Collaboration to Clarify the Cost of Curation

D4.5—From Costs to Business Models

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Executive Summary

This deliverable discusses business models for digital curation. It helps organisations to understand the requirements and drivers for curation services from a supplier and demand side. We investigated existing services and have developed guidelines to address new business opportunities. Implementation of our findings would facilitate an organisation's strategic planning for curation services through an improved understanding of services, streamlining and improvement of those services, planning for new collaborations, and identifying new business opportunities.

The ease of use of a Business Model Canvas (BMC) template and the visual representation of essential building blocks makes it suitable for strategic discussions of digital curation business models. A BMC provides an effective approach to identify and meet supply and demand side requirements through associating the identified customer segments with appropriate value propositions. In this report a template is used to present a sample of existing business models in digital curation. The key aspects of these business models are used to synthesise templates that encompass common properties and key aspects. A key application for this work is the identifying of value propositions which address the requirements of previously identified customer segments.

Other 4C project findings feed into the discussion of curation business models in this report. Findings about stakeholders clarify the situation of the various actors within the curation market. The evaluation of existing cost models identified gaps and needs that also contribute to the understanding of market dynamics. The assessment of indirect economic determinants provides further understanding of indirect benefits that can be fed into the business model canvas as value propositions. These and other findings are used in this report to improve understanding of the characteristics of digital curation and its potential business models.

Existing business models form the basis for completing templates and creating guidelines to develop and adapt new business models. In order to address new business opportunities a brief structural overview of the market is provided, and the landscape of different types of solutions explained. Guidelines support the community in developing completely new business models and provide additional information for adapting and adjusting business model canvases. The effects of changing elements of the canvas and the consequences for related elements are shown. Examples for new business models help readers of this deliverable to understand how these business modelling processes can be applied. This report increases the understanding of the key aspects of curation business solutions, and helps to identify and plan for new potential business opportunities.

1 Introduction

Requirements for digital curation are developing rapidly. The speed of change is dictated in part by technological progress that leads to changing file formats and storage technologies. At the same time, more and more data is being produced and collected. To ensure the value and opportunities for reuse and future exploitation of data new business models are needed to ensure the economic survival of the organisations which look after data. A competitive and vital market with a diverse portfolio of curation services would facilitate cost effective and efficient management of digital content.

This work on business models for curation services helps stakeholders to increase their understanding of the relationships and dependencies between different aspects of a business model. Stakeholder involvement is a critical factor in successful planning of strategic decisions. For example, representatives of technicians, curators, marketing, management, domain experts and external service providers help to complete the picture of a curation service, and ensure that all key concerns are considered. The report provides an overview of existing curation solutions and outlines their key aspects in terms of activity, customers, finance and unique selling points with respect to the curation domain. This document provides guidelines for planning of new services and adjustment of existing services. Moreover, it provides pointers to new business opportunities that help towards a competitive and diverse service market for digital curation.

This report increases the understanding of business models in the area of digital curation by providing examples of existing services and guidelines to develop new business opportunities. It helps organisations to understand the demand and supply side of curation services and to strengthen a business-centric view of these services. This work further facilitates strategic planning for curation services for example increased understanding of one's own services, planning for collaboration with other organisations or service providers, adjustment of services in response to new market requirements or launching new services. This report establishes a common basis for the communication between different stakeholders involved in curation services, to support the planning process and ensure informed decision-making.

The baseline for this work is a collection of representative examples for existing business models from three different domains: science, culture and commerce. Business services are outlined using the structured approach of a business model canvas template, which helps to describe the different aspects of a business service including views on the activity, consumer and financial aspects. In addition qualities and selling points that the services offer to their customers are analysed. The examples provide an overview of established curation services. Key aspects and common characteristics of the business services are discussed for each domain.

The early sections of the report cover the background and methodology in detail, in particular that related to Business Model Canvasses. Section 2 presents pointers to related work. It introduces the Business Model Canvas method and presents revenue models for business services. Other work on business models for digital curation is discussed as well in this section. Contributions of the 4C project supporting the work on business models is presented in Section 3. The collected business model canvases are presented in Section 4, including representative examples of the science, culture and commerce domains.

In a second part of this document—from Section 5 onwards—opportunities for new business models are discussed. Guidelines and examples are provided to support the designing of new services or fine-tuning of existing business services. We use the business model canvas as a tool for the planning process. We further provide guidelines and references to related work that helps to strategically plan new services. Findings of the 4C project that help to understand and specify business services are presented including

stakeholder needs, value propositions, cost structures and cost data. Moreover, a methodology is presented to structure current curation services. This structuring supports planning activities and comparison of existing solutions. Types of funding and collaboration for providing curation services are discussed in this report. Examples for the planning of new curation services are given indicating potential business opportunities.

The development of new business models can be based on existing services. By adjusting and adapting available services new business opportunities can be exploited, for example targeting new customer segments, offering improved services or new collaboration. Within the report changes of existing business model canvases are analysed and patterns are identified that describe the impact of changes. The application of the patterns is also demonstrated in this report.

The findings of the report are summarised in Section 6.

2 Related Work

Section 2.1 introduces the business model canvas, which is used to describe business models in this report. Section 2.2 presents related work on revenue models. Other work on business models for digital curation is discussed in Section 2.3.

2.1 Business model canvas

One of the underlying reasons for the ascendancy of digital curation as a core business requirement is rapid technological development with the inevitable consequential technological obsolescence. In order to analyse the value creation potential of e-businesses Amit and Zott (2001) identified four interrelated drivers of value:

- Novelty
- lock-in
- Complementary, and
- Efficiency

Efficiency is the primary value driver—communication and transmitting information via the Internet is reducing transaction costs significantly.

Complementary describes bundling products to control the value creation as opposed to selling products separately.

Lock-in is used to keep customers from migrating to other service competitors. Companies can develop dominant proprietary standards for products and services to increase the lock-in driver.

Novelty is the “newness” of the product or service.

In this early study, the authors identified the concept of value creation as an inherent element of business models. The BMC concept applied here is a result of these findings and extends them with the canvas as a visual representation tool and the concept of various components of a business model.

The business model canvas is a visual business model conceptualisation based on the work of Alexander Osterwalder and his earlier thesis on business model ontology (Osterwalder 2004). The book “Business Model Generation” (Osterwalder, Pigneur, and Clark 2010) introduced this business model concept to a wider audience. It describes a business model by placing the essential elements within a diagram consisting of nine building blocks. Figure 1 shows the business model ontology used by Fritscher and Pigneur (Fritscher and Pigneur 2010). The diagram also explains the relationships between each element and introduces perspectives within the business model ontology. The business model canvas shown in Figure 2 is a simplified representation of this ontology. In this work we describe business models using this simplified business model canvas.

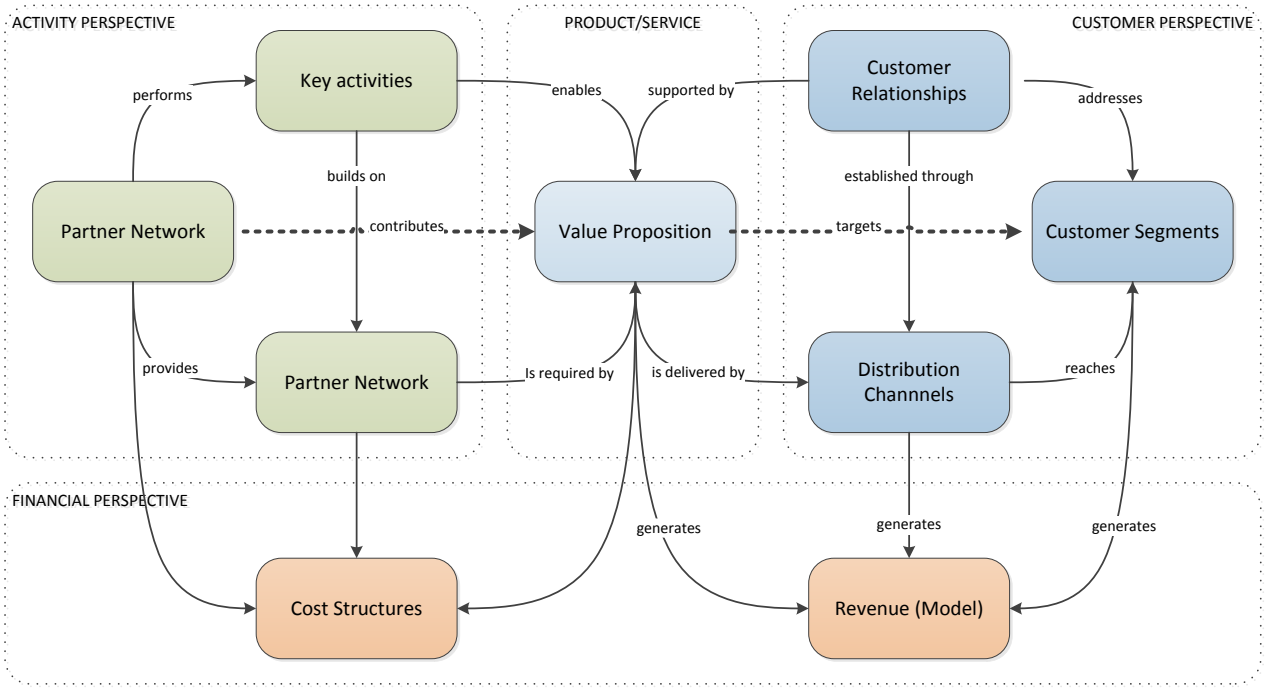

Figure 1—Business model ontology canvas showing nine building blocks (Fritscher and Pigneur 2010)

The Business Model Canvas

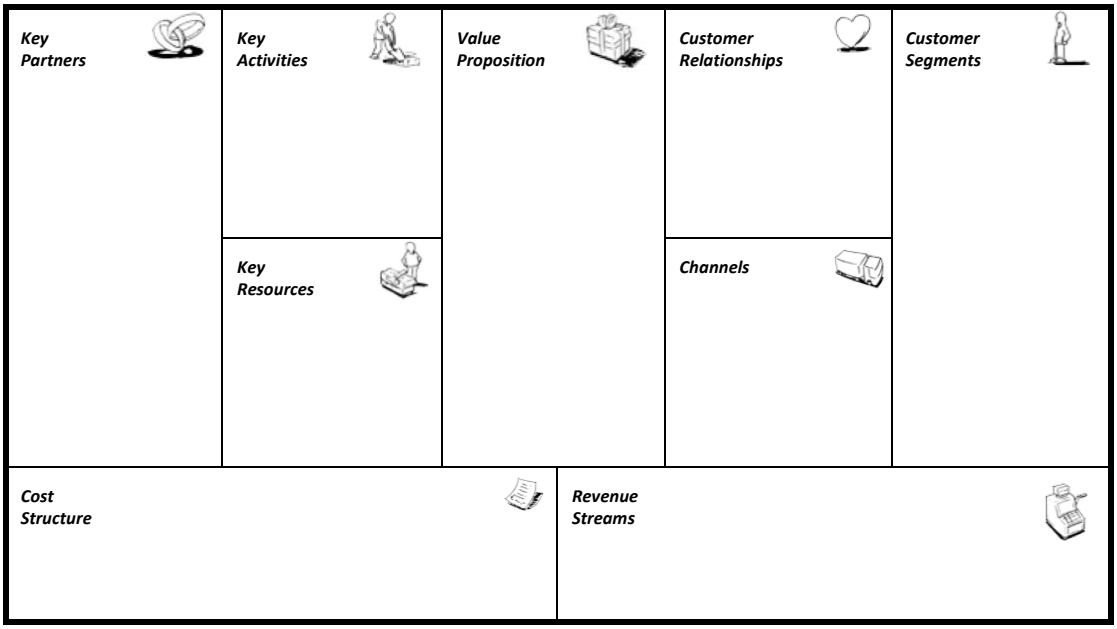

Figure 2—Business model canvas, a simplified version of the business model ontology (Osterwalder, Pigneur, and Clark 2010)

Value proposition

The central building block of the canvas is the value proposition. It can be seen as the qualities of the product that are offered to the customers considered in the business model. It describes the key reasons why customers use a specific product or a service of a business. A value proposition aims at solving the problems or needs of the customers, and therefore is seen by them as something that provides an additional value.

Key partnerships

There are three basic motivations for creating key partnerships. The first reason is that a business model requires a specific activity that cannot be performed by the company on its own, when a key resource is

missing or not sufficiently available—such as specialised knowledge or a technical infrastructure. Another motivation is the economy of scale to reduce costs and to optimize the use of resources. Sharing infrastructure and outsourcing are effects of these optimising partnerships. The third reason is risk reduction and reduction of uncertainties where partnerships are formed even between market competitors to collaborate and develop new offers. The high financial risk is shared among the partners, and they create new potential products or services such as large software solutions or new standards.

Key activities

The key activities are those that are required to enable a value proposition and make use of the key resources in order to offer them to customers. These activities can be to produce a physical asset, which is typical for manufacturing business models. They can also be problem solving, which is often the case if a company is offering a service as a value proposition. Consulting and training activities are common key activities in these cases. The third type of key activities are platforms to enable a value proposition. For example, the way credit card companies require activities related to their transaction platform connecting merchants, customers and banks.

Key resources

The building block key resources deals with resources that are required to offer a certain value proposition. Key resources can be physical (such as buildings or machines), intellectual (such as patents or partnerships), human (such as researchers or software developer), or financial (such as a budget large enough to conduct long-term studies for pharmaceutical research and development).

Channels

The channels of a business model canvas describe the interface of a company to its customers. T hrough this interface a company can raise awareness about its offers, let customers evaluate the company's value propositions, and purchase the offers. It also describes the distribution channels and after-sales activities.

Customer relationships

The customer relationship building block consists of the relations of the company to its customer segments. Relationships are used to acquire new customers and to keep in touch with current customers. They can be personal (where customers interact with real humans), or automated (where customers are using services that do not need direct human interactions).

Customer segments

The customers of a business model are listed in the customer segments building block. Here they are divided into separate segments if they have different requirements and if they need to be addressed with a separate offer. Customers are also grouped in separate segments based upon on whether a different channel is used for product distribution or service provision. Other reasons to define a separate customer segment are different types of relationships, profitability and customer interests in different aspects of the offer.

Cost structure

The cost structure lists the most significant cost elements of a business model. This could be the most expensive key activities or key resources. A more detailed evaluation of costs structures is best undertaken using cost models as this is not the aim of this business model canvas.

Revenue streams

The revenue streams represent the flow of payments to a company. A successful business model needs to understand for which value proposition its customers are willing to pay. Revenue streams can be one-time payments or periodical payments. There are many different mechanisms to generate revenues. A more detailed overview of possible revenue and funding models is presented in the Section 2.2 below.

2.2 Revenue models

An economically sustainable business model needs to cover its costs with enough revenue streams or reduce its cost elements if no further revenue streams can be acquired. A revenue model describes how a business can create revenue streams and is an essential part of a business model (Laniado 2013).

Model	Description
Brokerage Model	Bringing buyers and sellers together, which facilitates transactions and the broker charges a fee or commission.
Advertising Model	A web site provides content—access is often free—and advertising messages in form of banner ads are shown.
Merchant Model	Wholesalers and retailers of goods and services. Sales may be made based on list prices or through auction.
Manufacturer Model	The manufacturer creates a product and sells it to its customers.
Subscription Model	A predefined fee is charged for a product or service and based on a contract the customer will be charged periodically until expiration of the subscription.
Utility Model	Customers are only charged for actual usage of a service or product.
Royalty Model	Revenues are raised through royalty payments, which are usually a fixed percentage of the turnover or revenue. In this model a product needs to be successfully produced first before royalties are paid.
Free Model	Public sector organisations apply this model. No direct revenues are created and direct benefits are intangible such as better-informed citizens.

Table 1—Categories of revenue models (Rappa 2002) and (Donker 2009)

There are different strategies for generating revenues and many revenue models are described in the literature. Rappa (Rappa 2002) and Donker (Donker 2009) defined different categories of revenue models, which are combined in Table 1.

The brokerage model is a middleman approach where buyers and sellers of an offer are brought together by a broker. This can be in a business-to-business, a business-to-consumer, or a consumer-to-consumer market. Examples for brokerage models are virtual marketplaces, auctions, or search agents where a software application provides extended search abilities for certain goods or services in order to find the lowest price or a rare offer.

The advertising model is a well-known revenue model similar to the traditional media broadcast model where content is mixed with advertisement messages. This model works best with media that have high

number of users as the amount of the revenues directly depends on the number of viewers of the advertisements.

A company applying the merchant model buys products or services and sells them for an increased price. Retailers and wholesalers are classic examples for this revenue model where goods are bought from manufacturers and resold to end consumers.

The manufacturer model is arguably the most common revenue model. A company creates a good that has a value for its customers. The customer makes the purchase and pays the manufacturer.

The subscription model is often based on a contract where the users gains access to a service or product and agrees to pay predefined periodic fees. The advantage for the company is the security of regular revenue streams, which are raised in advance. Users benefit from this model because the costs are known in advance.

The utility model is also known as the pay as you go model. Customers only have to pay for the actual usage, which can be based on time, data volume, or any other measurement suitable for the offer. The advantage for the customers is that they only pay for actual usage. The disadvantage for the companies is that they need a mechanism to deal with small payments and that is only suitable if the access is more important than the possession.

The royalty model can be applied on successfully developed products. The revenues are based results because the price is a fixed percentage of the turnover or revenue of the user's product. The advantage of this model is that royalties can be paid after the success of the user's product, which leaves enough room to experiment. If the user's product becomes a success there is a regular revenue stream from royalties. The main disadvantage is that the company has no certainty that any income will be generated at all (for example if the user's product is not selling well).

The free model is often employed by public sector organisations fulfilling a public mission as service providers for citizens. There are no direct revenues, but indirect financial benefits may be created in the long term if value added products are created by earlier access or usage of a free public good, thus creating additional tax revenue at a later time.

The list from Table 1 is not an exhaustive list of all possible revenue models, as many variations and hybrid forms can be employed. The real life success of a revenue model depends on the custom business model, but the models introduced above represent the most common examples.

2.3 Work on business models for digital curation

The business model canvas is only one of various business model concepts. In 2003 the KB (National Library of the Netherlands) used a business model framework called component business model (CBM) in cooperation with IBM (van Diessen, Sierman, and Lee 2008) to develop a long-term preservation solution for digital publications. A CBM map is used to identify necessary or redundant services. It can be used to analyse the strategy of the organisation, its capabilities, and investments. Each of the components of the CBM map consists of people, processes and technologies (though the inclusion of technology has been criticised as is not a critical element for business models (Poulin 2010)). The business model canvas does not require technology as a mandatory element of its building blocks, and its ease of use allows a swift design process and multiple iterations to refine business model ideas.

The STOF-framework (Bouwman et al. 2008) is another alternative business modelling framework. It has been used in an adapted variant in a case study for the Dutch audio-visual archives. This framework, which was used for analysing purposes (Ongena, Huizer, and van de Wijngaert 2012), comprises of a

service, a technological, an organisational, and a financial component. The findings of the study revealed that the development of services in this context is mainly driven from a technical rather than a user perspective. Some issues of the organisational component are due to the non-profit nature of the cultural organisations, where fostering business modelling for developing new services is not a prime focus. The potential for creating new revenues is realised in monetising the customers' willingness to pay for the usage. The audio-visual material is mainly seen as cultural asset, and its economic value is potentially underestimated. The difference between the STOF-framework and the BMC approach is that the former is focusing on ICT-enabled services and it attempts to identify the necessary technical infrastructure, whereas the business model canvas is also suitable for businesses without technical infrastructure requirements (for example consulting services). As a result of the technical nature the STOF-framework, it also focuses on tooling, whilst the business model canvas approach is focused on strategic management and marketing (Bouwman et al. 2012).

Business models related with the creation and accessibility of digital Canadian cultural content have been assessed for the Department of Canadian Heritage (Wall 2002). One of the findings of that report states that public institutions rely to a large degree on public funding and alternative business models need to be developed. Although problems such as missing alternative funding sources for public organisations are identified and suggestions for alternative funding sources are described, the study does not offer advice on how to integrate these sources into a business model. The 4C project has gathered study results and project findings to provide guidelines for just such a purpose. In this deliverable possible revenue models are described and readers are provided with documentation and guidelines on how to create a new (or to adapt an existing) business model to mitigate the problems encountered when establishing alternative revenue sources.

