,000 inhabitants, it would be impossible for Curaçao as host country to operate more than one repository. All potential partners – cultural, educational and knowledge institutes – would benefit from adding digital material to one platform. However, the UoC library has limited capacity and far too little flexibility to support partners in joining the DCDP forces and adding collections.

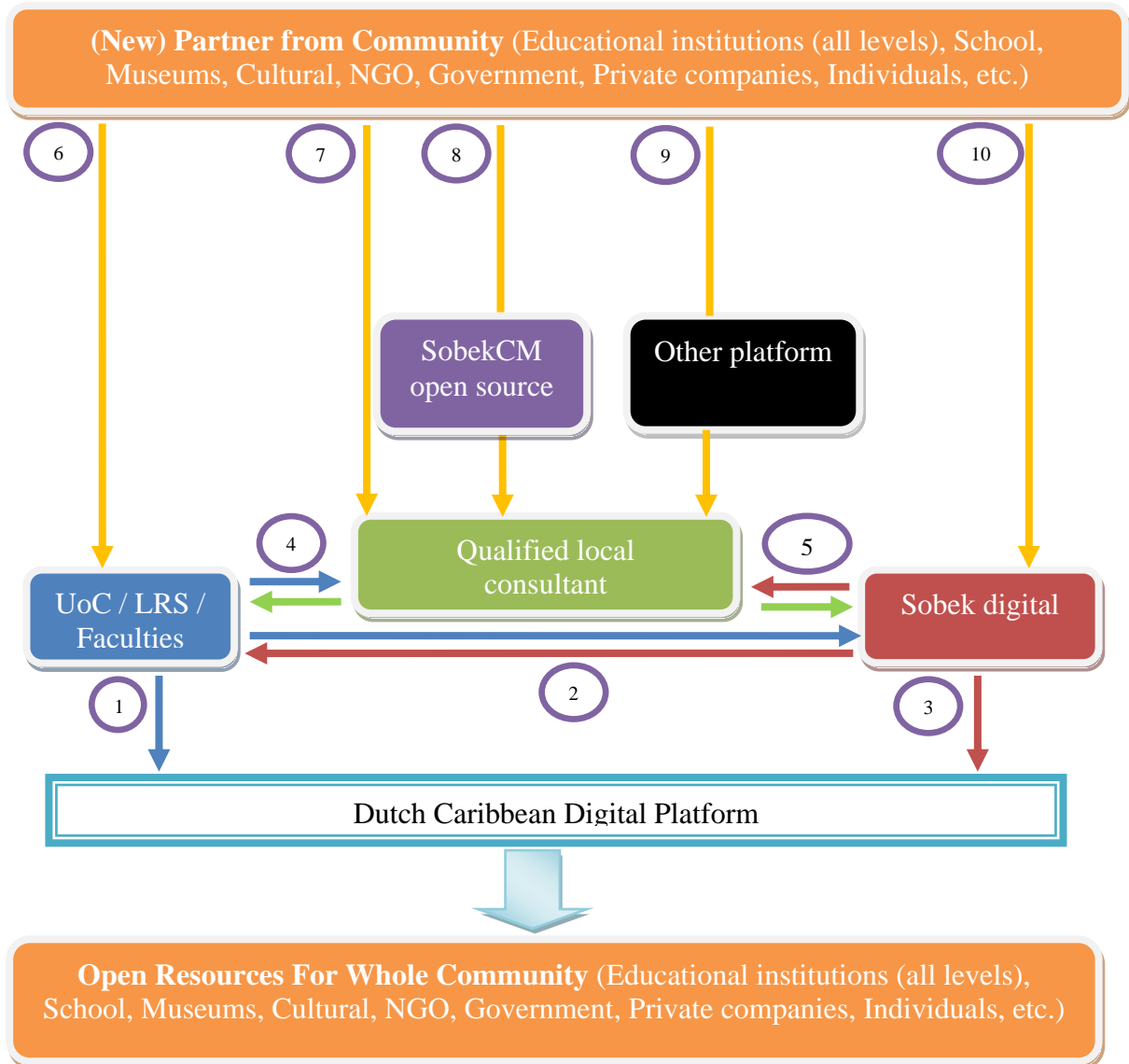
Our challenge now is: how can we work with partner organizations in such a way that is both inviting and inspiring yet workable, fair and thus sustainable? We think we should differentiate between (1) small collections & ‘single item upload’ procedures and (2) large collections & ‘batch upload’ procedures:



(1) Small collections & single item uploads: UoC provides access, collection space and guidance. This could include participating in mandatory training by our local consultant and UoC librarians.

(2) Large collections & use of batch loads: partners must work with a qualified local consultant, who takes care of (a) all arrangements with UoC (b) all arrangements with Sobek (c) actual uploading.

Appendix 19: Adapted LRS Digital Repository Infrastructure Design for stakeholders in Curaçao as a SIDS



Explanation:

- ① UoC, LRS, Faculties upload directly to the DCDP platform.
- ② Request via ticketing system to Sobek digital for problems or new requests.
- ③ Direct intervention of Sobek Digital on the system (e.g. bulk TIFF files)
- ④ Intervention of qualified local consultant with LRS for local issues, issues with SobekCM or issues with Partners
- ⑤ Intervention of qualified local consultants with Sobek Digital for local issues, issues with SobekCM or issues with Partners
- ⑥ New or existing partners with a limited amount of resources can receive services from the LRS to obtain rights to upload directly into collection(s) on the platform, and receive instructions on how to work with the system
- ⑦ Intervention of qualified local consultants with organizations containing large amount of digital resources that should be placed in the repository
- ⑧ Intervention of qualified local consultants with organizations that use the free open source SobekCM application to set up and host their own repository
- ⑨ Intervention of qualified local consultants with organizations that use other digital library application to set up and host their own repository
- ⑩ Organizations can make use of the services of Sobek Digital to host their own SobekCM repository to manage their resources

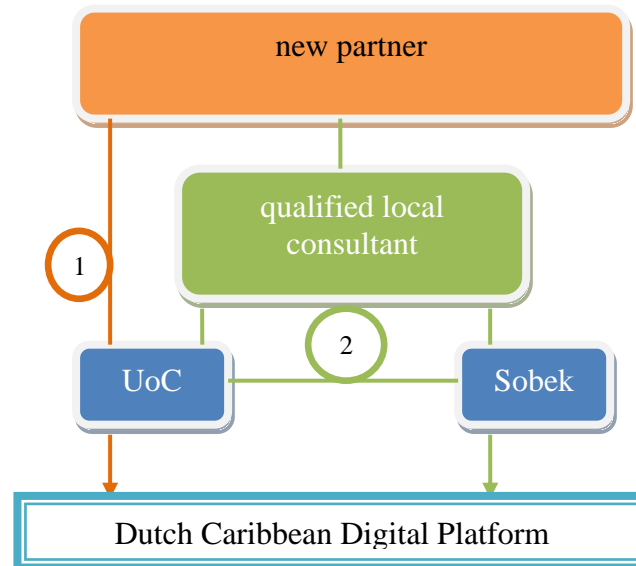
Appendix 20: Guided Emergence of Design repository infrastructure**MEMO**

To	UoC Repository Partners & Stakeholders
From	Margo Groenewoud, UoC Library & Research Services
Subject	Operational & business model for DCDP partner collections
Datum	28 mei 2015

The University of Curaçao is the proud initiator and host of the Dutch Caribbean Digital Platform (DCDP). This repository was developed as SobekCM instance in close cooperation with the Digital Library of the Caribbean (dLOC) and is now hosted at SobekCM. This hosting includes both storage, software upgrades and technical support. Our local consultant is Yunette Aniceta.

DCDP is developed as a community platform. The owner – UoC - is based in Curaçao, but the platform aims at serving the Dutch Caribbean as an entity. Given the small scale of our region, the platform is not restricted to being just an institutional academic repository, or just an education or cultural heritage platform, but combines these functions. Many cultural, educational and knowledge institutes in this region have a responsibility for a national cultural heritage collection. They are all potential partners who would mutually benefit from adding digital material to one platform.