Presto4U[1] aimed to identify useful results of digital audio-visual preservation and to raise awareness to improve adaption of these results (Meacham et al. 2013). The analysis of potential reuse of saleable intellectual properties (IP) presents three possibilities for monetisation. The first is to sell it to a third party. This includes code, if it was a piece of software, documentation and all rights of usage. The advantage of receiving a lump sum up front without certainty of commercial success is that the buying third party also takes over the risks involved with the purchase. The disadvantage of losing all rights is that it affects potential further developments and extensions, which also have potential to create future revenues out of the IP. The second option is to license the IP to a third party. Advantages are the option to further develop it and that the commercial success of the license can create additional revenues over time. The disadvantage is that revenue tracking can create costs and the requirement to support and maintain the software. The third option is to exploit the IP internally, which could be done by a spin-out or by an internal group. The disadvantage of this approach is that of losing the rights to the IP if the spin-out is sold to a third party. Presto4U describes in their report some licensing schemes in more detail, as well as potential routes from research to market. It provides general directions on how to commercially exploit IP by characterizing the actors (researcher, commercialising entity, and the user) and possible barriers for a potential product to enter the market. The work of Presto4U provides a good insight into the digital audio-visual preservation domain. In this 4C report we provide guidelines which allow a more holistic business modelling for digital curation taking into account more strategic aspects of business models.

[1] https://www.prestocentre.org/4u

It is important for a business to know where they are positioned within a value chain. As part of the process of planning, setting up, and running a digital repository a value chain demonstrates where the value of digital repositories lies (Swan 2008). The value of the digital assets is developed at various states of its lifecycle. The value curve showing the development of value of scientific publications during a research communication allows us to derive the value chain for digital repositories from the scholarly communication process (Roosendaal and Geurts 1997). Derived from the typology of business models for a web-based business domain, five operational categories of business models (Swan 2008) for digital repositories have been defined. These are:

1. Institutional-owned
2. Public bodies sponsored for the public good
3. Community basis
4. Subscription basis
5. Commercial basis, which also includes subtypes such as an advertising model

A business model matrix is applied to these categories to identify and model potential business model components for digital repositories. The matrix comprises general long-term prospects (viability, sustainability, and adaptability) on the horizontal axis and activity areas (business case, business scope and development, and business management) on the vertical axis. The elements of this matrix address essential questions covering issues such as stakeholder needs, expected costs, and adaptability of the business model. This approach provides valuable support for creating an initial business model. However, there is no focus on the relations between the components and how they affect each other, which is an important benefit of the visual approach of the business model canvas. Changing components would need a careful analysis of the complete model to check for its viability. Adaptations can be applied more easily with the canvas approach.

Going into detail with possible operating models for institutional repositories the Japanese example of developing regional and consortial repositories (Ueda, Ozaki, and Ozono 2013) explains the benefits of a shared solution. Host institutions are operating the necessary hardware for participating institutions and are responsible for system management. In this setting A “concentrated type” is the situation where a host institution conducts the ingest and digitisation of participating institutions. The “diversified type” is the operating mode where the host institution only provides system management and support. The advantage with this type is that the participating institutions also gain digital curation knowledge and improve awareness. Shared repositories foster the development of institutional repositories among small and medium sized institution that do not have the necessary resources to build their own solutions. In 2012, the National Institute of Informatics (NII)[2] established the JAIRO Cloud (Japanese Institutional Repositories Online Cloud)[3] as an additional shared repository solution for institutions. This shared repository operating model has not only allowed Higher Education institutions to develop institutional repositories but also smaller research and local public bodies and other academic associations. These promising results of consortial repositories in Japan describe the development from early project initiatives accompanied by necessary legislative initiatives to support the building of a national network of repositories. It is focused on institutional repositories whereas this 4C report attempts to address a wider audience with digital curation requirements.

[2] https://www.nii.ac.jp/en/

[3] https://community.repo.nii.ac.jp

In 2009 the DPimpact[4] study provided insights into the market for digital preservation services and aimed to understand the benefits of digital preservation and its potential economic value (DPimpact 2009). The findings of the study characterised the market from a financial perspective as underdeveloped. The traditional funding schemes are fragile and there is a lack of diversification in funding models. There are only a few institutions that introduced user fees as a revenue stream, and most of them are commercial organisations. The report also concludes that the management culture within not-for-profit organisations, which is described as "non aggressive", also constrains possibilities for pioneers, especially in memory and scientific research institutions. This hinders successful competition for public funding. Awareness about digital preservation is very low outside the industry. Fragmentation of effort is another problem of the market that leads to individual initiatives and isolated collaborations. The scarcity of skilled staff is another weakness that needs to be addressed. An important additional weakness identified is located on the supply side of the market. It is not well structured and need more efficient solutions. As a consequence of these findings the authors of the report suggest fostering the demand, increased standardisation, building up the supply side, support of research of technical development and measure to reinforce alignment of policies. The latter also comprises the establishment of common policy agendas between EU Member States and the convergence of efforts with other EU policy and research areas. The valuable findings of the DPimpact study provide an insight into the market. This 4C deliverable provides guidelines for organisations to position themselves, as individual or as collaborating entities, within this market and to create an economic sustainable business model. Examples of business models can be found in Section 4 and the guidelines about new business model opportunities are described in Section 5.

[4] http://cordis.europa.eu/fp7/ict/telearn-digicult/dpimpact-final-report.pdf

3 Impact of 4C project findings on the design of business models for digital curation

We believe that the findings of other tasks performed during the 4C project should influence the design of business models for digital curation. In this section we describe how the results of different 4C work packages and tasks builds upon and integrates results of other groups.

The 4C project aims to improve the understanding of digital curation at many different levels. Business models for developing markets such as digital curation address potential consumers, suppliers and solution providers is a key factor in achieving this.

Organisations which want to be a part of the market need to understand the market and can use the business model canvas for strategic planning. The starting point for understanding the market is a clear grasp of which actors are participating within the market. The initial web consultation conducted in WP2 identified and created a list of relevant stakeholder groups.

From this initial listing it is next necessary for the management of the identified organisations to formulate (specify) core elements such as the value proposition, which are provided by the key activities of the business model. In this context the value propositions and the key activities are likely to consist of curation services. The role of curation services, its providers and consumers is explained in deliverable D3.2 as part of the *Nested Curation Models.* In addition, the detailed costs of providers of curation services are addressed by the *Curation Cost Exchange (*CCEX)[5], which allows a structural mapping of costs created by curation activities. This cost information is inserted into the cost structure of the business model canvas.

In many cases, especially during early planning phases of a curation service, only a certain granularity of information about the actual costs can be provided. For this purpose several cost models were evaluated which allow budgeting and planning of curation activities. These estimations can also be fed into the cost structure of the business model canvas. The 4C Digital Curation Sustainability Model (DCSM) (described in deliverable *D4.2—Assessment of Community Validation of the Economic Sustainability Reference Model*) allows the identification of further value propositions. A rule-based approach to apply risk management is introduced in D4.4 using a risk registry and a generic business model canvas pre-filled with elements likely to be relevant for curation businesses.

This report addresses some of the needs that were identified during the 4C project in deliverables such as *D3.1—Evaluation of Cost Models & Needs & Gap Analysis* which identifies the needs of stakeholders and assessment of gaps in existing cost models. For example, the lack of support and missing communication of digital curation activities within the organisation were identified as one such. The use of business model canvas helps sharing the business model underlying digital curation with different stakeholders and supports strategic planning. Furthermore, it helps outline the benefits and quality aspects of curation work.

[5] http://www.curationexchange.org

3.1 Stakeholder groups

The Engagement work package WP2 (*D2.1—Baseline Study of Initiatives*) identified a condensed list of stakeholder groups as follows:

1. **Commerce**—digital preservation vendors, publishers and content producers, small and medium enterprises, cost model experts
2. **Culture**—memory institutions and content holders
3. **Education**—universities
4. **Science**—research funders, big data science
5. **Government**—government agencies

The stakeholder categories are the result of the web consultation conducted by WP2 to assess the current state of practice in curation cost modelling and to identify gaps of the existing cost models. The business model canvas examples used in this report (presented in Section 4) are grouped in similar categories as stakeholders as WP2 identified that the business models within each group share similar requirements. The services for education share similar needs with science for their research data and culture business services for their publications and have been grouped together. These two types of services of the education domain are represented by the examples of the national research data repository for science and the digital archive for culture domain in in Section 4. The government stakeholders were not addressed in this report as we focused on business services for curation whereas the government stakeholder groups represent the group of potential funding agencies and customers, influencers of, but not directly connected to business services.

3.2 Evaluation of cost models, needs and gap analysis

The 4C project deliverable *D3.1—Evaluation of Cost Models & Needs & Gap Analysis* evaluated the current (at the time of writing) cost models of digital curation. A range of shortcomings were identified. Providing a business model canvas outlining the business model allows us to address these shortcomings. The cost models examined show a *lack of benefit modules* as the focus solely on the costs of curation. The business model canvas addresses benefits for potential customers by describing them as value propositions. The evaluation also identified that cost models currently show *a lack of support for specifying the quality of repositories*. For example almost no cost models include methods or recommendations for certifications. We will present use cases in Section 4 where business models address this gap directly or as part of their value propositions, key activities or key resources.

The evaluation of the cost model functionality identifies a lack of support for certain user groups of account managers and department directors. The business model canvas is a visual tool for strategic planning and therefore does not require in detailed knowledge of all cost items, but insightful estimates for expenses. This improves the usability beyond the domain of cost model specialists and allows a high-level view of the digital curation services and solutions.

A key finding of the evaluation of current cost models within D3.1 was that it is often difficult to map costs and curation activities within an organisation. The business model canvas approach faces the similar challenge of mapping costs to the necessary *key resources* or *key activities* that are required to provide certain services or solutions. As a tool used in strategic planning the focus lies on the scale and types of the *costs* and potential *revenue streams.* For a more detailed view of the costs, D3.1 evaluated the different cost models and calculations based on various parameters such as number of assets, volume sizes, type of assets etc.

3.3 Indirect economic determinants

Over and above the stakeholder needs identified and reported by the work of WP2 and WP3, the project deliverable *D4.1—A prioritised assessment of the indirect economic determinants of digital curation* discusses indirect economic determinates (IEDs) that support the description of value propositions of business models. The assessment of the list of indirect determinants includes a set of properties for each determinant such as "definition", "cost context", "potential benefits" or "related concepts". They represent high-level concepts, and the assessment lists potential benefits for each of them. These benefits can be fed into the value propositions of the business model canvas. The list of indirect determinants is shown in Table 2. They describe motivations for and benefits of applying a specific business model for digital curation and can be found in currently used business models (as shown in Section 4). They can further be used to create potential business models. The aim of Task 4.1 was "to arrive to a list of IEDs that are understandable across a wide variety of domains and becomes an initial checklist of high-level concepts against which economic planning of curation can take place"[6]. The indirect determinates are selected and discussed for the presented business models in Section 4 of this documents.

Rank	Determinant
1	Risk
2	Trustworthiness
3	Benefits
4	Sustainability
5	Efficiency
6	Value
7	Transparency
8	Reputation
9	Confidentiality
10	Interoperability
11	Flexibility
12	Sensitivity

Table 2—Ranked determinants from D4.1 resulting from stakeholder consultation[6]

3.4 Curation Costs Exchange

The project deliverable *D2.8—Curation Costs Exchange* (CCEx) is an online platform to share real world cost figures of digital curation. The platform can be used to compare one's own curation costs with the cost information of other organisations. This data is a useful source for estimating and planning the costs of new services. The platform also presents selected contributions of the 4C projects and discusses the relationships between them.

3.5 Cost Concept Model and Gateway Specification

The deliverable *D3.2—Cost Concept Model and Gateway Specification* introduced a framework to support implementations of cost concept models. It is a useful guideline to improve the understanding of various concepts such as cost models, benefit models and business models. The concept of business models is part of the Nested Model for Digital Curation (see Figure 3), which is a visualisation of different concepts.

[6] 4C project deliverable "D4.1—A prioritised assessment of the indirect economic determinants of digital curation"

It details their relationships and interactions, and helps to understand also the relationships between the elements of a business model canvas. The main concepts of the diagram are organised in a supply and demand side for digital curation services that are described by a Business Model including a Cost Model and a Cost & Benefit Model. The business model canvas outlines the business model of the Nested Model for Digital Curation. Figure 1 in Section 2.1 shows that the business model provides curation services including a value proposition for the demand side. The costs are part of the business model and are calculated using a cost model. The cost model uses the concepts of resources and activities to derive the costs. As shown in Figure 1, a raw service consists of activities and resources to execute these activities. Both aspects are described in business model canvas. The model further contains key elements of a business model canvas such as Customers, (Key) Partners, (Key) Activities, (Key) Resources, Customer Relationships, Channels, Cost Structure and Revenue Streams that needs to be considered by the provider. A curation service delivered to customers needs to specify additional information about the quality and costs of the raw curation service offered, which is shown in the diagram as service level agreement. The curation service consumer represents the demand side, which is operating in a certain organisational context to mitigate threats from uncertainties and to maximise opportunities.

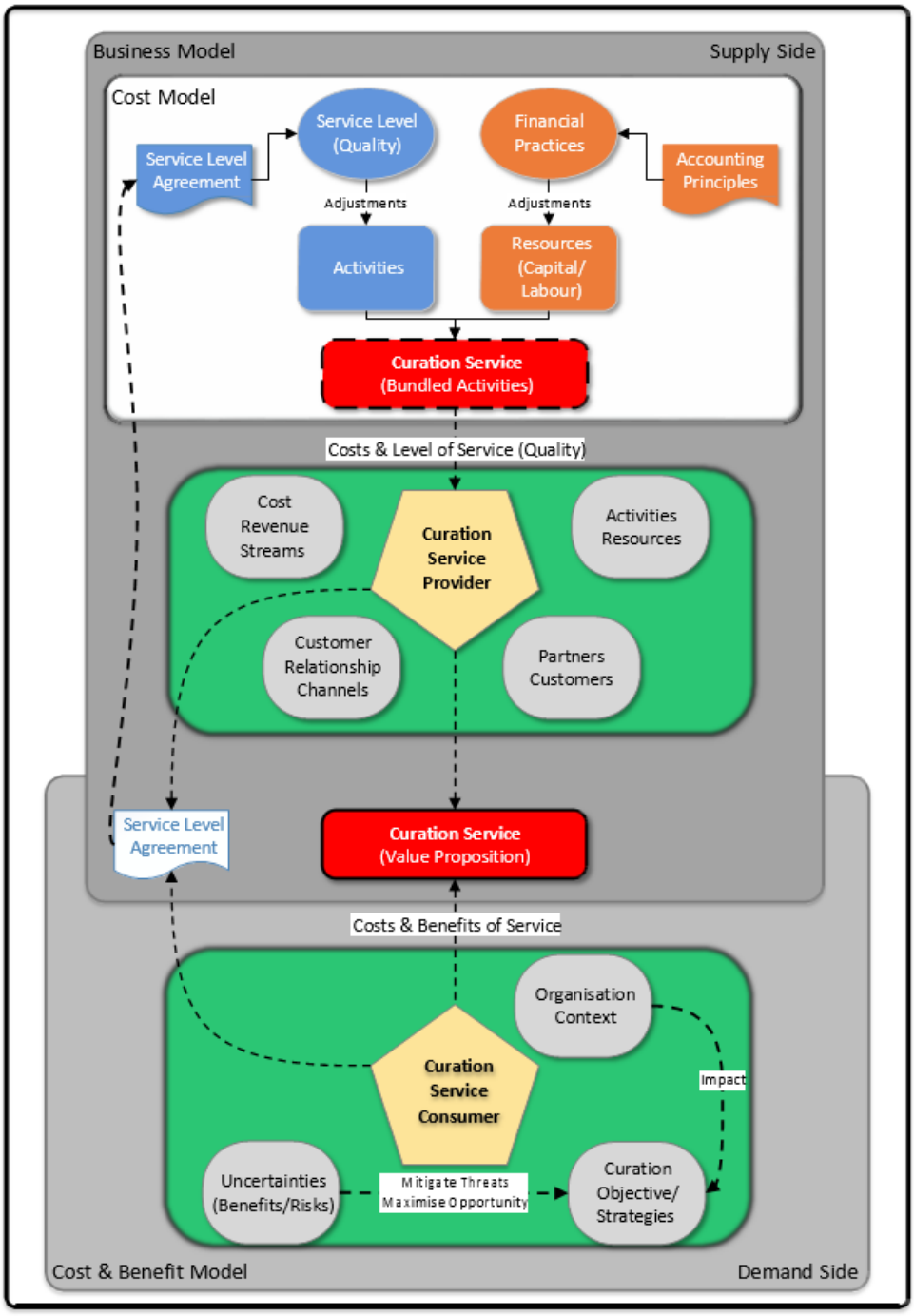

Figure 3—Nested Curation Models[7]

3.5.1 Collaboration for digital curation services

Business services can be operated by a single service provider, but also can be implemented as a collaborative effort between multiple service providers. Here we describe the different types of collaboration (for example with external service provider). We use the concepts in the *Nested Curation Models* (as shown in Figure 3) to describe the different types of associations that the consumer and the provider can engage in, and around which business models for curation can be developed.

[7] 4C project deliverable "D3.2 Cost Concept Model and Gateway Specification"

The effects of changing existing business services by using external partners or joining a collaboration with other organisation is described in Section 5.3.

Organisation using external service provider

Figure 4 shows the model for a bundled curation service (CS). The dotted line marks the boarder of the organisation, indicating that the service is supplied by utilising an internal and an external service provider (SP). In addition, as well as meeting the needs of an internal service consumer (SC) part of the organisation's service is offered to an external service consumer[8]. The figure shows that the business service consist of three curation services that can be used as individual service or as a bundled service. Consumers may demand the complete service or just specific services of it.

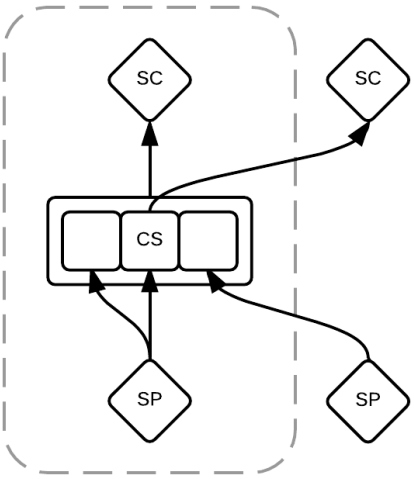

Figure 4—Organisation providing curation service by using an internal and external service provider

Collaborative service between organisations

Organisations may also collaborate in various ways to utilise a service. Figure 5 illustrates how two independent organisations can cooperate to provide a common service, and thus benefit from synergy effects.

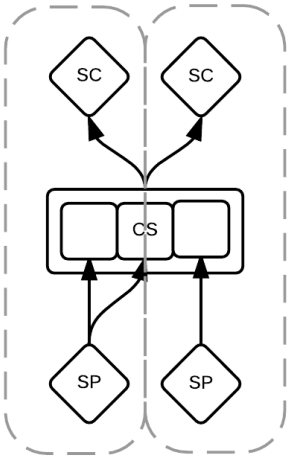

Figure 5—Two independent organisations associating to provide a shared service.

Figure 6 indicates more generally how two or more consumers may form various partnerships, and likewise, how two or more providers may commit to delivering the service through various types of

[8] The notation used in Figure 4 to visualise the collaboration of service provider, organisational boundaries and service consumer is used throughout this report.

agreements, including framework agreements[9]. Finally it shows the possible relationships may also include cases where the consumer and the provider are organisationally associated.

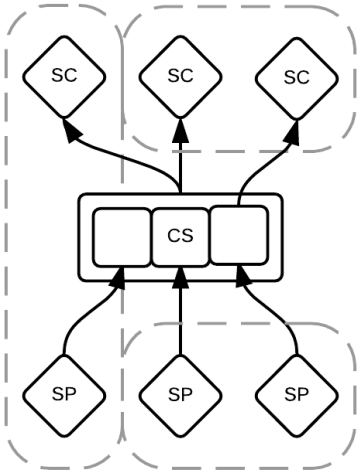

Figure 6—Business associations across consumers and/or across provider

3.6 Curation Sustainability Model

The 4C Digital Curation Sustainability Model (DCSM) (described in deliverable *D4.2—Assessment of Community Validation of the Economic Sustainability Reference Model*) supports the identification of new value propositions for use in a potential business model canvas. The model builds on the work of the Blue Ribbon Task Force for Sustainable Digital Preservation and Access[10]. It is a strategic tool for planning and discussion and thus provides ancillary material to help its intended users at managerial and executive level to understand the challenges of economically sustainable digital curation.