However, though the UoC library hosts this platform, it has no formal responsibility for building a national or regional digital library, nor does she have the capacity and organizational flexibility to support partners in joining the DCDP forces and adding collections. Our challenge therefore is: how can we work with partner organizations who want to add a collection in such a way that is both inviting and inspiring yet workable, fair and thus sustainable? We think we can take this challenge by first differentiating between (1) relatively small sub-collections & use of simple ‘single item upload’ procedures; and (2) larger sub-collections & need for ‘batch upload’ procedures. In case of situation (1), we at UoC can provide support, whereas in case of situation (2), the partner would need to work with a qualified consultant who can take care of the set-up of hosting and adding a sub-collection to the DCDP repository:



Of course this needs a little more detailing in practice, but the general idea is to offer a choice between:

(1) Small collections & single item uploads:

- a. UoC provides access, collection space and guidance.
- b. This includes participating in mandatory training by our local consultant and UoC librarians.
- c. Organizations can also start ‘small’, to see if this works for them, and if they really want to build a solid and extended collection, then start process 2 with a consultant.

(2) Large collections & use of batch loads:

For larger collections and batch loads, partners must work with a qualified local consultant, who takes care of:

- a. all arrangements with UoC (general agreement and/or membership)
- b. all arrangements with Sobek (this could include making their own instance linked to us)
- c. actual uploading

Follow-up activities

1. UoC: define to what extent we can handle and support the ‘category one’ group in terms of:

- user and application management (add users and child collections, basic support)
- training
- data limit
- quality control

2. What our ‘qualified local consultant’ Yunette Aniceta can do is together with SobekCM and/or dLOC define a basic offering & pricing for partners interested.

Feedback of M. Sullivan, SobekCM developer

... 1) I am not sure if this would be Yunette (since she is more of a consultant than a permanent employee perhaps?) but I would probably have a consultant involved in every case. To evaluate what the potential partner is really looking for.

2) You will probably want to create an (institutional) collection for every institution that is added, so that consultant could help with that. In addition, you may want to create a new default metadata set, selecting that institution by default for users that submit online. We can talk about these suggestions later of course, but I think you mention creating a collection, or sub-collection in your document. For the second situation, if an institution want to have their own separate repository, we would generally call that their own "instance".

2) I like the idea of using the first situation as an "incubator" (term that is very popular at least here in the States) to help these organizations get their digital footing, and then they can move onto something larger as they grow and need more.

3) Technologically, we can certainly support multiple instances all linked back to your DCDP. No problems with that.

4) Financially and for resource allocations, it would certainly benefit us to have a local consultant like Yunette helping with training, first level questions, etc.. Obviously, we can reflect that in the prices for both UoC and/or the new partner institutions. ...

Feedback of L.Taylor

... I agree with what Mark has stated, and that this looks great! Would you be interested in doing the talk again at a later time as a webinar? It'd be great for others to see what and how you're building the community and with the community.

In thinking about the communities, the SobekCM communities have two groups that are also available as potential resources:

- Advisory Board for Florida and the Caribbean (more Florida focused; a bit local in some ways; the second call was great)
- Developers, Implementers, and Expert Users Group (worldwide)

Both groups are sharing resources including new tool developments, new user resources, new ways of using the tools, etc.

For the point:

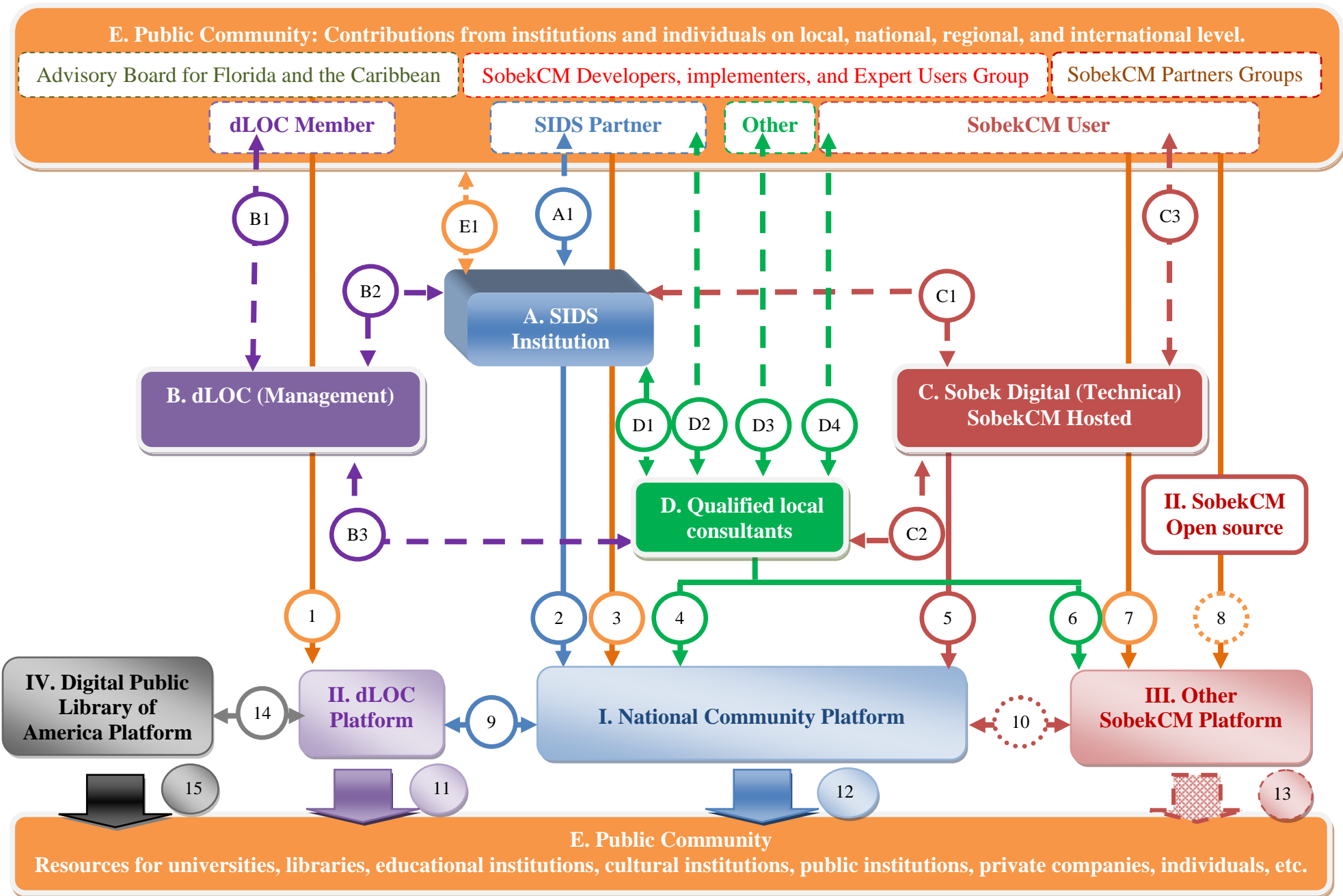
“the platform is not restricted to being just an institutional academic repository, or just an education or cultural heritage platform, but combines these functions.”

This is of huge interest to many folks. Even most of the other institutions in Florida using SobekCM aren't using the IR functionality yet and so folks are interested in learning more, and in seeing how this gets promoted and supported. With the www.sobekrepository.org site now including the help documentation, how could the software developer and user community help you further with DCDP? With the communities being new and young, I don't think we know how yet, but I think asking for what you'd like to see of the communities that now exist and the others that will grow would be a great way to help the communities grow and to get even more support for DCDP ...