3.7 Risk analysis

Business model canvases are also used in the deliverable *D4.4—Report on Risk, Benefit, Impact and Value* where it is used as a tool to apply a risk analysis based on a generic business model canvas. A risk registry for digital curation is derived from the work. The deliverable also presents case studies where the application of risk management using the generic business model canvas is shown on real repository examples.

3.8 4C Roadmap

The 4C roadmap (available on the 4C website[11]) provides messages for different stakeholders involved in digital curation to think about more sustainable ways to manage digital assets. These messages are reflected many in aspects that are discussed in this report for business models and business opportunities. Key findings of this report that are challenging or missing for the supply as well as from the demand side for comprehensive curation service market are discussed in roadmap. For example, the identification of the value of digital assets is a key driver for the demand side and helps to communicate the curation

[9] The Directive 2004/18/EC defines a framework agreement as "an agreement between one or more contracting authorities and one or more economic operators, the purpose of which is to establish the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, the quantity envisaged."

[10] http://brtf.sdsc.edu/biblio/BRTF_Final_Report.pdf

[11] http://4cproject.eu/roadmap

requirements to the provider. Other key statements such as more efficient curation systems are discussed in this report for strategic planning of curation services. Collaboration or external service providers can increase the efficiency of services as well as improve market positioning by offering new functionalities or better scalability. The messages of the roadmap help to identify and formulate value proposition for services. They further help to improve existing services and identify potential business opportunities by offering sustainable, transparent, efficient and scalable curation services for the market.

4 Overview of business models in digital curation

A number of business domains with existing business models relating to digital curation are examined here. The examples are grouped into three domains that have similar needs: science, culture and commerce. For each domain, representative examples of curation services have been provided in the appendices. The examples selected represent common services of the domain and were used to identify key aspects and characteristics of services for each domain. This has allowed us to better understand the currently available curation services and their focus. Furthermore, their analysis facilitates the extension and refinement of existing business services, and helps to identify potential new services that are currently not available on the market.

The understanding of the demand side is a crucial factor for every business. The business models show the focus of the services and illustrate what aspects are seen as valuable by specific customer segments. The business model canvas describes the communication channels and relationships used to reach those markets. The revenue streams describe accepted sources of payment for the identified services.

The business models also show the provider side of the services. They outline key partnerships that are needed to deliver the services. In addition, key activates and the required resources are described.

4.1 Science

The research community is facing the challenge of finding sustainable solutions to preserve research results and the underlying research data. The challenges of providing a scientific e-infrastructure are manifold. It is widely accepted that access to deposited datasets should be available to a broad audience and preferable on an Open Access basis. The digital repository proposes to maximise the accessibility and the availability, to enable the discoverability and the reusability of scientific research data. Furthermore, it should enable long-term storage and curation and other potential benefits of these digital assets (Swan 2008). Universities and other research organisations often build partnerships for creating an e-infrastructure for scientific research data that allows collaborations across organisational borders. In a collaborative implementation of a digital repository for research data, additional issues such as interoperability and trust need to be dealt with. The security issues of the repository comprises multiple aspects such as security (as in data integrity), prevention of data poisoning, or security with regards to restricting access to confidential data.

The synthesis outlined here was derived from two business models in the science domain:

- The Data Archiving and Networked Services in the Netherlands
- The National Laboratory of Civil Engineering in Portugal.

The detailed information can be found in Appendix A.1 Science.

4.1.1 Key aspects and characteristics of science related business models

The business model canvas in Figure 7 describes the research related business model that combines the key characteristics of the examples that were described in Section 4.1 above. The canvas shows the most important key elements of the business model. It should be used as an initial template when developing a new business model and needs to be adapted and expanded in succession depending on the situation. The guidelines for the development of a new business model canvas can be found in Section 5.

<table>
<tr>
<td>KEY PARTNERS
Project partner

Vendors

Data repositories</td>
<td>KEY ACTIVITIES
Long-term preservation

Infrastructure service coordination (policies, contracts, service level agreements)

KEY RESOURCES
Skill

Staff

Technical infrastructure</td>
<td>VALUE PROPOSITIONS
Reusability of research data

Discoverability

Public mission

Trust and reputation</td>
<td>CUSTOMER RELATIONSHIPS
Support

Training

CHANNELS
Research project

Internet</td>
<td>CUSTOMER SEGMENTS
Research data depositor

Research data user</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Staff

Technical infrastructure</td>
<td colspan="2">REVENUE STREAMS
Public funding

Storage/access fees</td>
</tr>
</table>

Figure 7—Business model canvas of a research data repository

This business model canvas, depicted in Figure 7**,** models a prototype research data organisation. There are basically two customer segments, the customer of the research data repository who want to deposit their research data and the ones who want to access and use deposited research data.

There are common value propositions such as the increase of discoverability, the reusability of research data, and the public mission. In order to be able to reuse data it needs to be discoverable and different issues such as data management, support for data producers, data archiving and documentation need to be addressed. Reusability produces new opportunities for innovation and for new data users. It also reduces the costs research effort through the reduction of duplication. A further common value proposition is that of the public mission as a research data repository serves the public in several ways. One of the ways is by providing sustainable access to the research data for potential future innovations. Research results often originate from publicly funded projects and by enabling future generations to access to these results, additional value is generated. The reused research data is a valuable source for educational and training material and thus another way of fulfilling the public mission of the organisation.

Revenue streams consist of public funding which ensures that the expenses for operating and maintaining the repositories are covered. Additional fees for data depositors or for data users could be allocated for further development of repository functionalities.

The customer segments of research related business models can be (generically) described as depositors and users of research data. Primarily these are likely to be researchers and students of higher education institutions (HEI). Obviously, these groups can be data depositors as well as data users. Researchers can improve their research methods by validating research results and analysing research findings. In order to access and use research data they can discover and access it through the research data repository.

The customer relationship between the repository and its users is motivated by the fact that the data that is going to be deposited needs to comply with clearly defined quality levels with regards to technical, legal and descriptive (metadata) requirements. The repository also offers support for users who want to gain access to deposited digital assets. It can offer different ways of support, for example individual face-to-

face contact, support via telephone, online training material and manuals and workshops and courses promoting sustainable data archiving and reuse of data.

A research data repository can provide an online web interface to enable simple access for its customer segments. Another channel to reach the customers is through cooperation within research projects where project participants agree on depositing the results in the repository. This action is predicated by creation of a suitable data management plan.

The key activities consist of the long-term preservation activities and the coordination of infrastructure services such as policies, contracts, service level agreements.

The key resources are comprised of special skills of archivists and librarians, technical personnel, researchers. Furthermore, the repository provides the necessary technical infrastructure to offer its services.

Repositories can collaborate within research projects and therefore universities and other research organisations are often key partners. Additional key partners are third party vendors who provide commercial solutions for the keys activities, for example, outsourced curation activities like digitisation. They can also provide support for the key resources, for example, consulting services for certification of digital repositories or outsourced technical infrastructure such as storage. A third group of key partners are the other research data repositories, which can share parts of the infrastructure and which can exchange knowledge and provide access to a wider selection of digital assets.

The most significant elements of the cost structure are costs for personnel and for the technical infrastructure.

The revenue stream is generally mainly through public funding and can be extended with usage fees, such as depositing fees in relation to the volume of curated research data or fees for accessing deposited data. As part of the public mission most repositories are keen to enable access for a large user community and would not like to restrict the access by introducing fees for accessing and using the deposited research data.

4.2 Culture

The synthesis outlined here was derived from three business models in the culture domain:

- The Digital Archive of the National Library of Estonia
- The Danish Royal Library Digitisation of Danish books on demand service
- The Portuguese Web Archive.

The detailed information can be found in Appendix A.2 Culture.

4.2.1 Key aspects and characteristics of the culture domain

There are a number of key aspects of business models for the culture domain. Some value propositions are commonly shared among organisations of different branches. These characteristics are used to create a prototype business model canvas (Figure 8) which is encompasses of all the relevant characteristics.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Partners of the same domain

Vendors

Data repositories</td>
<td>KEY ACTIVITIES
Digital long-term curation

Domain specific curation</td>
<td rowspan="2">VALUE PROPOSITIONS
Public mission

Accessibility

Long-term storage and curation

Trust and reputation

Education

Research</td>
<td>CUSTOMER RELATIONSHIPS
Support

Training</td>
<td rowspan="2">CUSTOMER SEGMENTS
Public

Researchers

Students</td>
</tr>
<tr>
<td>KEY RESOURCES
Digital curation skills

Domain specific skills

Staff

Technical infrastructure</td>
<td>CHANNELS
Internet</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Staff

Technical infrastructure</td>
<td colspan="2">REVENUE STREAMS
Public funding

User fees</td>
</tr>
</table>

Figure 8—Business model canvas for cultural organisations

The customer segment of organisations consists of the public who can access the physical facilities such as reading rooms. Usually access to these facilities is not subject to restrictions and access is often free and aims to reach out to as many users as possible. Another customer segment is academic researchers who use curated assets as part of their ongoing research. This segment of users may need different access to curated assets because their research could require a higher quality or a different format of the digital objects. Students or any other scholarly users may need additional tools to interact with the digital assets for educational purposes.

The first value proposition that also applies to all cultural institutions is public mission. Most of the intuitions are obliged to ensure access to the curated assets, often for free or for only a small fee. Access to the digital assets needs to be easy and available to a broad audience. As part of the public mission to preserve the cultural digital assets, the institution's value proposition is also the long-term storage and curation of these assets. Research and education benefit from trust and a good reputation as additional

value propositions because they rely on the quality of the digital assets for studies and educational reuse. As described before, students and other scholarly users may access the repository's content via a web portal, which provides further tools for this customer segment to interact and work with these objects.

The customer relationship between the organisation and the public is characterised by providing support in various forms. Support by providing documentation and help on a web portal may be sufficient for an average user. This can be enhanced with a helpdesk to answer questions. Students are also supported. They may receive some level of training if they have an access to a system with more possibilities for interaction than the public access system. A similar customer relationship is established with researchers, but this group of users may also need personal support to conduct their research.

The key activities are long-term curation and domain specific curation activities. It is possible that the former will not be in-house as smaller organisations may need to operate on a tight budget which doesn't allow them to hire staff for digital curation activities.

The required key resources are personnel with digital curation and domain specific skills, as well as the technical infrastructure such as storage and book scanners. The technical infrastructure can be outsourced if smaller organisations are not able to afford it. In addition, digital curation skills can be acquired through third party consulting or by partnerships with organisations which can provide support or training.

Key partners can be organisations of the same domain, which has the advantage that their requirements and business models are similar. This facilitates collaborations and knowledge transfer. It also allows sharing of key resources between these organisations to increase efficiency. Other third party vendors who provide technical solutions can also be partners if the budgets of the organisations allow outsourcing. A third group of key partners are data centres. These organisations have the necessary technical and organisational resources to offer support for implementing an independent solution. Alternatively data centres can offer shared usage of computational and storage capacities that would allow smaller organisations to implement a cost efficient solution.

The cost structure mainly consists of the costs for staff and for the technical infrastructure. The revenues are based on federal funding and can also be extended by user fees.

4.3 Commerce

Two business services are used as source material in this section:

- KEEP SOLUTIONS consulting services
- The RODA repositories

The detailed information can be found in Appendix A.3 Commerce.

4.3.1 Key aspects and characteristics of commerce

The business models of vendors of the digital curation market have only a few commonalities, as the potential offers for this market are diverse and can cover any activity in the long and potentially complex curation process. Key activities and key resources of the organisations within the digital curation domain can be outsourced and provide an initial key activity for companies who want to create a business model. Therefore, it is not feasible to sketch out a common business model canvas for commercial business models without becoming too generic in the descriptions of essential building blocks such as key activities, key resources, or customer segments.

Vendors who want to participate in the market for digital curation and who want to promote their offers to potential customers need a business model, which has specific value propositions. Their solutions need to underline the trustworthiness of the vendor. One possible way to achieve higher trust is to show that their offers—whether they are software, hardware, or consulting products—is to comply with established standards such as ISO 16363 or with other best practises.

Furthermore, trust can be strengthened by having widely acknowledge expertise in the field of digital preservation and by having strong relations with the community in form of key partnerships. If a vendor uses open source software as basis for their own customised software, the trustworthiness of the vendor is increased by an active collaboration with the community who develops the open source product. Being actively involved in the research of standards and best practices for the digital curation is another proof of a strong connection to the community. These activities can be seen as elements of the building blocks for channels or customer relationship to potential customer segments.

The economic sustainability of the vendor also contributes to his trustworthiness. A smaller vendor who has not established a certain reputation will not be trusted for offering long-term storage solutions if they do not provide additional guarantees for the sustainability of his solutions. The size of the company can decrease concerns about the trustworthiness and security.

Evidence based reputation is related to the trustworthiness of the business model because as it can be seen as a proof of previous successful implementations of the solutions the vendors offer. Past successful projects imply that future projects will also be successful. This is not a domain specific relation but it can still facilitate an initial sketch out for a business model canvas.

5 New business model opportunities

In this section we provide guidelines for developing new and adapting existing business models for the digital curation market. We discuss potential changes of existing business services—changes that can lead to adaptation to new requirements and business opportunities. We provide templates that help to identify effects of potential changes using the business model canvas methodology, such as new key partners or new customer segments. The examples and templates selected represent prominent candidates that are likely to have high potential in the market of digital curation. Besides changing or adapting services, we also show a short guide about the creation of a business model canvas for new services. This work empowers strategic planning for digital curation services by identifying relationships between different aspects of business services using business model canvas.

Section 5.1 introduces an approach to provide a structured overview about digital curation services. The overview should help to align business services with other existing services and identify potential collaboration and bundles of services. Section 5.2 provides guidelines for developing a new business services. Selected examples for new business services and discussion about the creation process are also given in Section 5.2. Adaptations and adjustments of existing business models are discussed in Section 5.3. Patterns are defined that helps to identify impacts on changes. Examples for changes of existing business models are presented in Section 5.4.

5.1 Digital curation solutions

The market for business solutions for digital curation is hard to estimate as solutions are very diverse and have a lot of overlap with other market segments. Anecdotally there appears to be an increased number and diversity of participants and solutions in the digital curation market. In order to gain a true picture an overview of the current state of digital curation solutions is needed. However, consolidated overview of service market is still missing. In this section we present an idea of how to structure curation services that helps to facilitate the development of new services or extension of those already in existence.

Figure 9 provides an approach for a simplified view of curation services. The structure is inspired by the work of Ruusalepp and Dobreva (Ruusalepp and Dobreva 2012). There are three main branches, namely tools and services, end-to-end solutions, and consulting. This is a simplification of the landscape of solutions. It is possible that solution vendors or other organisations are offering bundled hybrid forms within the curation market, such as tools and consulting services as, for example, ‘Ingest Workflows’. The complete system is seen as a bundle of the tools and services. The overview is not all encompassing, but should help to structure and design new business models. The subsections that follow discuss in details the main elements of Figure 9.

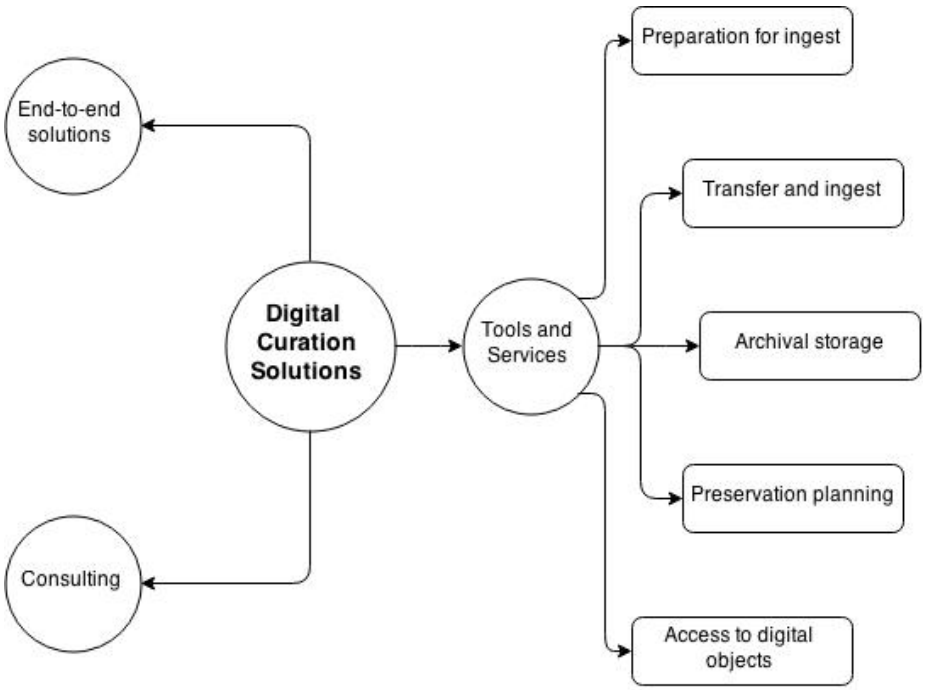

Figure 9—Digital curation solutions

5.1.1 Tools and services

The arrangement of tools and services is taken from the report mentioned above (Ruusalepp and Dobreva 2012), in which they have been overlaid on the digital preservation lifecycle elements based on the OAIS reference model and the Producer Archive interface specifications (PAIMAS) [12]. Ruusalepp and Dobreva list example services for each category within the report. The detailed structure for tools and services is shown in Figure 9.

Preparation for ingest

The first category "Preparation for ingest" deals with issues of standardisation of the pre-ingest phase such as standardisation of the communication between the information producer and the archive. The generation and transformation of metadata is also part of the pre-ingest phase. This phase covers tools and services that conduct quality checks of file formats, characterisation for identifying file formats, format conformity checks, or the extraction of technical properties.

Further examples could be; format migration tools for transforming digital objects; tools for storage media copying and transformation; tools for analysis and generation of metadata, validity checking, and capturing of web content. Besides metadata the tools needed for appraisal (automated or semi-automated) are also included in this category.

Transfer and ingest

The category "Transfer and ingest" includes tools that deal with aspects such as file formats (that have an impact on the technical steps during ingest), authenticity, integrity and provenance data, metadata (the completeness thereof and enhancement), and various transformations of the digital object necessary to allow the exchange of object between the producer and the digital archive. There are different definitions

[12] Producer-Archive Interface Methodology Abstract Standard (PAIMAS), 2004, http://public.ccsds.org/publications/archive/651x0m1.pdf

of ingest related processes, and Ruusalepp and Dobreva state that ingest workflows can be implemented in a different way, the choice of tools depending on the particular institute setting. An example of a tool characterizing and extracting metadata is the micro service in Archivematica[13] which identifies and validates formats, extracts object metadata and adds output to the PREMIS files. Another example is that of the Merritt Characterization Services[14] (University of California) micro service which provides automated examination of digital objects to determine the significant properties and addressing identification, validation, feature extraction, and assessment.

Archival storage

These tools are the core of the preservation system and the functional entity is responsible for sustaining the bit-stream and keeping them available for future access. They have to support large scale archives and provide high speed access to the preserved digital objects. Important features/functions include: the allocation and binding of unique persistent identifiers to the objects; guaranteeing the authenticity and integrity; providing reliable transport; and recovery from failure (Linden et al. 2005). Grid and cloud storage are emerging technologies in the preservation market and it is to be expected that archival storage will become more distributed (Ruusalepp and Dobreva 2012).

Preservation planning

There are not many services dealing with preservation planning which in this context includes technology watch monitoring of file formats stored within the digital archive, and checking for their obsolescence. If the latter event occurs, a digital preservation task should be initiated. Preservation planning also monitors errors in the storage media and activates preservation steps to recover data. Services in this category are often a collection of specialist tools for characterisation, quality analysis and workflow management. The PLATO[15] tool is one example.

Access

Tools in this category allow to access digital objects of the archive and deal with aspects of user-friendliness, flexibility and combining objects in repositories with other content (Ruusalepp and Dobreva 2012). These tools have to satisfy the needs of users of the archive, and are used for extraction and transformation of stored digital data.

5.1.2 End-to-end solutions

In addition to special tools and services addressing one of the phases, the market also provides end-to-end solutions that address all relevant phases of the lifecycle of digital objects. Users or customers of these solutions only need to purchase one bundled product. These tools and services can also incorporate different specialised tools within their complete solution. Preservica[16] provides as an example of just such an offering, providing a suite of workflows compliant with the OAIS reference model. It is also available as a cloud-based version addressing smaller establishments and can be customised for different organisational requirements. Other providers include for example ExLibris[17] and IBM.

[13] https://www.archivematica.org

[14] https://merritt.cdlib.org

[15] http://www.ifs.tuwien.ac.at/dp/plato

[16] http://preservica.com

[17] http://www.exlibrisgroup.com

5.1.3 Consulting

Consulting for digital curation comprises of services where organisations offer their expertise and specialised knowledge for consulting issues. Customers can make use of third-party expert knowledge and do not need to recruit trained personnel. Various consulting companies are available within the digital curation market.

5.2 Guidelines for developing new business models

As previously stated, the business model canvas is a visual template to support the creation of business models which is easy to use, especially by mixed ability/experience groups. The visual approach allows different stakeholders to communicate their ideas and requirements even if they may not share the same point of view and expertise. The creators of the business model canvas suggest using a whiteboard or a big piece of paper and sticky notes to sketch out the ideas. Each element can be described by using a sticky note and adding it to a building block of the canvas. During the process, elements can easily be added, removed, or moved to other parts of the canvas. This tends to be a free-flowing, brainstorming style processes. There is no particular order in which the building blocks of the business model canvas should be described (Fritscher and Pigneur 2010).

The 'Ideation Process' (Osterwalder, Pigneur, and Clark 2010) is a method that can be used create a business model canvas from scratch. It is a five-step process designed to come up with 'the big idea' and begins with the mobilisation of the right team (see Figure 10).

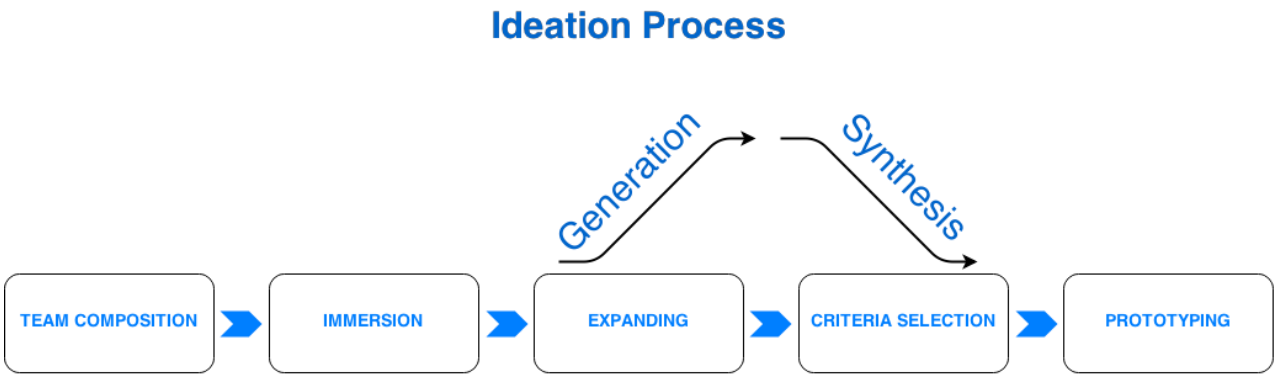

Figure 10—Ideation process based on (Osterwalder, Pigneur, and Clark 2010)

The team should be diverse consisting of members with different seniority and from different business units who have different levels and areas of expertise. For a digital curation business model a team could be comprised of an archivist, a metadata specialist, a staff member of the IT department, a lawyer, a management member, and a potential data producer. The variety of views represented by these different stakeholders facilitates the later brainstorming steps.

The aim of the research (the immersion step) is to gather enough specific knowledge allowing understanding the market domain and its actors. This includes general information about the digital assets, its users and their behaviour, analysis of new technologies and assessment of existing business models. This is an essential preparation step before drafting and describing the initial canvas prototypes. Questions regarding technical, financial, organisational and legal issues need to be addressed and understood, such as:

- Are there existing and well accepted standards for specific digital file formats or metadata standards that should be implemented?
- Are there existing policies in place for handling digital assets?

- Who are the potential users of the data and how do they access the digital assets?
- Which departments are involved in the business model?
- What resources are available and what are required?

In the next phase possible expansions of the building blocks of the business model canvas are discussed. This part of the process does not follow a specific order and expansions can originate in any or all of the building blocks. If an organisation can increase its resources by adding, for example, certification to its key activities, transformations will begin there. If a university has high storage or computation capacities that are not fully utilised an expansion coul originate from its infrastructure and its key resources. By adding a new offer, the expansion and transformation begins by adding elements to the value proposition. For example a library can offer a new web-based access for schools and universities, thus their transformation start with a new value proposition and could affect the customer segments. At this stage the aim is to generate as many new ideas as possible in a brainstorming fashion. The examples of business models for curation presented in Section 4 help to identify services that are currently available on the market and identify what value proposition they offer for their customers. A structured overview of curation solutions is provided in Section 5.1, helping to align and bundle services. The related work presented in Section 2.3 discusses the curation market and curation solution for specific market segments. These resources help to gather ideas for new services and to create unique value propositions for one's own activities.

During the criteria selection stage the team tries to prioritize the generated ideas. The aim is to synthesise the most promising ideas by specifying their most important criteria. The criteria can be in the context of the digital curation market, but it can also be domain independent such as implementation time, revenue potential, customer resistance, and competitive advantage. In the context of the digital curation market a possible criteria would be that any new business model has to make use of an existing software or hardware infrastructure (such as an in-house preservation solution). Other criteria could be budgetary constraints that only allow a predefined financial range for new resources.

After applying the prioritizing criteria, the number of remaining business ideas are reduced significantly, to three to five potential business models. At this phase these business models are sketched out by using the business model canvas. The basic elements have been described before in Section 2.1 and an overview of the business model canvas can be seen in Figure 1. Examples of the prototyping step are presented in this section.

5.3 Guidelines for changing and adjusting existing business models

This section presents guidelines on the BMC design process and shows in what way changes can be introduced into existing business models. A structured overview of changes helps to refine and extend existing business models by, for example, providing new services, using services of new partners, or targeting new customers. Changes can occur in relation to the infrastructure used (partners and activities) and costs, or in relation to customer segments—including the relationship to each customer segment and the necessary channels to reach them. Concrete examples of these changes are shown in Section 5.4, where the impacts in connection with other elements are explained in more detail.

Section 2.1 outlines the relationships of the key BMC elements and how changes could effect other building blocks. Here we discuss how these relationships may be manipulated in a digital preservation context to affect the overall business model. It is important to mention that these guidelines are a simplification of the development of business models, which it is an iterative and continuous development and highly depending on the organisational and economic context of the real business model. Nevertheless, they illustrate the consequences of changes in one building block and explain the

relationship between the different blocks. Examples are given for new or modified business models outlining for example new market or new customers segments.

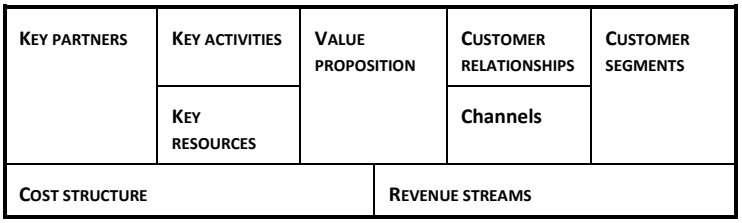

Figure 11—Blank business model canvas

Figure 11 shows an empty business model canvas with the nine building blocks:

- Key partners (KP)
- Key activities (KA)
- Key resources (KR)
- Value proposition (VP)
- Customer relationships (CR)
- Channels (CH)
- Customer segments (CS)
- Cost structure (C$)
- Revenue streams (R$)

The canvas consists of elements related to costs and the infrastructure of the business model (on the left side of the canvas, see Figure 12) and a part that is focused on the customer related blocks (on the right side of the canvas, see Figure 13). The value proposition in the middle of the canvas can influence the costs as well as the customers. For the proposed changes in this section the affected building blocks are highlighted in the business model canvas to show the relations within the canvas.

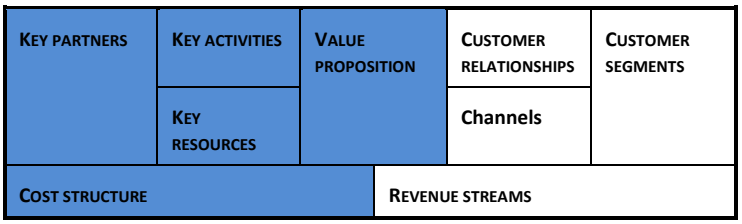

Figure 12—Cost related building blocks of the canvas

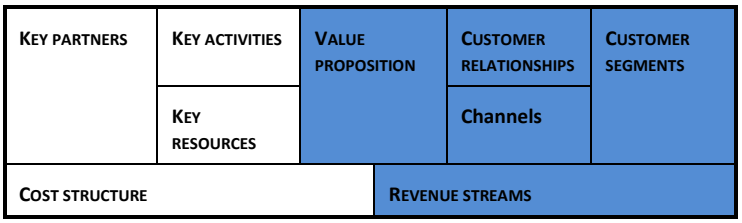

Figure 13—Customer related building blocks of the canvas

In the next examples, opportunities to discover new business models by changing elements of the business model canvas are described, in particular those that could have the greatest impact. Changes can typically be reducing or increasing resources, removing or adding new elements.

The process of business model generation is not a one-stop development and needs constant adaptations to changing business environments such as key trends (technology, regulatory, societal and cultural, socioeconomic), industry forces (suppliers, stakeholders, competitors, new entrants, substitute products and services), market forces (market segments, needs and demands, market issues, switching costs,

revenue attractiveness), and macro-economic forces (global market conditions, capital markets, commodities and other resources, economic infrastructure) (Osterwalder, Pigneur, and Clark 2010).

Here we are manipulating the following building blocks:

- Cost and infrastructure changes:
  - Key partners
  - Key activities/key resources
  - Cost structure
- Customer segment related changes:
  - Customer segments - keeping same key actives/resources
  - Customer segments - including change of key resources

5.3.1 Cost and infrastructure changes

Potential business models can be derived by changing the cost and infrastructure side. By changing the cost related elements, key activities and key resources will be affected, which inn turn allows for additional value propositions.

Primary changed building blocks are highlighted in dark blue and secondary changes are highlighted in light blue.

5.3.1.1 Changing key partners

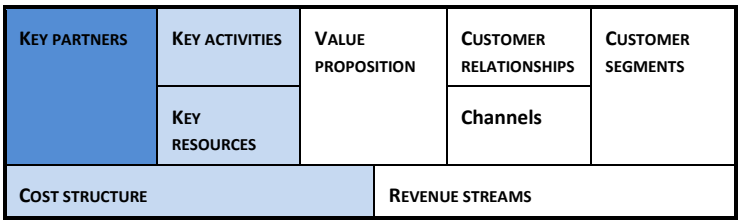

Figure 14—Changing key partners in a business model canvas, without effects on the value proposition

There are two different scenarios for changes of a key partner. In the first scenario changes effect only the costs and the infrastructure (left side of the canvas as shown in Figure 14). The second scenario effects the value proposition and customer related building blocks (shown in Figure 15).

Changing or adding key partners affects the cost structure within the business model canvas (see Figure 14). For example, activities that have previously been undertaken in-house can be outsourced to external partners. This frees internal resources (such as staff or technical infrastructure) and changes the cost structure (payment of service provider) (he different kind of collaboration with partners for a business services are outlined in Section 3.5.1). Key partners include external and internal services providers.

As mentioned above, an example for a change of a key partner is the use of an external partner that provides the same services with the same quality attributes that was before operated in-house, e.g. using cloud storage or collaboration with another organisation using their service. Other changes might be the use of services from other organisational units within the same organisation. The key aspect of these changes is that the service provided remains unchanged. Therefore, the effects are limited to the left side of the business model canvas without changing the value proposition. Key activities remain the same, but might be operated by another key partner. A change in key resources and a decision to use external services result in freeing internal resources. Alternatively, outsourcing of services can reduce the required skills within the organisation, which in turn reduce the expenses of staff. The change of key partner can

have effects on the cost structure—for example service contracts, collaboration agreements. By definition, these changes have no effect for the customers of the business services—the service provided remains unchanged.

The second scenario shows that a change of key partner can have effects on the value proposition (Figure 15). In this case a new key partner provides a service with a different functionality or quality attributes that have an effect on the business service offered by the organisation. The use of a new external service might influence the key activities as it delivers better or faster outcomes. Example for such a change would be the use of cloud storage that increases scalability and availability of the services, or improved services for quality assurance that results in more accurate outcomes. A change in the quality or functionality of key activities caused by a change of key partners has an effect on the value proposition of the business. It should result in new or improved value propositions that strengthen the market position of the organisation. An improvement of the value proposition can attract new customer segments.

A change of a key partner can also have a negative effect on the business, for example lowering the quality of an activity or reducing the throughput. The effects on building blocks of the business model canvas are the same as shown in Figure 15. The value proposition might be degraded and customers may use alternative providers for the services. Changing a key partner that provides a lower quality of the activities should at least have a positive effect on the cost segment.

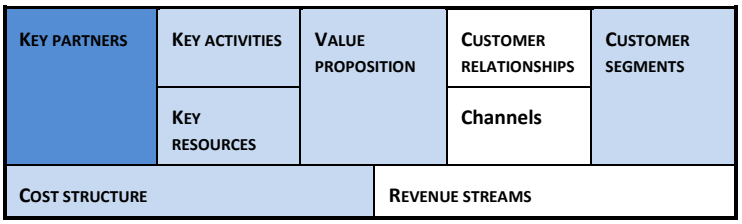

Figure 15—Changing key partners with effects on the value propositions

There could be many different motivations for changing service providers, such as reducing costs or improving quality.

Examples of changing key partners include:

- Ending use of external services (In-housing services)
- Adding new service provider (Outsourcing of services)
- Change of service provider
- Implementing collaborative services

5.3.1.2 Changing key activities/key resources

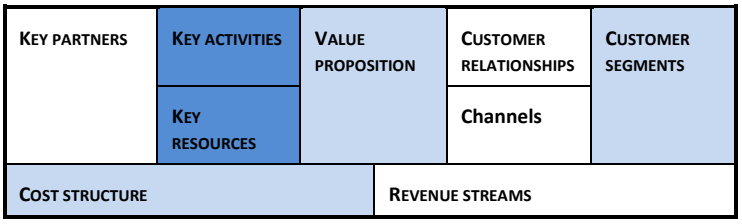

Figure 16—Changing key activities/resources in a business model canvas

Changes in the key activities have direct impact on the required key resources and vice versa (see Figure 16). An improvement of key activities by increasing efficiency and effectiveness—for example by improving internal workflows, increasing maturity of curation processes, or using of new tools—can lead to a reduction of required key resources. Reducing key resources such as the number of employees or their working hours also has a positive impact on the cost structure. On the other hand, a reduction of

resources can have a negative effect on the key activities, for example delays or a reduction of quality. Adding new key activities (such as support for new formats) to the business services may require additional resources to implement (for example knowledge and tools).

A change of key activities effects the value proposition of the business services. A positive change of the value proposition can attract new customer segments. For example, by providing new or better service quality, one could attract new segments that are willing to pay extra for higher service levels.

Examples of changing key activities and key resources are:

- Making tools/workflows more efficient (such as increase automation of workflows, use of better tools)
- Acquisition of new skills and tools (for example to support for new formats)
- Hiring of personnel that make workflows/tools more effective/efficient

5.3.1.3 Changing the cost structure

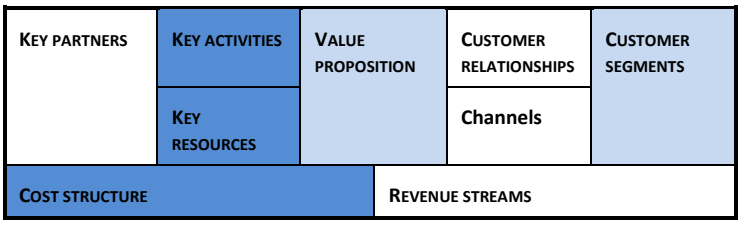

Figure 17—Changing cost structure and its consequences

Smaller changes in the cost structure usually have no effect on the other parts of the business model canvas. However, significant changes can affect the key activities and the use of key resources (see Figure 17). If costs are changed significantly it may also have impact on the value propositions. Budget cuts can be seen as an example. A possible mitigation strategy for lowering expenses is a change of key activities (for example lower quality of services using fewer resources or reducing the quality of key activities). As discussed in Section 5.3.1.2, changes of key actives can have effects on the value propositions and possible also on the customer segments.

Examples of changing the cost structure:

- Budget cuts
- Reduction of infrastructure costs (for example by increasing maintenance cycles)
- Reduction in salaries (for example a hiring freeze)
- Increased cost structures caused by increased of overhead costs, and so on

5.3.2 Customer segment related changes

There are two types of changes of a business services for addressing new customer segments. The service is offered to new customers without changing the service (described in Section 5.3.2.1) for example by advertising the service to new markets. Alternatively, new customers may have other or new requirements that require adaptation of the service and its value proposition. T hese changes of the services are discussed in Section 5.3.2.2.

5.3.2.1 Changing customer segments without changes of key activities and resources

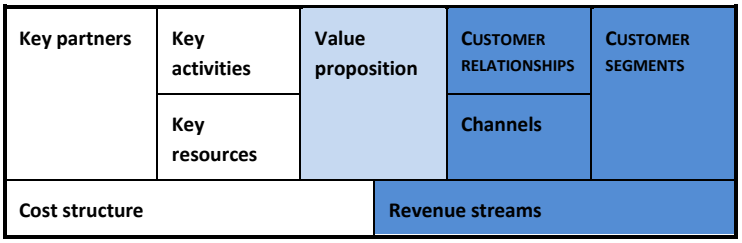

Figure 18—Changing customer segments without effects on costs and infrastructure

In this case the same service is offered to a new customer segment without changing the elements of the cost and infrastructure side of the business model canvas (see Figure 18). It applies if the new customer segment has the same requirements for the service as the original customers—customers in the same domain or market segment often share similar requirements. If the same service can be provided to a new market segment, only a modification of relationship and channels might be required (if is found that significant modifications are required then it is probably that a new customer segment is being addressed—seethe following section). Acquisition of new customers can improve the value proposition of a business service as reference.

For example, one can imagine that a public library invested in infrastructure (hardware, software and staff) for image digitisation. Unused capacity can be offered to partner institutions such as smaller libraries. This results in additional revenue streams. The currently unused resources are however limited, and can thus pose limitation in terms of scalability and available of the new business services. When all unused resources are spent, a change of key resource is required and that also causes a change in the cost segment.

New customer segments may need stronger customer relationships such as personal support extra or marketing activities to bind them. At the same time, the new customer segment may also require other channels to deliver the services, for example, different access times or frequencies.

Examples of changing customer segments and keeping the same key activities and key resources could be:

- Offering internal service to partner organisations, for example a large archive offering an existing curation service to smaller archives
- Services addressing additional, but already established, customer segments (for example archives addressing the public sector with services formerly only made available to universities)

5.3.2.2 Changing customer segments with changes of key activities and resources

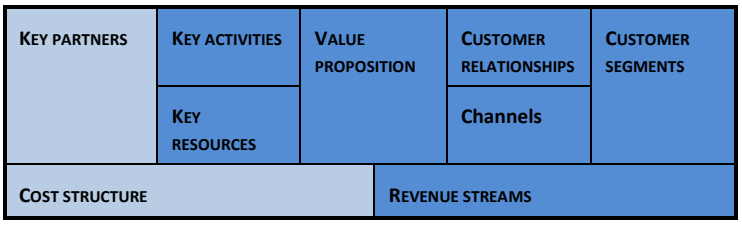

Figure 19—Changing customer segments including changes of key resources and value propositions

Offering existing services to new markets and customers can require adjusting the services for their individual needs. In contrast to the case described in Section 5.3.2.1 above this case requires a change of the key activities and key resources to serve new customers (see Figure 19).