Feedback of B. Wooldridge

.. this looks like a great start. Would you all be interested in adding some language about what it would look like if the contributing institution also would like to include the resources in dLOC and then the Digital Public Library of America (for which dLOC is now starting to share metadata)? Mark and I have discussed how it could possibly work to have Sobek Digital hosted instances have select materials that are batch uploaded into dLOC as well. We would need to figure out how you all (and the U. Virgin Islands) would want that to work and then how to give your partners the option to collaborate or not. ...

Appendix 21: Generalized Design for a National Community Repository infrastructure for (Dutch) Caribbean SIDS (Y. Aniceta)



Explanation of the flow of resources (numbers), using UoC and an example of a SIDS institution.

1. The existing methods of members contributing with resources to dLOC
2. UoC, LRS, Faculties upload directly to the platform as SIDS institutions.
3. New or existing partners with a limited amount of resources can receive services from the LRS to obtain rights to upload directly into collection(s) on the platform, and receive instructions on how to work with the system
4. LRS, LRS Partners or Non-partners can make use of services of qualified local consultants to manage their resources on the repository
5. Direct intervention of Sobek Digital on the system (e.g. bulk TIFF files)
6. Organizations can make use of the services of qualified local consultants to set up their own SobekCM repository to manage their resources
7. Organizations can make use of the services of Sobek Digital to host their own SobekCM repository to manage their resources
8. Organizations can use the free open source SobekCM application to set up and host their own repository
9. dLOC is interconnected to the repository and can acquire or deposit open resources directly if permission is granted.
10. Organizations are interconnected to the repository and may acquire or deposit open resources directly if permission is granted.
- 11-13. dLOC, the National community platform and other individual repositories provide their resources to the community
- 14-15. dLOC arranges that the relevant resources are deposited at international digital libraries.

Flow of resources,. Explanation of the flow of resources, information and support, using UoC and an example of a SIDS institution.

- A1. Partners of the SIDS institutions interact directly when transferring resources, information and support.
- B1. dLOC members interact directly when transferring resources, information and support.
- B2. dLOC and SIDS institutions provide management support and improvement ideas to each other.
- B3. dLOC and qualified consultants provide management support and improvement ideas to each other.
- C1. Sobek Digital and SIDS institutions provide technical support and improvement ideas to each other.
- C2. Sobek Digital and qualified consultants provide management support and improvement ideas to each other.
- C3. Sobek users interact directly to Sobek Digital when transferring resources, information and support for hosted solutions
- D1. Intervention of qualified local consultant with LRS for local issues, issues with SobekCM or issues with Partners
- D2. New or existing partners with can receive services from qualified local consultants to upload a greater number of resources directly into collection(s) on the platform, and get instructions how to work with the system
- D3. Non partners using other platforms can contact LRS directly to request if their resources may be uploaded on the platform, and if accepted, the qualified local consultants can look for possibilities how to accomplish this.
- D4. SobekCM users can obtain services of qualified local consultants when needed

Links to websites

- ⁱ University of Curaçao Dr. Moises da Costa Gomez (UoC): <http://www.uoc.cw>
- ⁱⁱ Faculty of Arts (FoA): <http://www.uoc.cw/afsite/>
- ⁱⁱⁱ Library and Research Services (LRS): <http://uoc.cw/biblosite/>
- ^{iv} USONA: <http://www.usona.an/>
- ^v USONA Onderwijs en Jongeren webpage: http://www.usona.an/item_7073/o_j/
- ^{vi} Lerarenopleiding Funderend Onderwijs (LOFO): <http://www.uoc.cw/afsite/index.php/lofo-curacao-en-bonaire2>
- ^{vii} Information & Communication Technology Services (ICTS): <http://uoc.cw/ictssite/>
- ^{viii} TAC Economics: <http://www.tac-financial.com/>
- ^{ix} United Nations Children's Fund (UNICEF): <http://www.unicef.org/>
- ^x Papiamentu yurls: <http://papiamentu.yurls.net/cw/page/>
- ^{xi} Método liber: <http://www.diturunpoko.com/>
- ^{xii} Grassroots Curaçao: <http://www.grassroots Curaçao.com/>
- ^{xiii} Fundashon Bon Intenshon: <http://fundashonbonintenshon.org/>
- ^{xiv} Sustainable Kòrsou scholenproject: <http://www.sustainablekorsou.org/>
- ^{xv} Jisc: <http://www.jisc.ac.uk/>
- ^{xvi} EBSCOhost: <http://www.ebscohost.com/>
- ^{xvii} Emerald insight: <http://www.emeraldinsight.com/>
- ^{xviii} Google scholar: <http://scholar.google.com/>
- ^{xix} United Nations Educational, Scientific and Cultural Organization (UNESCO):
<http://en.unesco.org/>