Depending on the market, new or adapted value propositions are required. For example, additional functionality, higher quality of services, improved scalability, compliance or liabilities. These required changes need adaption of the key activities performed and also affect required key resources. If the required knowledge or functionality is not available in-house a new key partner might be required to fulfil the new customer's requirements. Figure 16 and Figure 17 also show key activities and resources as primary changes. In those cases factors such as improved workflows or significant changes in the cost structure are the sources of the changes and thus do not directly affect key partners. This example focuses on addressing customer segments which may require external resources or activities and hence do affect key partners.

A change of the customer segment also needs an adaption of the customer relationship and the customer channels in order to reach the new markets. Figure 19 shows that all segments of a business model canvas are affected in this case.

Examples of changing customer segments and adapting key activities and key resources could include:

- Opening up an internal service for the public. For example an archive offering a new curation service for storage and curation of private documents. The required changes for private users are extensive, additional care and support service, new channels to reach the market and new interfaces to offer the services, billing functionality for users.
- Services addressing additional but already established customer segments. For example archives for research data expanding the customer segment into the medical sector that might require other procedures and certificates for digital curation.

5.4 Examples for new business models

In this section two examples are given for building new business models. Both examples build on an existing organisation that offers new business service to the market. We have focused on business services of an existing organisation—which already have curation services for internal use—in order to demonstrate specific aspects of the process of offering a new business model for the market. Only the key aspects of creating a new business model for caution services are discussed here. Other aspects of a new business creation such as the finance and legal aspects of creating a company including are not covered in this document. They are discussed in many other works and strongly depend on the individual situation. The section is designed to help readers to understand what should be considered when offering services to the market and to stimulate discussion and further reflection around the subject of new services and business opportunities.

Two examples are given, the first example demonstrates the use of business model canvases as a planning tool for business services. It helps to structure the business service and to identify missing aspects. The second example shows how business model canvass help to outline an idea of a new business services.

5.4.1 Curation service for digital images

The following section describes a business model that is still in an early planning phase. The organisation has a digitisation service for 2D material for internal uses. The 'big idea' is to develop a business model for the digitisation services to offer the service to the external market. The unused capacities of the service will be used and earn additional income will be generated. The first iteration of the business model canvas is outlined Figure 20 presents the initial planning step.

<table>
<tr><td>KEY PARTNERS
System vendors (hardware, software)

Other units in organisation

DP community (review, advice)</td><td>KEY ACTIVITIES
Digitisation of 2D materials

Long-term preservation

Qualification of images (technical, descriptive and administrative metadata)

Customer care

KEY RESOURCES
Staff (Imaging specialists, metadata specialists, workflow specialists, curators, software developers)

Digitisation hardware</td><td>VALUE PROPOSITIONS
High quality digitisation

Fulfils requirement for digital preservation

Cost saving

Easy to use</td><td>CUSTOMER RELATIONSHIPS
Helpdesk

Meetings

CHANNELS
Personal contact</td><td>CUSTOMER SEGMENTS
Niche market

National memory institutions</td></tr>
<tr><td colspan="3">COST STRUCTURE
Staff

Digitisation hardware</td><td colspan="2">REVENUE STREAMS
Public funding for basic operational costs

User fees (usage or subscription based)</td></tr>
</table>

Figure 20—Initial business model canvas for digitisation

The key activity is the digitisation of 2D material. The required key resources staff with the required skills and expertise and the hardware are already available within the organisation. The costs of the digitisation services consist of the working staff and the hardware. Both factors are already costs to the business weather or not an addition business service is offered.

The infrastructure for the digitisation service is maintained and provided by external vendors who represent key partners. Other units within the organisation are planning to offer the business service. Part of the required staff is provided by other units. Also the administrative work is done by other units within the organisation.

As the organisation is involved in digital curation, the digitalisation service should fit the requirements for digital preservation activities. Hence, the digital preservation community acts as a key partner. The digitisation services follow recommendations and guidelines generated by the community. The left side of the business model canvas describes the current situation within the organisation including the activity, staff, resources and costs. The right side outlines the initial plan of the business model for digitalisation services.

For the business model, the customer segment is discussed and identified. The idea is to offer the high quality digitisation services for niche markets that have very high quality requirements. A potential market segment could be national memory institutions. The vague customer segment at this point hinders the detailed definition of other BMC segments—the customer relationships, channels, the value proposition and the revenue stream strongly depend on the customer and the market. For national memory institutions, the use of external digitalisation services can save some costs, as no similar in-house services need to be operated.

The draft of the value proposition includes the high quality of the digitalisation work, the consideration of preservation requirements and the cost saving (using it to provide an external services reduces the overall cost for in house use). One potential customer channels could be personal contacts that allow high degree of customer care and simplify the use of the service for a potential customer. Relationship and channels are still at an early stage. The existing revenue stream consists of the current funding they get for operating the curation services for internal use. New customers would generate additional income. The type of fee is currently under discussion.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
System vendors (hardware, software)

Other units in organisation

DP Community (review, advice)</td>
<td>KEY ACTIVITIES
Long-term preservation

Handling of 2D material

Upload of images (ingest)

Qualification of images (technical metadata)</td>
<td rowspan="2">VALUE PROPOSITIONS
Expertise in digitisation of 2D materials

Customizable

Cost saving

Easy to use

Trustworthiness</td>
<td>CUSTOMER RELATIONSHIPS
Contracts/Service Level Agreements

Personal contact</td>
<td rowspan="2">CUSTOMER SEGMENTS
Business e.g. service provider that act as broker for the mass market</td>
</tr>
<tr>
<td>KEY RESOURCES
Staff (Imaging specialists, Metadata specialists, Workflow specialists, Curators, Software developers)

Digitisation hardware</td>
<td>CHANNELS
Handling of 2D materials

Online access to digitised materials</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Staff

Digitisation hardware

Storage</td>
<td colspan="2">REVENUE STREAMS
Public funding for basic operational costs

Usage model</td>
</tr>
</table>

Figure 21—Business model canvas for digitisation—second iteration

In the second iteration, the business model canvas needs to be refined and adjusted to cope with the needs of the new customer segment. Based on the canvas shown in Figure 20, a refined potential business service for the commercial market is outlined with a new customer segment defined. Instead of aiming for a niche market a mass market is targeted. The large capacity of the available infrastructure and bigger market potential were the main reasons for this change. Instead of targeting individuals as customers the organisation wants to offer their services for commercial users that have significant needs for digitisation and/or those who can act as a broker for individuals. A key advantage of this scenario for our organisation is a limited number of customers that need to be taken care of. This reduces the required resources in terms of personal for customer relationships. Serving the mass market directly would require an extensive customer relationship management including helpdesk, marketing and billing. In addition, the digitisation service is constructed for large amounts of material that is automatically digitised. A few large volumes of material are more efficient to handle for the service that many small requests. Hence one proviso for a broker arrangement is that any broker wishing to handle small volume digitisation for it's own customers needs to be able to supply the many small requests bundled as a single large job. As our organisation offers no services for the mass market, a business to business (B2B) scenario was chosen for the digitisation service.

Figure 21 shows the resulting business model canvas. The customer segment contains businesses including companies with large quantities or commercial service provider that act as brokers for their customers. Due to the limited number of customers of our service, individual assistance and support can be provided. The details of the services are specified in individual contracts and SLAs. The service uses two channels, material for digitalisation is sent by post/courier and the resulting images can be accessed online. The service is charged based on a usage model. The value proposition of this use case is the expertise in digitalisation and the trustworthiness of the organisation. The customers save on costs by using the service on demand. The services and contracts are customizable and are designed for easy use.

The types of key resources, partner and costs are the same as the original canvas in Figure 20. Additional key activities are required for handling of 2D material from customers and customer care. For these activates additional capacity is required.

The canvas presented here shows the planning and refinement steps from an initial idea to a more concrete candidate for a business services. The canvas identified the key elements for the business services on a strategic level. As a next step, detailed planning of each segment of the canvas would be required. For example, the market situation has to be investigated to account for the market potential, competitors and marketing to the target segment.

5.4.2 Curation service for audio-visual content

This section presents an example of a new business model to bring curation services to the consumer market. Here we discuss the required basic resources, activities and partners that are needed to offer a curation service for audio-visual (AV) content. The business service targets the niche market of small film productions and professionals. We also discuss how to reach and target small markets.

A detailed study about the feasibility of an audio-visual cultural heritage archive for the Dutch market is discussed by Ongena, Huizer, and van de Wijngaert (Ongena, Huizer, and van de Wijngaert 2012). The study uses an STOF-model[18] (Bouwman et al. 2008) to outline the business service, but addresses the same aspects of a business model as a business model canvas. The case study identified some imbalance between different factors of the Bouwman model (service, technological, organisation and financial). One of their key findings ab out the lack of knowledge about (potential users) and their requirements regarding archiving also applies to the examples used in this report. Whilst the case study in Ongena, Huizer, and van de Wijngaert outlines a business model for a heritage archive for public use, the example presented here discusses a service for commercial users. Many aspects are common to both cases, such as technical development, copyrights and markets.

The ‘big idea’ of the business model presented here is the provision curation services for audio-visual content for the consumer market. The organisation we working with has expertise in managing media content for internal use, but wants to offer a portfolio of services for audio-visual content on the market. Figure 22 shows the business model canvas for the service. The portfolio includes services for secure storage, content streaming and curation of the content in terms of technological developments (such as new formats). Professional and small film productions holding audio-visual content that needs to be preserved for the future were identified as the target customer segment. The target market was deemed to be attractive market because it is of sufficient size in terms potential users and it has a low entrance barrier. Digital content represents business assets for the potential customers of the service. Larger film

[18] STOF—**S**ervice domain, **T**echnology domain, **O**rganisation domain and **F**inancial domain

production and companies operate own archives for their content, but smaller companies and professional users are more willing to outsource the storage and curation of their data.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
System vendors (hardware, software)

(External storage provider)

DP Community (review, advice)</td>
<td>KEY ACTIVITIES
Long-term preservation

Secure bit storage</td>
<td rowspan="2">VALUE PROPOSITIONS
Scalable cost efficient storage of audio-visual content

Curation for audio-visual content

Streaming services for selected material

Customisable interface

Trustworthy</td>
<td>CUSTOMER RELATIONSHIPS
Helpdesk

Service Level Agreements</td>
<td rowspan="2">CUSTOMER SEGMENTS
Professionals

Small film productions</td>
</tr>
<tr>
<td>KEY RESOURCES
Video specialists

Workflow specialists

Web service developers

Curation tools

High-speed internet access

High performance computer

Storage specialists

Storage</td>
<td>CHANNELS
Online access portal

Online transfer of digital material

Physical transport of storage media (tapes, hard disks etc)

Target marketing in specialist publications and on event

personal meeting and sales discussion</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Staff

Curation tools

Hardware

Storage</td>
<td colspan="2">REVENUE STREAMS
User fees (usage based)</td>
</tr>
</table>

Figure 22—Curation service for audio-visual content for professionals and small film companies

The selling proposition of the service for the users is that there are the savings to be made in term of money and resources by not operating their own archive and professional curation services for their material. Raw audio-visual content requires considerable amount of storage space (for example the movie Avatar required 1 petabyte of local storage to render the movie[19]. Smaller film production will require less storage, but the initial and operational costs for a storage system are still considerable cost factors. The offered services ensure secure bit storage of the material and only the used storage capacity has to be paid for (service-on-demand). The service customer can outsource the storage of older material that is not currently being used. In order to provide a secure storage as a service, a storage infrastructure needs to be built that includes off-site backup facilities. Detailed planning of the storage infrastructure is

[19] http://news.bbc.co.uk/2/hi/technology/8421091.stm

required, because the audio-visual material has significant requirements in terms of capacity, as well as access. The storage functionality of this services is a potential candidate for collaboration with a storage provider and can be outsourced to increase flexible in terms of scalability of the own service. An external storage provider could also be a good alternative for an off-site backup location. The storage service is represented in the business model canvas in Figure 22 as key activity, key resources (storage specialist and storage), costs, (optional key partners) and value proposition. Suitable channels for the storage service are online transfer of the material or physical transport for larger amount of data.

The storage functionality of the business services could be enhanced by additional curation and access services. The materials stored by the services provider will be accessible for the customers via internet. The service offers for selected material a streaming service that allows the customer to stream the selected material online without downloading the complete material beforehand. The film production companies can offer this service for their customers to access their material. The streaming services require a high-performance technical infrastructure for fast access on the data and high-speed internet connection for the transfer. The service is only available for selected material and is a service that is an additional cost charged to the customers. The interfaces of the streaming service can be customised for the individual requirements of the customers.

The third service in the portfolio is the curation service of audio-visual content. The services maintains the digital content over time, the focus of this service is to keep the stored content accessible and useable for the customers. Technological progress for audio-visual digital systems (and hence content) has been extremely rapid in the past few years. The resolution of camcorders has increased, new compression and container formats have been developed and new technologies such as 3D have been brought into service. The curation of old materials requires considerable effort in terms of working hours, knowledge and required software and hardware. A curation service allows the outsourcing of this activity for smaller companies and individuals that usually have limited resources available. The curation services ensures that the customers material is maintained in formats that can be accessed, modified and rendered with current available technology. The target customers have the need for this service in order to keep their business assets viable. The service provider needs a set of resources for the curation service including skilled staff with expert knowledge of curation, software tools for migrations and hardware to process the material. A challenge from the provider perspective is the huge number of video formats and technologies that have been developed in the last years. The service needs to support a sufficient number of existing formats, but also clearly communicate with the customers that not all formats can be curated.

Curation services are sensitive activities in that the provider assumes responsibility for the digital content. The provider needs to prove that the offered service is trustworthy. Trustworthiness can be communicated and establish at many different levels. For example, the service provider needs to prove that it has the required knowledge and expertise in the domain. To this end staff should preferably be active members of the AV community and be aware of new development and standards. Expertise can be established by publication of activities, contributions to standards and development of tools within the domain. Another aspect of trustworthiness for curation services is business stability and long term operation of the services. Customers will prefer service providers that operate on an economical stable basis and provide credible assurance that the service will continue to operate in the medium and long terms. Longstanding market presence and a broad product portfolio are generally considered to be indicators of economic stability for companies. Another measurement for trustworthiness is certifications. Finally for this example, the company has a significant market presence in another related domain. This too can also help to establish trust for a new service.

A challenge for any new business is reaching the target market segments. In this example the defined target market is rather broad so marketing and publication activates with relatively wide (but still sufficently targeted) audiences are promising candidates. One possible example could be advertisement in specialist publications and at appropriate events. Both should help to reach the targeted customers. With both of these channels first contact with customers is likely to be via the homepage. Personal meetings can then be arranged for consultation and sales discussions.

The business model presented here has particularly significant resource requirements both in terms of infrastructure and expertise. This factor limits the potential competitors on the market, in particular for the curation aspect of the service.

Setting the pricing for some aspects of the services is challenging as storage and streaming services are an established market with falling prices, but with a deficits in terms of archive quality trustworthiness. An obvious way forward for this aspect of the service is to establish collaborative relationships with external service providers for more cost efficient operation. The curation aspect of the service, on the other hand, is a relatively rare offering and a good selling point. The cost of providing the service (and hence the price that should be paid by the customer) strongly depends on the degree of automation—every additional human interaction can increase the operating costs significantly. The market success of the services strongly depends on convincing the customers that the offered service is trustworthy and will be available for many years into the future. In addition, the quality of the curation services and the customers perception and understanding of that quality are key drivers for pricing. In a nutshell, the customer needs to understand the effort involved in maintaining/curating the material.

5.5 Examples for changing and adapting existing business models

In Section 5.3 we discussed the way changes introduced to different parts of business model canvas can effect other parts. Here we present examples describing consequences of changing existing business models for digital curation.

5.5.1 Cost and resource related changes

The first example demonstrates changes in terms of resources and costs.

5.5.1.1 Change of key partner

This example describes a change of key partners for an archive that acts as a central service provider for a network of universities and other higher education institutions. The archive will add a new external service provider to outsource the storage of the archive. The examples of the change template are described in Section 5.4.

Figure 23 shows the business model canvas of the digital archive that provides curation services for a network of universities and other higher education institutions derived from the work of Ruusalepp, Justrell, and Florio (Ruusalepp, Justrell, and Florio 2014).

The building blocks that we're adapting are highlighted in dark blue and the blocks that are affected are highlighted in light blue. The items in yellow were changed either directly or indirectly as a consequence of the change of key partners.

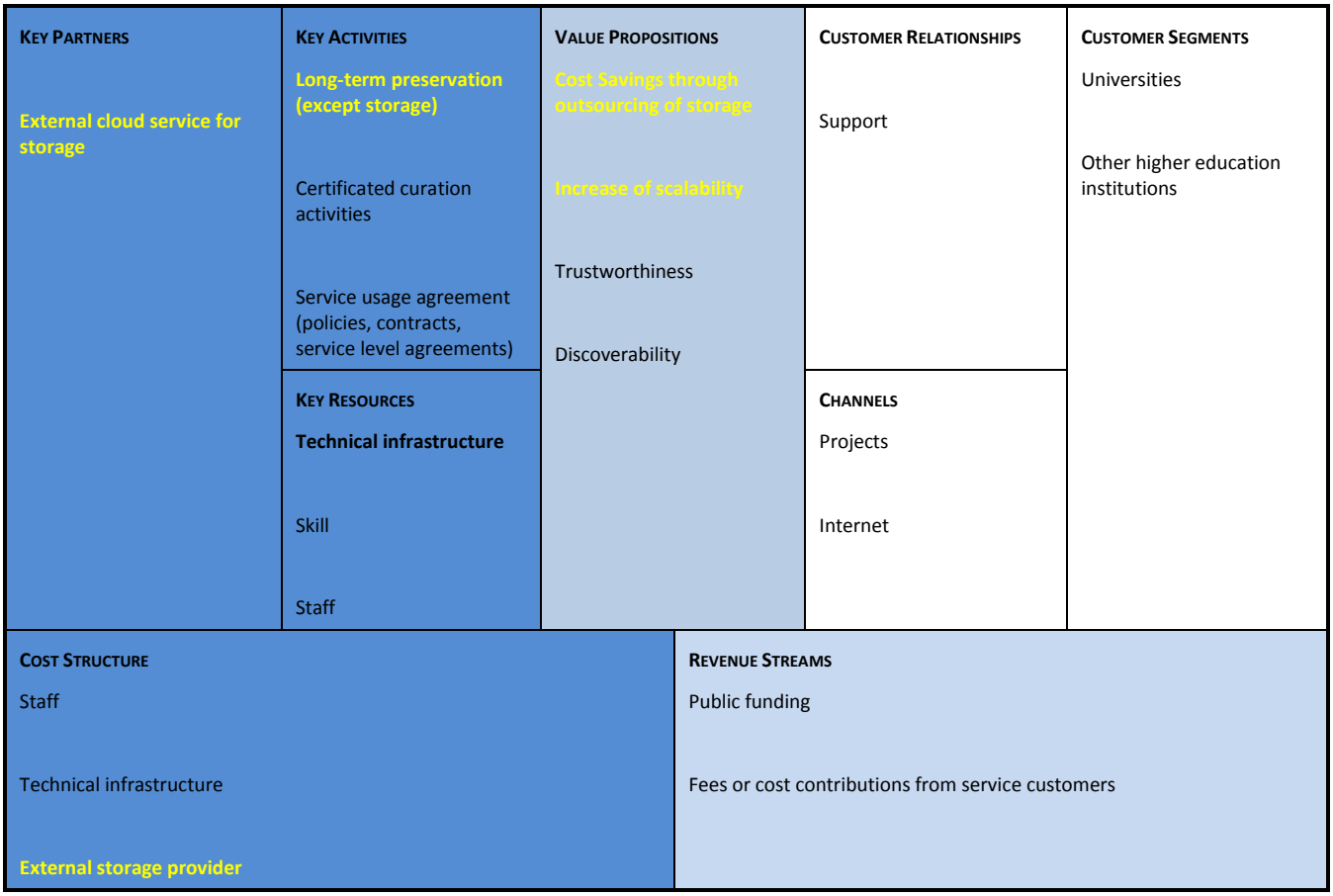

Figure 23—A centralised archive service using outsourced cloud/grid storage

The initial situation was that the archive operated all activities in-house. The increased demand in storage for the service triggered the outsourcing of the storage. The use of external services reduces the costs as it is cheaper than operating the storage in-house. It further improves the scalability of the services as additional storage capacities can be added on demand.

As Figure 23 shows, a new key partner was added to the business model canvas. The use of the external services reduces the key activities, the storage that need to be performed by the organisation and, as a result, fewer key resources are required to deliver the service to the customers. These savings were offset by the new service feed that need to be paid for the storage services.

The change in key partners affect the value proposition as the reduction in costs of operating the service provides cost savings for the customers. The scalability of the services was also improved by the use of external provider.

The changes have no effects on the customers as they can rely on the trustworthiness of the service provider as it complies with certificated curation standards. The archive offers long-term preservation activities in-house and outsources storage to an external cloud or grid service provider (see Figure 24). This allows scalability of the storage services and the outsourced services are part of the cost structure of the archive.

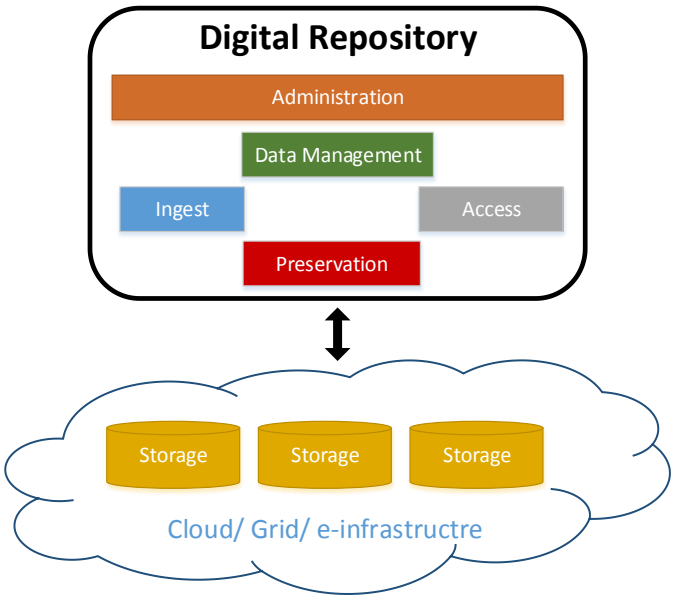

Figure 24—An archive service using outsourced storage

5.5.2 Customer segment related changes

The next examples of business model deal with changes of the customer segment.

5.5.2.1 Change of customer segment without changing key activities and resources

In this example we show the change of the customer segment for a research data repository without changing key activities and resources. The example follows the pattern described in Section 5.3.2.1. The initial business model canvas is shown in Figure 7 in Section 4.1.1. In the new business model the repository offers a commercial use of their research data for companies and other institutions. The commercial use of research data depends on data and the rights that the repository holds. The motivation for the change is the commercial exploitation of the data holdings. The repository provides access to data that is not publicly available or raw data that has not been published.

The changes in the business model canvas are shown in Figure 25. The customers segment is extended by commercial users that pay for use of the research data. A royalty fee or usage model can be used for generating an income from the customer. By using the royalty model the customers and the repository agree on fees for the commercial use, where the usage model the user pays for the actual usage of data. The royalty model is applied on successfully developed products. Commercial customers usually pay a fixed percentage of their revenues to the repository for using its service as part of a product or service for end-users. The usage model would lower the entrance barrier for new customers, but leaves no room for negation about the price. Both models provide an additional revenue stream in this business model canvas.

The commercial use of research data is an additional value proposition for the business service. The new commercial customers have access to a new source of information and do not invest resource to create the data by themselves. The curation activities performed by the repository ensure the quality of the data. The relationship between new customers and the repository is based on the trust and the reputation of the repository. In order to promote and exploit the new services new/modified internet channels are used. The access to the service is provided via a Webpage to search and access the research data. APIs are provided for direct access to larger amount of data.

Offering access to the research data for commercial use does not require changes of the key activities or additional resources. The left part of the business model canvas remains unchanged.

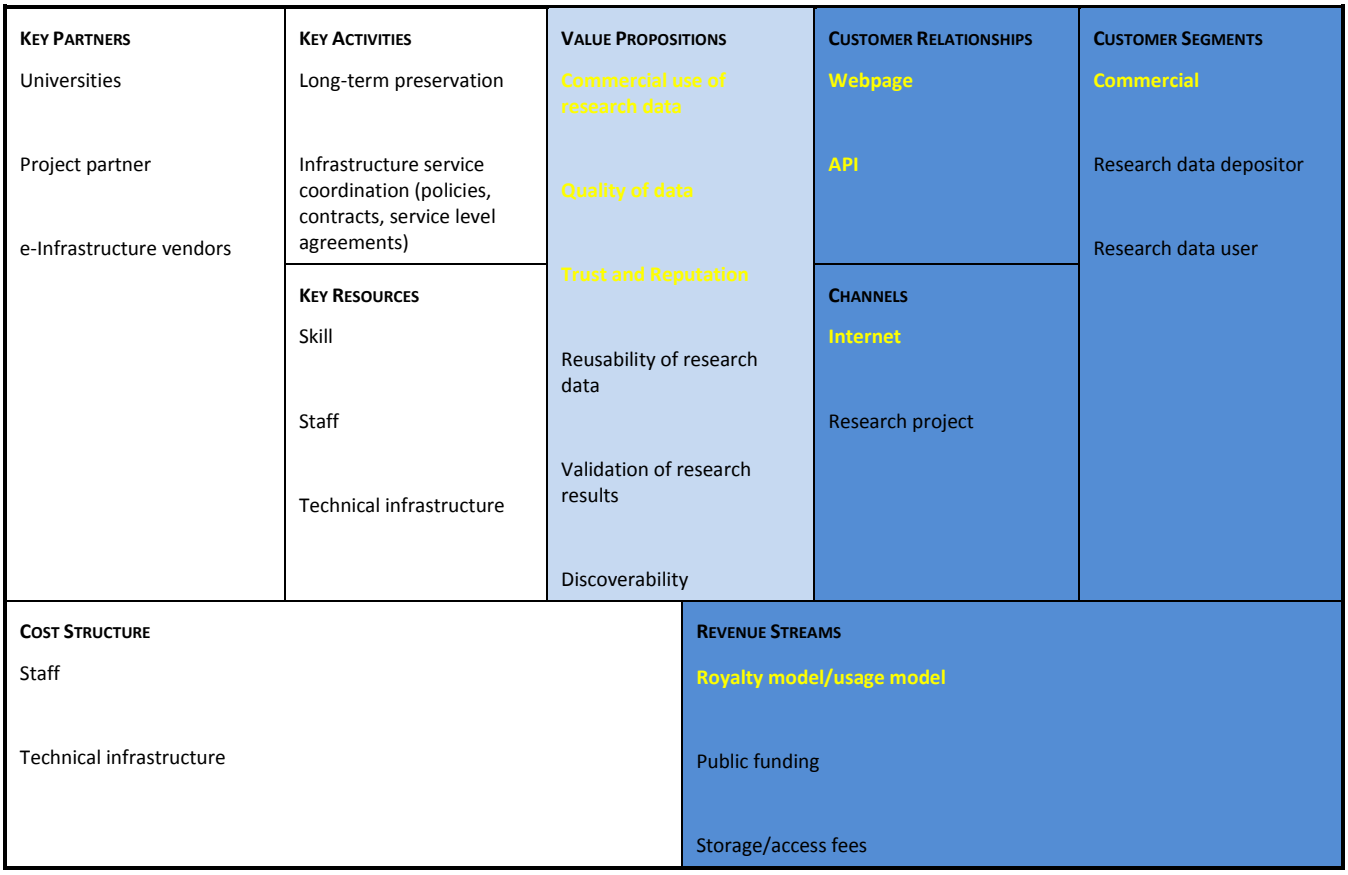

Figure 25—Business model canvas of a research data repository extended for commercial customers

5.5.2.2 Change of customer segment with changing key activities and resources

Delivering a service to new customers can require changes of key activities and resources as the new customers have different requirements for services or need additional services. This example shows a research data repository that extended their services for universities. The initial business model canvas of the repository is shown in Figure 7 in Section 4.1.1. The change of the customer segment follows the pattern described in 5.3.2.2.

The main motivation for the extension is to gain additional revenues by providing the available infrastructure and expertise to new customers. In this scenario universities are potential customers as they deal with large amounts of research data. Cost-efficient curation of the data without needing in-house expertise and services can be a good deal for the universities. The repository provides interface to their repository for uploading and accessing the university research data. Support for the services is provided by the staff of the repository. On top of this, the expert knowledge about managing research data is offered as a consulting service to the customers (universities) and complements the service offer. The research data repository is public funded, which established the required degree on trust in the long term availability of the curation services.

Figure 26 shows the business model canvas for the new customer segment. Universities are added as customer segment. The dominant communication channels are personal contacts between responsible persons of the universities and the archive. Assistance is provided by the repository to integrate the services into the existing infrastructure of the university. Interfaces are provided to allow members of the

university to access the research data. In addition, on-site consulting can be offered for the integration and management of research data.

Figure 26—Business model canvas for research data repositories providing infrastructure as a service

The value proposition of the business model canvas consists of efficiency and quality of the service and the trustworthiness of the organisation. A key motivation for the customers should be the cost saving by using the service from the repository. The service is offered as a scalable on-demand service. The customer has the advantage that only actual service usage is charged. This business case is intended for the medium and long term use. Therefore, the contracts are based on a subscription model combined with payment for usage. As the repository is publicly funded customers have a confidence and trust in the sustainability of the offered services.

Figure 26 shows that additional key activities are needed for the business, namely support and consulting services. The additional workload for the infrastructure and staff can require additional resources and increases the costs of the services. Additional storage and computation resources are needed to handle the data of the universities. The support and consulting service requires new staff resources. These changes are shown in key resources and cost structure of the business model canvases on the left side. The increase in resources can require additional key partners such as service providers for infrastructure.

6 Conclusion

This document discussed business models for digital curation by presenting examples of existing solutions on the market and providing guidelines and template for new services. To facilitate communication among different stakeholders of organisations, the visual representation and conceptualisation of the business model canvas was used to describe the business models within this report. It represents an easily usable template for the modelling process. The business modelling process is complex and requires a holistic view of the organisation within the digital curation market. Insights from various stakeholders and perspectives are synthesised in this report, outlining key aspects of successful business models.

This work builds upon previous results of the 4C project that contributed to an understanding of the process of business modelling for digital curation. The stakeholder group analysis, the cost model evaluation, the assessment of indirect economic determinants, the online platform Curation Cost Exchange, the Cost Concept Model, the digital curation sustainability model, and the risk analysis all provided essential pieces of information used in the creation of economic sustainable business models.

For this document business model canvases from various stakeholder groups were used as an initial input. The key aspects of these examples are used to derive business model canvases templates for each group that summarise their common characteristics. These templates can be used as starting point for organisations with similar requirements for the business modelling process. Moreover, a survey of related work of business models including use case examples and revenue models is presented in the report.

A brief overview and description of the digital curation market and its actors helps readers to understand the landscape of the market and some of the various solutions on offer. The steps to develop a new business model and the consequences of adapting an existing business model canvas are explained in order to provide useful guidelines for the business modelling process. The guidelines include different scenarios of changes within the canvas and their consequences for other affected building blocks of the business model canvas. The guidelines are accompanied by examples describing planning and customisation scenarios.

Different actors exist in the market for digital curation, and solution providers are looking for economic sustainable business models. Potential customers may not even be aware of their curation necessities and requirements. The main difficulty of formulating value propositions for organisations and their customers is shown by the challenge of the business modelling process. Converting intangible benefits into visible and understandable value propositions is a challenging task. Providing guidelines to help to derive customised solutions is a step in the right direction. For the future, standards and accepted best practises can help providers to shape the service portfolio on a curation service market.

On the consumer side, the requirements of potential customers need to be better understood. The benefits of curation need to be communicated to the potential customer in order to understand the consequences of neglecting their curation requirements. An outlook for different stakeholders for a more comprehensive future curation market is provided by the 4C Roadmap[20].

[20] http://4cproject.eu/roadmap

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Appendices—Example Business Models

A number of examples of existing business models in digital curation are presented here. As in the earlier sections, the examples are grouped into three domains: science, culture and commerce. For each domain representative examples of curation services have been provided.

These examples should help readers to get an understanding of the existing curation services and what aspects need to be considered for offering a curation services. They are useful sources for planning and refining one's own curation series on a strategic level, as they outline the demand and supply side of the services.

To start we have presented two business models from the science domain. Each business service is described by using a business model canvas model with a particular attention to the value proposition. The canvases are analysed with respect to their indirect economic determinants as described in deliverable *D4.1—A prioritised assessment of the indirect economic determinants of digital curation*. These are followed by a presentation of curation services in the area of cultural institutions. Finally the services of commercial providers are discussed. These case studies were used to identify the common key aspects of the services for each domain which were described in Section 4.

A.1 Science

In this Section two business models in the science domain are presented. The Data Archiving and Networked Services in the Netherlands operates a national research data repository that provides access to researchers. The other example describes the archive for dam monitoring of the National Laboratory of Civil Engineering in Portugal. The archive stores and maintains data of dam construction and provides access for researchers and public authorities.

A.1.1 Trusted national research data repository (Data Archiving and Networked Services, The Netherlands)

The Data Archiving and Networked Services (DANS)[21] is an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW)[22] and the Netherlands organisation for Scientific Research (NWO)[23]. It has operated a not-for-profit digital repository to provide long-term access to research data in the humanities, social sciences and other disciplines since 2005. DANS addresses individual academic researchers, research centres and institutions, government departments and the national statistical agency as data depositors. In order to encourage researchers to self-archive and reuse research data, DANS has developed its own platform, the DANS Electronic Archiving System (EASY)[24]. The business model canvases of the research data repository is shown in Figure 27.

The main value proposition for the research data repository of DANS is its trustworthiness as a national repository for long-term preservation of research data. The repository complies with international established data quality marks to assure trust and reliability. As a not-for-profit organisation online access and support services are provided free of charge. DANS does offer paid services for processing of data that does not comply with the agreed format, for basic data storage in case of institutional depositors, and for consultancy of large projects for third parties and Data Seal of Approval (DSA) consultancy.

[21] http://www.dans.knaw.nl/

[22] http://www.knaw.nl/en

[23] http://www.nwo.nl/en

[24] https://easy.dans.knaw.nl

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Royal Netherlands Academy of Arts and Sciences (KNAW), including IT department

Netherlands Organisation for Scientific Research (NWO)

Outsourced data storage management provider

University libraries and other (trustworthy) data repositories</td>
<td>KEY ACTIVITIES
Sustainable digital archiving including software development

Maintenance of the Dutch research information portal www.narcis.nl

Maintenance of the national resolver for URN:NBN persistent identifiers

Consultancy and training in research data management</td>
<td rowspan="2">VALUE PROPOSITIONS
Not-for-profit digital repository ensuring long-term access

Online archiving system, EASY—an electronic archiving system for research data

Trust

Interdisciplinary

Storage implements international established data quality mark (DSA)

Interoperability by utilising metadata standards

Open Access with additional rights management

Funding from project grants</td>
<td>CUSTOMER RELATIONSHIPS
Promoting sustainable data archiving and data reuse, including individual support, e.g. about metadata; preferred file formats; access rights; license agreement; persistent identifiers

Promoting certification of digital repositories</td>
<td rowspan="2">CUSTOMER SEGMENTS
Researchers (primarily Humanities and Social Sciences)

Local Data Facilities and Domain-Specific Research Infrastructures</td>
</tr>
<tr>
<td>KEY RESOURCES
Certification expertise

Human resources e.g. data managers, preservation staff, IT developers, project managers, applied researchers</td>
<td>CHANNELS
Website for submission, search and download of data sets

Training (F2F and online) for data specialists

Conferences

e-newsletter

Individual e-mail or telephone contact about deposits</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Staffing costs

Software development and maintenance/support

Storage and backup</td>
<td colspan="3">REVENUE STREAMS
Lump-sum funding from KNAW and NWO

(Inter)National project grants

Paid services</td>
</tr>
</table>

Figure 27—Business model canvas of a trusted national research data repository (DANS, NL)

A.1.1.1 Value propositions

The DANS data repository offers a solution to academic researchers, research centres and institutions, government departments and the national statistical agency to store their valuable data for long-term preservation and to provide an easy to use online access to the deposited datasets—the DANS Electronic Archiving System (EASY). Researchers can browse through the collection of research data and filter their results using the EASY website. Data depositors can upload their datasets with the same online system that guides the user through the upload process. After depositing, the users will receive a licence agreement by email and additional information about assigning Persistent Identifier to their datasets. EASY facilitates depositing of and access to research data for the data producers, as well as the reuse of this data.

Data depositors can rely on DANS' expertise and knowledge as a trusted repository. As an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Netherlands organisation for Scientific Research (NWO) DANS' mission is to promote and provide permanent access to digital research information. Online access and support services can be provided free of charge and its funding scheme ensures the long-term sustainable operation of the repository and engenders trust by the customers.

DANS ensures that the archive serves its customers and does not have any conflicting commercial or institutional interests.

The repository contains mainly research data in the social sciences and humanities but it is also open for other research fields. DANS is developing into a discipline-independent data organisation and is constantly developing its preservation services further to serve more users more efficiently. To ensure access and interoperability of deposited data, compliance with and implementation of international established metadata standards are part of the repositories mission.

A.1.1.2 Customer Segments

The main customer segment is scientific researchers primarily of Humanities and Social Sciences. As a not-for-profit organisation, DANS can focus on its main mission to provide sustained access to digital research data for researchers in the Netherlands and to develop into a discipline-independent data organisation. Researchers can choose whether to allow public access to their data or to restrict the access. DANS offers a package of services to enhance the deposited data quality and ensure sustained access.

An additional customer segment for DANS consists of local data facilities such as university libraries and domain specific research institutions. For this segment DANS is focused on information and awareness rising by supporting information portals, providing support and training for the research community, supporting virtual research environments with research tools, data storage, and transfer of research data for long-term archiving in a trusted digital repository.

A.1.1.3 Customer Relationships

In order to fulfil its mission to promote and provide permanent access to digital research information, DANS offers information and solutions for its customers. Researchers need to tackle the problems of preserving digital research data. These problems include metadata formats, preferable file formats, access rights, license agreements, and persistent identifiers. These issues are complex and DANS can provide individual support with its expertise and technical solutions.

DANS promotes the certification of other digital repositories. Organisations can apply for the Data Seal of Aprproval (DSA)[25] by an online-self assessment, which will be peer-reviewed. The awarded seal is valid for a limited period of time.

A.1.1.4 Channels

DANS offers different services that can be accessed directly through the web. Scientific researchers can deposit data through the online archiving system EASY, which also offers access to the research data sets. Another portal is via the National Academic Research and Collaborations Information System (NARCIS)[26], a gateway to scholarly information in the Netherlands which is not only used by researchers but also by students, journalists, and people working in educational and government institutions as well as in the business sector. Besides different websites and portals DANS also offers training for data specialists, ranging from doctoral students, master students, to researchers, and experts. Training is held face-to-face and also online. DANS actively promotes sustained access to digital research data through various

[25] http://www.datasealofapproval.org

[26] http://www.narcis.nl/

conferences and newsletters. Additional individual contact by telephone or email is offered for any questions concerning deposits.

A.1.1.5 Key Partners

DANS is an institute of KNAW and NWO and is provided with funding from both organisations to promote and provide permanent access to digital research information. Furthermore, the IT department of KNAW supports DANS with its infrastructure and staffing.

Some parts of the DANS repository are outsourced. An external storage provider is part of the technical framework of the repository. This partnership is an example for a supplier-buyer relationship where DANS buys in from an external technical supplier.

University libraries and other data repositories are key partners for DANS. Together the organisations can realise economies-of-scale by sharing their resources and by improving efficiency. DANS offers different services to these partners to improve their repository infrastructures. Collaboration can also take place within national and international projects to promote long-term preservation of digital research data.