^{xx} Jisc: <http://www.jisc.ac.uk/>

^{xxi} Repositories Support Project (RSP): <http://www.rsp.ac.uk/>

^{xxii} SURF website: <http://www.surf.nl/>

^{xxiii} The International Federation of Library Associations and Institutions (IFLA):

<http://www.ifla.org/>

^{xxiv} Organisation for Economic Co-operation and Development (OECD): <http://www.oecd.org/>

^{xxv} dLOC: <http://www.dloc.com/>

^{xxvi} Information & Communication Technology Services (ICTS), previously CCUNA):

<http://www.uoc.cw/ictssite/>

^{xxvii} Ministerie van Onderwijs, Wetenschap, Cultuur en Sport (MOWCS):

<http://www.gobiernu.cw/web/site.nsf/web/A352B659097684CC0425785D00688FF7?openDocument&language=nederlands>

^{xxviii} Fundashon Planifikashon di Idioma (FPI): <http://www.fpi.cw/>

^{xxix} Fundashon Material pa Skol (FMS): <http://www.materialpaskol.org/>

^{xxx} Rooms Katholiek Centraal Schoolbestuur (RKCS): <http://www.rkcs.org/>

^{xxxi} Dienst Openbare Scholen (DOS):

<http://www.gobiernu.cw/web/site.nsf/web/262F3C20F003BCCE0425794300495046?OpenDocument&language=nederlands>

^{xxxii} Vereniging Protestant Christelijk Onderswijs (VPCO): <http://www.vpco.org/>

^{xxxiii} Interactum: <http://www.interactum.nl/>

^{xxxiv} PERSBERICHT Bibliotheken en Kenniscentra verenigd in Dutch Caribbean Library

Association_march2012, <http://www.fobid.nl/node/72>

- ^{xxxv} (Koninklijke Bibliotheek (KB), or the Royal Library: <http://www.kb.nl/>)
- ^{xxxvi} Koninklijk Instituut voor de Tropen (KIT), or the Royal Tropical Institute:
<http://www.kit.nl/>
- ^{xxxvii} the (Koninklijk Instituut voor Talen- Land en Volkenkunde (KITLV), or the Royal
Institute of Languages-Southeast Asian and Caribbean: <http://kitlv.nl/>)
- ^{xxxviii} Conference Connect & Cooperate webpage: <http://www.bantraha.com/Events/june-27-conference-connect-cooperate/>
- ^{xxxix} Ministry of Economic Development website:
<http://www.gobiernu.cw/web/site.nsf/web/E75CCA27FA17BE7F0425785C006ECC29?opendocument>
- ^{xl} Curaçao Innovation & Technology Institute (CITI): <http://citi.cw/>
- ^{xli} Bureau Telecommunication & Post website: <http://www.btnp.org/index.php?lang=en>
- ^{xlii} Fundashon pa Inovashon di Enseñansa na Kòrsou (FIDE): <http://fide.cw/>
- ^{xliii} Federal Agencies Digitization Guidelines Initiative (FADGI):
<http://www.digitizationguidelines.gov/>
- ^{xliv} Dublin Core metadata initiative: <http://dublincore.org/>
- ^{xlv} IEEE Learning Technology Standards Committee (LTSC): http://ltsc.ieee.org/doc/wg12/LOM_WD6_3a.pdf
- ^{xlvi} Khan Academy: www.khanacademy.org
- ^{xlvii} Merlot: <http://www.merlot.org/merlot/index.htm>
- ^{xlviii} OER Commons: www.oercommons.org
- ^{xlx} IEEE Learning Object Metadata: (<http://ieee-sa.centraldesktop.com/ltsc/>),