DANS engages in national and international projects. The Research Data Netherlands (RDNL) is a national project where DANS is cooperating and providing expertise to the research community by offering training courses. On a larger scale DANS is a partner of the Digital Research Infrastructure for the Arts and Humanities (DARIAH) project where it supports the project mission of developing a 'digital workbench' for arts and humanities scientists in Europe. Project partners can benefit from DANS expertise, optimise their services and resource usage, and receive project grants for their collaboration.

A.1.1.6 Key Activities

DANS conducts research into sustaining access to digital information to improve its services. This benefits the development of expertise and in turn increases DANS' reputation and trust by other organisations. Another key activity covers software development relating to procedures required to develop archival systems and to improve access to stored data sets. DANS also provides consultancy and training in research data management. Organisations can make use of DANS' consultancy service for scientific data projects.

DANS operates and maintains the Dutch research information portal NARCIS (National Academic Research and Collaborations Information System).

As part of the effort the ensure sustainability of research data and results DANS collaborates with Dutch university libraries, research institutes, the Royal Library and EduStandaard to maintain and strengthen the URN:NBN infrastructure in the Netherlands[27]. URN:NBN is a 'persistent identifier' where a unique key connects to a digital object and enables a durable retrieval regardless of changing names and locations.

A.1.1.7 Key Resources

Building upon its expertise about trust and certification, DANS has developed clear criteria in the field of quality, preservation and accessibility of data for the Data Seal of Approval (DSA). As the initiator of this internationally established quality mark and as a trustworthy data repository with partners such as CBS

[27] http://dans.knaw.nl/en/content/categorieen/diensten/persistent-identifiers

Statistics Netherlands[28] and Netherlands Coalition for Digital Preservation (NCDD)[29] DANS has earned trust as one of its key resources.

DANS can rely on the skills of a wide range of qualified staff members, for example data managers, digital preservation experts, IT developers, project managers, and applied researchers. Based on their knowledge DANS can offer its key activities such as consultancy for other memory institutions or smaller pilot projects where DANS can also provide financial support.

A.1.1.8 Cost Structure

The collection of the DANS data repository comprises 25,000 datasets (March 2013) with a size of 21.5 Terabytes (Palaiologk et al. 2012). The institute draws on a mixed budget of approximately 3.8 million euro a year. Personnel costs account for 65% of the total costs, followed by 14% for office, 14% for data acquisition (which comprises of promoting data preservation ideology, acquisition or research data for the archive, and submission negotiations to specify requirements for producers and depositors), and 7% for IT services and equipment.

The major staff expenses of the personnel costs are caused by preservation activities with approximately 30% followed by 14% for the development of the archival system and 8% for project management (Palaiologk et al. 2012).

A.1.1.9 Revenue Streams

DANS operates as a not-for-profit organisation. Its budget consists of funding from KNAW and NOW, additional grants from national and international projects, and other sources, such as foundations, individuals, government, cooperation and fees-based streams from clients (Palaiologk et al. 2012). Besides its free core services, DANS offers paid services such as long-term storage of data in dark archives for institutions who themselves provide access to the data, conversion of exotic data formats, retro-archiving (archiving of older digital research data according to the Academic Digital Archiving method developed by DANS[30]), and individual consultancy and tools for data processing for scientific data projects (Dillo 2013).

A.1.1.10 Benefit/Indirect economic determinant as part of the value proposition

The indirect economic determinant identified here are as follows.

Trustworthiness is part of the value proposition of the DANS business model canvas and it is promoted by implementing an international established data quality mark, the Data Seal of Approval (DSA), and by close collaboration with university libraries and other trustworthy data repositories to strengthen the infrastructure of the persistent identifier URN:NBN.

As a maintainer of the persistent identifier infrastructure stakeholders profit from increased **flexibility** and **interoperability** of their research data which cannot be affected by changed names or locations of the digital objects.

[28] http://www.cbs.nl/en-GB/menu/home/default.htm

[29] http://www.ncdd.nl/en/

[30] http://dans.knaw.nl/en/content/categorieen/diensten/retro-archiving-data-ada-method

Another indirect economic determinant is the improvement of necessary **skills** through consultancy and training in research data management. DANS provides documentations and organises conferences to promote sustainable established preservation solutions.

A.1.1.11 Collaboration and organisational boundaries

DANS collaborates with internal and external service providers to operate the national research data repository. Figure 28 shows the collaborations, service customers and organisational boundaries of the repository.

The repository uses services from internal providers for example the IT department. The storage service is outsourced to an external provider. The primary user customer segment is external researchers and organisations as visualised in Figure 28.

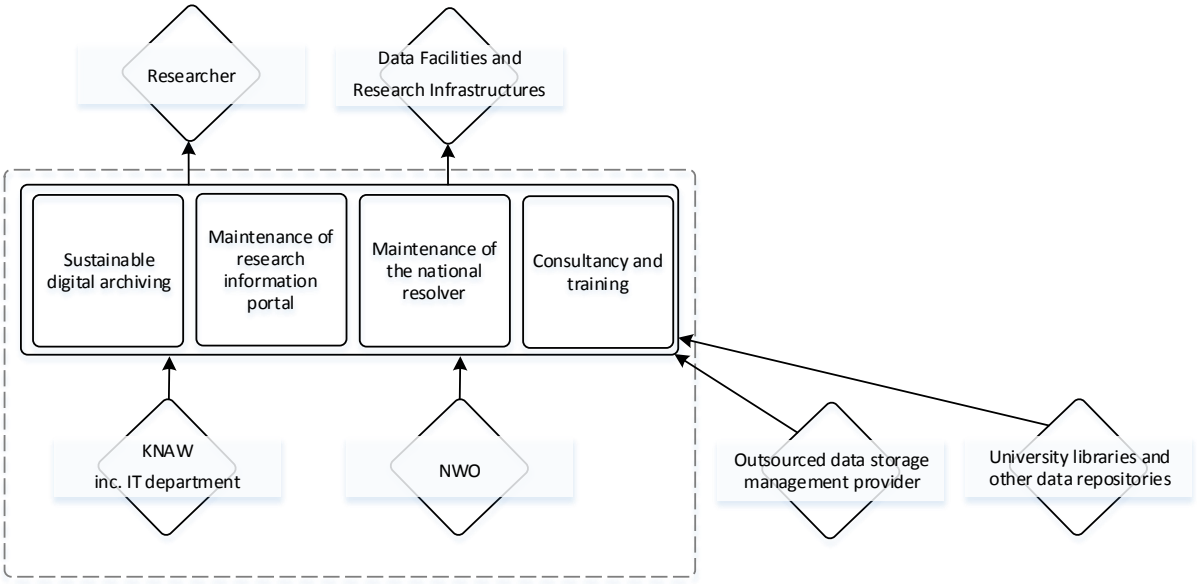

Figure 28—Collaboration and organisational boundaries of the DANS national research data repository[31]

[31] The visualisation follows the notion described in Section 3.5.1.

A.1.2 Research and engineering institute (LNEC—National Laboratory of Civil Engineering, Portugal)

This section presents the BMC for the Portuguese National Civil Engineering Laboratory (LNEC)[32] and their archive of concrete dam monitoring data, GestBarragens.

LNEC, established in November 1946, is a public Science and Technology institution, which is subject to Government supervision through the Ministry of Public Works, Transports and Communications. It undertakes its role in conjunction with the Ministry of Science, Technology and Higher Education. Its activity revolve around in the various fields of civil engineering and its main assignments are the execution, supervision and promotion of scientific research and technological developments to achieve progress, innovation and good practices in civil engineering. The institution is also responsible for providing an unbiased and suitable scientific and technical support to the government, in its governing and regulatory activities. At present, it has about 680 staff, of which approximately 42% have a University degree and about 22% are researchers holding a PhD or an equivalent degree (from the 2006 Social Report). It also has about 80 scientific research fellows with a grant awarded by LNEC. From the annual LNEC budget, about 50% of LNEC's income results from the generation of private revenues, namely the provision of science and technology services, the remaining 50% is derived from the National Budget and from other sources (from the 2006 Activity Report).

LNEC undertakes research in the following areas:

- Use of monitoring technologies to gather observation data and automatic communication systems
- Development of "smart systems" for just-in-time dam safety control
- Risk analysis of dam construction and operation
- Characterisation and modelling of the future deterioration of dams and their foundations

According to the Portuguese Dam Safety Legislation that regulates the dam safety control of big dams[33], LNEC also has the responsibility to survey the behaviour and the structural safety of approximately 150 concrete and masonry dams. This responsibility includes the elaboration of observation plans, the periodic inspection of the dam structure and potential anomalies, the generation of analysis and interpretation reports of the observed behaviour and also, the management and operation of an electronic archive of data concerning the dam safety. The business service of the archive for dams monitoring is shown in the business model canvas in Figure 29.

[32] http://lnec.pt

[33] Defined as dams where the maximum height from the foundation is more than 15 meters or with a reservoir with more than 100 000 m^3 of capacity

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Software providers

Hardware providers</td>
<td>KEY ACTIVITIES
Preservation planning

Archive administration

AIP storage and Data Management</td>
<td rowspan="2">VALUE PROPOSITIONS
Concrete dam safety

Long term preservation of AIPs

Access to preserved information</td>
<td>CUSTOMER RELATIONSHIPS
Data access by researchers for analysis

Automated and manual real data</td>
<td rowspan="2">CUSTOMER SEGMENTS
LNEC researchers

Dam owners

Portuguese authorities</td>
</tr>
<tr>
<td>KEY RESOURCES
Automated and manual real data

Staff and Skills

Archiving infrastructure</td>
<td>CHANNELS
Online access to data for analysis

Internet for on line query and submission service</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Archive development and maintenance

Wages and Salaries

Storage and Backup</td>
<td colspan="2">REVENUE STREAMS
Public funding

Contracts with dam owners</td>
</tr>
</table>

Figure 29—Business model canvas of the archive for dam monitoring

A.1.2.1 Key Partners

Software Providers

Software providers develop and maintain software to support the value propositions of the organisation. The development and maintenance of GestBarragens is performed by the internal team from LNEC. However, there are parts of the system that are dependent on external providers such as the development and maintenance of the dam sensors data gathering handheld devices.

Hardware Providers

Hardware providers sell and maintain the hardware deployed in the organisation to support the value propositions of the organisation.

A.1.2.2 Key Activities

Preservation planning

LNEC monitors the environment of the archive and provides recommendations and preservation plans to ensure that the information stored in the archive remains accessible to, understandable by, and sufficiently usable by, the customers over the long term, even if the original computing environment becomes obsolete.

Archive Administration

One of LNEC's main activities is to guarantee the services and functions for the operation of the archive system. This includes soliciting and negotiating submission agreements with customers, auditing

submissions to ensure that they meet archive standards, and maintaining configuration management of system hardware and software. It also provides system engineering functions to monitor and improve archive operations, and to inventory, report on, and migrate/update the contents of the archive.

AIP storage and Data Management

Another LNEC key activity is to receive Archival Information Packages (AIPs) from the submission service and to add them to the permanent storage, refreshing the media on which archive holdings are stored, performing routine and special error checking, providing disaster recovery capabilities, and providing data to customer to fulfil their orders.

A.1.2.3 Customers Segments

LNEC Researchers

The LNEC Researchers use the information in the archive to analyse dam structures behaviour through time, and as such, they are both a consumer and part of the designated community, as the archive needs to address their requirements.

Dam Owners

Dam owners also have specific requirements as they are both consumers and producers. The dam owners use the information in the archive to check on their dam's structural integrity. The data collected in sensors and by staff from the dam owners is ingested to the archive, for long-term preservation and analysis.

Portuguese Authorities

The Portuguese authorities also have specific requirements that are detailed in law. There is a mandate to collect this information by law.

A.1.2.4 Value Propositions

Concrete Dam Safety

A value proposition of LNEC's archive is to improve concrete dam safety through the collection of data from dams and further analysis by LNEC researchers.

Long term preservation of AIPs

LNEC ingests structural concrete dam data that must be transformed into AIPs for long term preservation. There is no legislation relating to how long the data must be preserved. As such, data is preserved indefinitely.

Access to preserved Information

LNEC researchers and dam owners use the data in the archive to study structural behaviour of dam structures and to model future behaviour.

A.1.2.5 Customer Relationships

Data access by researchers for analysis

LNEC's researchers initiate dissemination information package (DIP) access sessions with the archive to collect relevant information on dam structural behaviour.

Automated and manual real data

There are sensors installed in dams that have automated procedures to read data and send it to the archive for ingest. However, there are some measurements that have to be performed by people on a periodic basis and this data is submitted manually to the archive for ingest.

A.1.2.6 Channels

Online private access to data for analysis

The order service enables on-line private access to data for analysis for the LNEC researchers. Due to the sensitive aspect of the information in the archive there is the need to maintain private access.

On line query and submission service

Dam owners submit their data, collected automatically and manually, through an on-line submission service made available by LNEC's archive. There are sensors installed in dams that have automated procedures to read data and send it automatically to the archive for ingest. However, there are some measurements that have to be performed by people on a periodic basis and this data is submitted manually to the archive for ingest.

A.1.2.7 Key Resources

Automated and Manual real data

The AIPs of the archive allow access to the data collected in dams and ingested automatically and manually.

Staff and Skills

The archive system GestBarragens uses an intricate technological infrastructure that is maintained by highly skilled staff. As a result, if there is a major change in staff that affects the skills available, this might affect the ability to continue delivery of long term preservation of information, one of the value propositions. There is a set of required staff to maintain the GestBarragens infrastructure, namely developers, civil engineers and system architects. Also, in order to perform maintenance of the sensors, there is the need to have electrical engineers.

Archiving Infrastructure

The GestBarragens system is an information system that provides the whole infrastructure for the archive.

A.1.2.8 Cost Structure

Archive Development

One of the costs of the archive is software development. This cost comes from the initial development of the archive and also new functions and requirements that arise from the designated community and also when new technology is needed.

Archive Maintenance

Another of the costs of the archive is maintenance. Maintenance of the archive is performed both by the software and hardware providers and also by the archive staff. There is the need to perform periodic procedures to guarantee that the archive is running smoothly and the information in the archive remains relevant for the designated community.

Wages and Salaries

One of the costs of running the archive is the wages and salaries of the staff that supports the operation of the archive. There are staff with different qualification in the team and wages and salaries differences are also taken in consideration.

Storage and Backup

One of the main costs in the archive is related to storage and backups. As storage is not outsourced there is the need to check and maintain periodically the hardware that deals with the information storage in the archive. Staff from the internal development team is assigned to these tasks. Currently there is data in the archive dating from 1951 to the present day, from 20 Portuguese dams. Each dam can have up to 22 different types of sensors, and a total of up to 1586 sensors. All these data sources lead to several million sensor readings with a linear growth estimation of 0.26x10^6/ year.

A.1.2.9 Revenue Streams

Contracts with Dam Owners

The contracts that LNEC has with the dam owners, which are mandatory by national law and which allow the owners to ingest and archive data in the archive, are one of the revenue streams of the archive.

Public Funding

The main portion of the revenue of the archive comes from public funding. As LNEC is a public organisation there is budget allocated for LNEC as part of the annual government budget.

A.1.2.10 Benefit/Indirect economic determinant as part of the value proposition

The indirect economic determinants of the LNEC business model are:

Risk—LNEC's collection of monitoring data of the structural integrity of concrete dams is used by the owners of the supervised dams to assure the safety of their facilities. LNEC's activities to increase sustainability mitigate the risks of losing the collected monitoring data and at the same time ensures the accessibility in the long-term.

Sustainability—LNEC's main activities are the administration, storage and data management of the submitted AIPs. These activities aim to ensure the sustainability of the archive's holdings. Moreover, LNEC has a legal mandate to collect this data.

Interoperability—The stored AIPs are not only used for safety concerns and because of the legal mandate. The data is also used for research, and therefore LNEC also ensures discoverability and the interoperability of the data.

A.1.2.11 Collaboration and organisational boundaries

Figure 30 shows the collaboration of the business model of the research and engineering institute. The business uses services from internal and external providers. External vendors provide software and hardware. The services are used by internal and external users. For example researchers within the organisation use the data stored in the archive for analysis. Public authorities and dam owner also have access to the system.

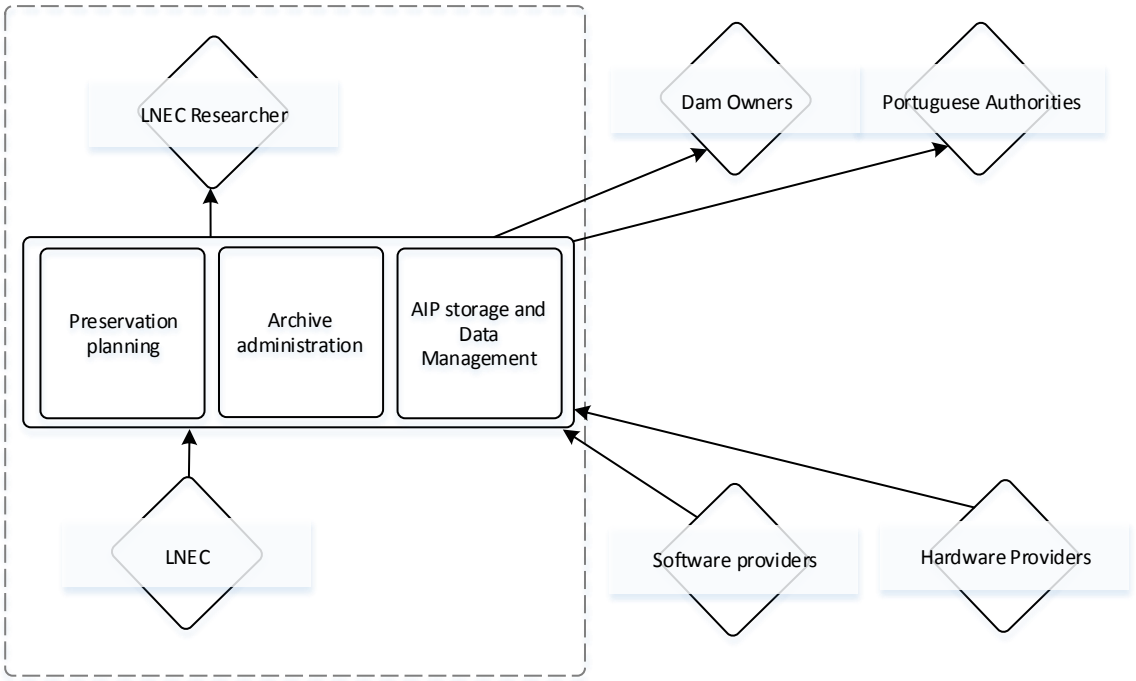

Figure 30—Collaboration and organisational boundaries of the research and engineering institute

A.2 Culture

For the culture domain three example business models are presented. The first example describes the digital archive of a national library. The archive contains digital assets of the library with access for the public. An on-demand service for digitisation of books by a national library is used as the second case. The third example presents the business model of the Portuguese Web Archive.

A.2.1 Digital archive (Digital Archive of the National Library of Estonia, Estonia)

The mandate of the National Library of Estonia (NLE)[34] is to collect, store and make publically accessible publications from Estonia or about Estonia. NLE is the primary legal deposit library in Estonia. It collects digital print files (digital source material before it goes into print) of all publications published in Estonia, harvests and archives the Estonian web and is coordinating the national digitisation programme for printed material. It also functions as a parliamentary library providing information services for the parliament. NLE has defined its core values as: reliability, openness, innovation, professional services and user orientation.

Their digital archive Digar[35] houses the digital collections of the National Library, apart from the web archive. Digar was started in 2004 and its purpose is to store files, digitised copies of publications and publications collected from the web. The digital archive contains books, newspapers, journals and magazines, maps, sheet music, photos and postcards. It is linked with the main union catalogue of the library but can also be searched through its own user interface. A new version of the user interface for publishers for submitting print files and data about publications is currently under development.

The business model canvas shown in Figure 31 describes the services NLE offers with its digital archive Digar.