- ⁱ IMS Metadata initiative: <http://www.imsglobal.org/>
- ⁱⁱ CanCore: <http://www.cancore.ca/>
- ⁱⁱⁱ Advance Distributed Learning (ADL) Initiative: <http://www.adlnet.org>
- ⁱⁱⁱⁱ Coursera: <https://www.coursera.org/>
- ^{lv} Narcis: <http://www.narcis.nl/?Language=en>
- ^{lvi} Delpher: <http://www.delpher.nl/>
- ^{lvii} WikiwijsLeermiddelenplein <http://www.wikiwijsleermiddelenplein.nl/start/>
- ^{lviii} Repositories Support Project (RSP) Planning Checklist: Start: <http://www.rsp.ac.uk/start/>
- ^{lix} UNESCO International Institute for Education and Planning (IIEP):
<http://www.iiep.unesco.org/en>
- ^{lx} Website with reports focusing on challenges in tertiary education in small states:
<http://www.iiep.unesco.org/en/challenges-tertiary-education-small-states-2921>
- ^{lxi} Council of State University Libraries (CSUL): <http://csul.net/>
- ^{lxii} Hoofdstuk III: Duur van het auteursrecht, art. 38 t/m 43 Auteursverordening 1913
- ^{lxiii} More information on Creative Commons licenses: <https://creativecommons.org/licenses/>
- ^{lxiiii} [creativecommons.org/licenses/by-nc-sa](https://creativecommons.org/licenses/by-nc-sa/3.0/legalcode) <https://creativecommons.org/licenses/by-nc-sa/3.0/legalcode>
- ^{lxv} Florida International University (FIU): <http://www.fiu.edu/>
- ^{lxvi} University of Florida (UF): <http://www.ufl.edu/>
- ^{lxvii} Mockup builder: <http://mockupbuilder.com/>
- ^{lxviii} Abby Finereader Corporate Edition: <http://www.abbyy.com/>

- lxviii MimioTeach Interactive System: <http://www.mimio.com/en-EM/Products/MimioTeach-Interactive-Whiteboard.aspx>
- lxix JustInMind Prototyper <http://www.justinmind.com/>
- lxx Amigoe: <http://www.amigoe.com/>
- lxxi Mongui Maduro Foundation: <http://www.madurolibrary.org/>
- lxxii Jurdoc: <http://www.jurdoc.cw/>
- lxxiii Stichting Monumentenfonds: <http://www.monumentenfonds.org/>
- lxxiv Central Bureau of Statistics Curacao: <http://www.cbs.cw/>
- lxxv Nationaal Archeologisch Antropologisch Museum (NAAM): <http://www.naam.cw/>
- lxxvi http://www.ict-and-education.com/index.php?topic=track6&style_id=0
- lxxvii A series of Local digital resources developed by Eline Seinhorst and Alysha Schrader: <http://uoc.sobeklibrary.com/results/?l=nl&t=Seinhorst,Schrader>
- lxxviii Sobek Digital: <http://sobekdigital.com/>
- lxxix Universiteitsbibliotheek (UB) Leiden: <http://bibliotheek.leidenuniv.nl/>
- lxxx Ministry of Economic Development website: <http://www.gobiernu.cw/web/site.nsf/web/E75CCA27FA17BE7F0425785C006ECC29?opendocument>
- lxxxi More information of the Caribbean ICT Roadshow of 2009 can be found at: <http://connectedcaribbean.com/download/Overview%20of%202009%20Roadshows.pdf>
- lxxxii Files "Onderwijs en jongeren Curaçao", available at <http://www.usona.an/algemeen/downloads/downloads/>