[34] http://www.nlib.ee/en

[35] http://www.digar.ee

<table>
<tr>
<td>KEY PARTNERS
Software developers

Content providers

Ministry of Culture

IT department</td>
<td>KEY ACTIVITIES
Preservation of print files, e-books and digitised publications

Digitisation

Segmentation

Development of DIGAR user access interfaces

Development of E-services portal

KEY RESOURCES
STAFF

HARDWARE

SOFTWARE

KNOW-HOW ISBN-CENTRE</td>
<td>VALUE PROPOSITIONS
Storage and preservation of print files

Access to school reading and academic literature

Exposure for publishers

User access control options

Additional services for publishers based on statistical data collected in the e-services portal

User friendly interface</td>
<td>CUSTOMER RELATIONSHIPS
Regular meetings

User support

CHANNELS
DIGAR (digital archive)

E-services portal</td>
<td>CUSTOMER SEGMENTS
(small and large) Publishers

Students

Researchers</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Hardware costs

Software costs

Personnel costs</td>
<td colspan="2">REVENUE STREAMS
Government funding

Fee-based services for publishers based on aggregate data collected in the portal</td>
</tr>
</table>

Figure 31—Business model canvas of the Digar digital archive

A.2.1.1 Value propositions

Through its digital archive Digar the NLE offers free storage space for the files of books, digital publications and e-books deposited or submitted as legal deposit copies by publishers. The files are submitted for free, and in exchange they are stored and actively preserved. Since Digar is used for public access to archived content, it also provides exposure for publications. Publishers have the right to determine the access levels and rights for each publication as well as the length of embargo period. The access levels range from being accessible only on dedicated workstations within library to open public access.

A new e-services portal is being developed for publishers, which collates all NLE services to publishers into one environment for ease of access and to speed up the process of interacting with the Library. The new one-stop-shop will be a significant improvement compared with the current process of applying for a standard publication number (e.g. ISBN), submitting legal deposit copies and print files, and receiving statistics on the use of a given publisher's products in libraries. Savings in time, efficiency and reduced need for repeated data input are the primary gains for publishers once the portal is implemented.

Digar has recently had a facelift for improved usability. The new user interface features collections and tools developed with school teacher and student requirements in mind. User authentication now includes

social media options like via Facebook, Twitter and Google+ account. Bookmarking and shareable virtual bookshelves make using, re-using and discussing publications easier in school and academic settings.

A.2.1.2 Customer Segments

The digital archive Digar serves two key customer segments—publishers who are the main data providers into the archive, and end-users, mainly students and researchers.

A.2.1.3 Customer Relationships

NLE has contractual agreements with publishers for the archiving services. For current newspapers there is an agreement with the Estonian Newspaper Association, which acts on behalf of newspaper publishers and coordinates their archiving activities. For e-books an agreement exists with only one e-book publisher, as most archived e-books in the digital archive are project based initiatives.

Customer relationships are maintained through regular newsletters and meetings for general updates. Direct e-mail or phone contacts are also utilised when there are issues with print files that prevent them from being archived.

The Digar website has a feedback page for end-users where they can send any questions, problems or suggestions. The organisational policy is to respond to each non-anonymous query, request or comment that has been received.

A.2.1.4 Channels

The interaction with publishers is currently via FTP servers for submission of print files. E-mail, telephone and meetings are other the channels that are used for reporting and resolving issues.

The digital archiving and preservation service that is offered to the publishers is maintained through the Digar website, but user access controls cannot be set there by the publishers. This feature will be available in the new e-services web portal.

Digar and its services to students and researchers are accessible through a web interface.

A.2.1.5 Key Partners

For the creation, development and maintenance of digital archive software, an external software developer has been acting as a partner for around 10 years. Recently two additional software companies are providing support and new developments for Digar.

Although in this business model canvas publishers and content providers are the customers, they can also be seen as partners. In order to provide publications for the readers, it is important to have relationships with publishers who submit content.

Another partnership is with the Ministry of Culture, which plays a key role in the funding and also develops projects to provide additional digital content for the Library. For example, a recent project called “Estonian Literature” made it possible to have many classical works available as e-books though Digar.

On the readers’ side, various teacher associations are acting as partners in disseminating the message about new content that has become available via Digar.

A.2.1.6 Key Activities

The activities of the NLE that support the creation and maintenance of the value propositions are:

- Archiving of print files, e-books and other digital content.
- Preservation of the content of the digital archive.
- Providing authorised access to the archived content.
- Serving publishers and their specific needs (for example changes in access rights, statistical reports or print files of individual publications).
- Software development to support and develop the above activities.

NLE is continuously investing into the development and maintenance of its digital archive software and develops new functions. Currently the library is also developing a new e-services portal for publishers to support the workflow for submitting print files.

- User support and helpline.
- Marketing and user training.

A.2.1.7 Key Resources

The key resource for the preservation of print files, e-books and digitised publications is a skilled and experienced staff. The Digital Archive department employs specialists who check the quality of the content submitted by the publishers and submits the files to the digital archive. It also provides a helpline for publishers, maintaining regular communication with them and resolving issues with submitted print files. The IT department manages the development contracts with software developers and provides system and application administration service internally. One software developer works full-time on the maintenance and development of the Digar software.

The Library has equipped its own server and storage room where all the archived data is stored in conditions that meet international standards.

A.2.1.8 Cost Structure

The direct cost figures of maintaining the digital archive are not available because of the many costs that are indirectly embedded in the budget of the National Library. Comparative cost calculations were estimated for the years 2007 and 2012. The primary cost item was and is staff costs, with software development and maintenance costs second largest; hardware maintenance costs are shared between multiple services and are not very significant; utilities and administrative costs can be estimated at a very general level.

A.2.1.9 Revenue Streams

The activities of NLE are financed directly from the state budget and negotiated via the Ministry of Culture. Project-based funding for software development is available via the Ministry of Culture and the Ministry for Economics and Transportation. The National Library applies for project funding annually and this funding stream makes up around one third of the total IT budget of the organisation.

Fee-based services are offered to media monitoring companies based on aggregate newspaper collections archived in Digar. These are based on contractual agreements negotiated between publishers, media monitoring companies and the NLE.

A.2.1.10 Benefit/Indirect economic determinant as part of the value proposition

The **skilled** staff of Digar is the key component that the value proposition is relying on and that sets NLE apart from other libraries in Estonia. Their competence is maintained through training and other similar opportunities to enhance their current skills or acquire new ones.

Through a flexible access rights control mechanism, Digar is offering assurance to publishers that **sensitivity** and **confidentiality** issues are resolved and controlled in a reliable and trustworthy manner.

The received files are archived and backed up with at least two copies. The access copies are separate from the original and archive copies of each item. The preservation system is assures the **authenticity** of the archived files**.**

A.2.1.11 Collaboration and organisational boundaries

Figure 32 shows the collaboration with services providers of the Digar digital archive. The internal services provider is in this example the IT-department. External services are delivered by content providers and software developers. The external customers are the targets of the service.

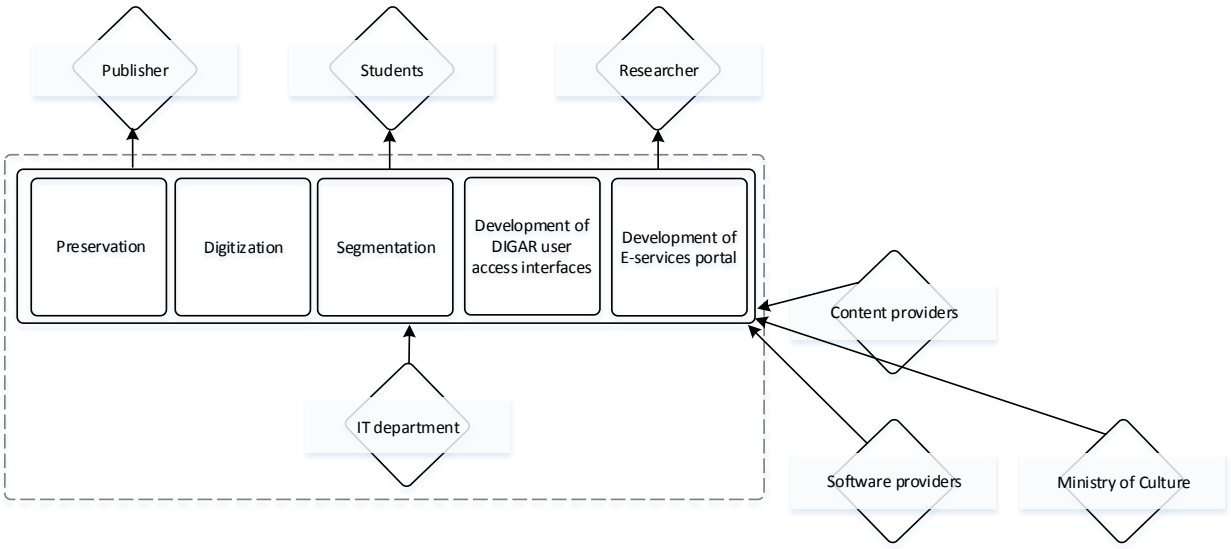

Figure 32—Collaboration and organisational boundaries of the Digar digital archive

A.2.2 Digitisation of Danish books on demand (KBDK, Denmark)

The Royal Library is Denmark's national library and university library for the University of Copenhagen[36]. The legislative framework for the Royal Library is set out in the National Budget and further specified by specific legislative frameworks. The Royal Library is mainly publicly funded. In the National Budget of 2013 the library had an appropriation of 336 million DKK and, with supplementary income, the total funding amounted to 389 million (approximately 52 million EUR). In 2013 the number of staff measured as full-time equivalents (FTE) at the library was 438. Nearly half of the total expenses were spend on salaries and about one third of the total expenses related to the library's buildings (interests, property tax, operational expenditure and maintenance).

The library's main duties are to deliver research, national library service and university library service. As part of the Royal Library's obligation to provide library services, the library has established a pilot service

[36] http://www.kb.dk/en/index.html

to digitise Danish books on demand and make them available online. The service has been established through a project funded by the Danish Ministry of Culture from 2012-2014. The service has been well received by users—3,452 books were ordered and digitised in 2013—and the library would like to continue the service, but needs to find ways to sustain it. The business model canvas of the services is shown in Figure 33.

The case highlights two challenges related to funding which are common in publicly funded memory institutions. One is how new test services, such as the Danish books on demand, are integrated into institutions' standard services and sustained beyond the temporary project funding. The other refers to the discussion about what services users (tax payers) can expect free of charge from public institutions' standard services—and what is to be considered as additional services for which institutions can reasonably burden users with fees.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Different units within the organisation (all internal)</td>
<td>KEY ACTIVITIES
Order
Logistics (transportation of books)
Digitisation of books
Delivery of PDF</td>
<td rowspan="2">VALUE PROPOSITIONS
Provision of digital copies of access restricted books that are otherwise only available in reading rooms at the Royal Library
Secure availability
Trusted provider
User friendly systems
Customer support</td>
<td>CUSTOMER RELATIONSHIPS
Online ordering/delivery system
Error handling by mail</td>
<td rowspan="2">CUSTOMER SEGMENTS
Researchers
Students
General public
Niche market</td>
</tr>
<tr>
<td>KEY RESOURCES
Expedition staff
Imaging specialists
Metadata specialists
Workflow specialists
Software developers
Library system integrated with order/delivery solutions
Vans
Scanners and software</td>
<td>CHANNELS
Library system</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Most expensive resources: operators (digitisation)
Most expensive activities: expedition and imaging</td>
<td colspan="2">REVENUE STREAMS
Pay per digitized book (once digitized the next time the book is requested it is free)
Saved expedition and preservation costs on future loans</td>
</tr>
</table>

Figure 33—Business model canvas for digitisation of books on demand

A.2.2.1 Value propositions

The service offers unique online access to digital copies of the national collection of Danish books through the library's catalogue. Before the service was implemented the physical books were only accessible in

the library's reading room and normally only for dedicated researchers. Whilst the service is still aimed at researchers, it is now also open to the general public.

The Royal Library has already made all Danish books printed before 1600 available on-line, and books printed between 1601 and 1700 are currently being digitised and continuously being made available. Books printed between 1701 and 1900 are digitised on demand free of charge through the service. Due to Intellectual Property Rights only Danish books printed before 1901 can be made available on-line through the service. Digital versions of the Danish books included in the service can be ordered through the library's online-catalogue. Copies of books that are already digitised are delivered directly on-demand in searchable PDF, whereas copies of books that have not yet been digitized are delivered free of charge within 3-5 days, again as PDF.

A.2.2.2 Customer Segments

The customers are researchers, scholars and the general public. Whilst they are all interested in online access to the digital copies of the books, they may have different requirements for search facilities and for processing the information contained in the digital books.

User of the service must have a valid library card and access is only possible through devices with a Danish Internet Protocol (IP) addresses.

A.2.2.3 Customer Relationships

General information about the service and how to order guidance is provided on the Royal Library's website[37] and through the library's online catalogue REX.

Individual questions may be sent to the library by e-mail.

A.2.2.4 Channels

The books are searched for, ordered and provided through the general library system. Since the service is only a pilot, no resources have been spent on promoting the service apart for the above mentioned descriptions on the library's website and verbally from librarians to users. If the service is made permanent ways of advertising it will need to be investigated.

A.2.2.5 Key Partners

The service is not dependent on external partners, but several departments within the organisation are involved with delivering the service, and this requires firm management to keep delivery schedules.

A.2.2.6 Key Activities

The key activities include the search, ordering and delivering system. These are inter-connected through the workflow management system that handles all the steps in the workflow and notifies the library system when the order is ready for delivery.

When books are ordered, that have not previously been digitised, they are first retrieved from storage and inspected to assess whether they lack registration or whether they need any conservation treatment prior to digitisation. If so, any corrective actions are undertaken. Then the books are digitised, and the digital information processed—if possible, Optical Character Recognition is applied to make the digital

[37] http://www.kb.dk/en/nb/samling/dod/index.html

information searchable. In addition, the digital books have metadata added, both descriptive and administrative, and the digital files stored in the library's repository system. When the quality of the digital copies of the books has been controlled and approved, the physical books are returned to storage and the PDF files delivered to the customers via e-mail.

A.2.2.7 Key Resources

The general library system forms an important part of the service providing the interface with customers. Likewise, book scanners and different types of software are required for digitisation and image processing. In addition, packaging materials and vans are needed for secure transportation of the physical books, as well as possible materials for conservation.

The library also draws on a variety of personnel, including IT developers, workflow managers, personnel in charge of expedition and logistics, conservators, imaging specialists, curators and metadata specialists.

A.2.2.8 Cost Structure

The project incurs direct capital costs for the acquisition of book scanners and software for processing such as Optical Character Recognition. It also incurs direct labour costs for staff to plan and establish workflows, for running and maintaining the workflows and for assuring the quality of the production. In addition, the project incurs indirect costs (overhead) for general management and facilities, and so on. The indirect costs are added proportionally to the direct expenses incurred by the service.

The total cost of delivering a digitised book on demand is on average DKK 275 (EUR 35), of which approximately one third is that incurred by digitisation. Given the fact that there are large variances between the original books with respect to format (size), number of pages, need for metadata and conservation this average cost has a considerable degree of variance.

Assuming that 3,500 books on average are requested per year at a cost of EUR 35 per item, the cost of sustaining the service would amount to EUR 122,500 per year.

A.2.2.9 Revenue Streams

When the project funding terminates, the service could be sustained by reallocating resources internally, by attracting new external funding, or by applying some kind of user-fee on the service.

The library wants to explore a revenue model based on user-fees. Given the fact that the library is publicly funded this may be questioned because one can argue that users have already paid for the service through taxes. However, the Royal Library has already for several years operated with user-fees on additional services, such as delivering high quality reproductions of art works.

Also the library wants to take into account the revenues in the form of cost savings that the service will provide. Once a book has been digitised, cost savings will occur next time the book is ordered, as delivering the digital copy will save the costs related to accessing the physical books. Furthermore, it will result in saved costs for conservation of the physical books caused by mis-handling.

The library is currently analysing what level of costs users may be willing to pay for the service—spanning from the total average costs of delivering a digitised book (around EUR 35) to a lower administration fee for example around EUR 5, assuming that the saved costs would provide the residual revenues. Once a customer has paid for digitising a book, it will remain free of charge.

A.2.2.10 Benefit/Indirect economic determinant as part of the value proposition

These are indirect economic determinants of the digitisation for the books on demand service of the Royal Library:

Reputation—The Royal Library enjoys a high reputation and acquires Danish books for legal deposit. Legal deposit was extended to electronic publications in 2006. The library's collection comprises books of high importance for book history, such as the Gutenberg Bible. The library is also partner of international projects and actively researching in the field of digital curation.

Quality—The digitisation service also covers quality assurance for digitised books. Each digitised book is checked and sent to the reader only after approval of the quality. As a consequence, the quality of the eBooks is more reliable (metadata is also added to the digitised books including descriptive and administrative information) and authenticity of the digital assets is ensured.

Trustworthiness—The trustworthiness of the library originates from the quality of their curation activities and their reputation as a public national institution with a long history, and with the responsibility of the legal deposit of national books and electronic publications.

A.2.2.11 Collaboration and organisational boundaries

Figure 34 shows the collaboration and customers of the digitisation services with the organisational boundaries. The services are provided and operated internally and the primary user segment is external.

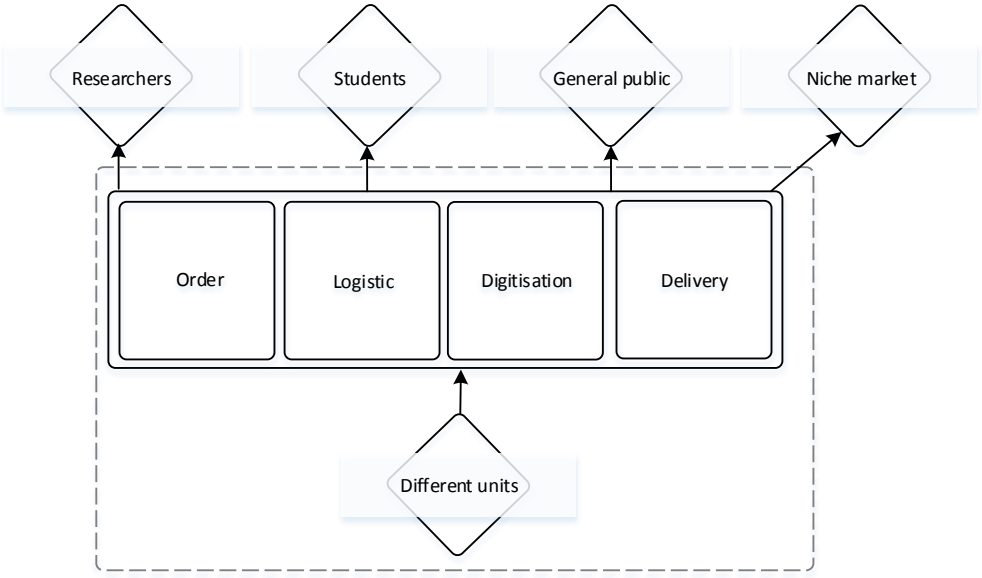

Figure 34—Collaboration and organisational boundaries of the KBDK digitisation service

A.2.3 Web archive (Portuguese Web Archive, Portugal)

The Portuguese Web Archive[38] (PWA) preserves the information published on the web that is of clear interest to the Portuguese community for future access. It also provides research resources, for instance, in the fields of history, sociology or linguistics, and preserves information from the past that is no longer

[38] http://sobre.arquivo.pt

available on the Internet. With the creation of a system that supports regular crawls of the Portuguese web along with its long term storage and access, it is intended to provide the following services:

- **Term search over the archived contents**: it enables the identification of archived contents over the years that contain certain terms
- **URL search over the archived contents**: it allows to identify several versions of a content gathered from a given URL
- **New search engine over the Portuguese web**: the archive enables searching over several Portuguese web collections. Providing a search service over the most recent collection, as current web search engines do, is attainable in a relatively small additional effort and it is an interesting service for the Portuguese community.
- **Historical collections of web contents for research purposes**: the web has information about the most various subjects reflecting society changes across time. Researchers from different fields use the web as a source of information for their studies. Providing web collections will enable these researchers to store and process web data locally on their computers without having to crawl the web themselves.
- **Characterisation reports of the Portuguese web**: a web archive system must be tuned according to the characteristics of the archived data. Therefore, Portuguese web characterizations must be periodically generated. As these studies are interesting to a broader audience, they will be published. Characterising national webs is interesting to measure the spread of information technologies in different societies and the evolution of the web across time.
- **Backup system of the archived information**: this is a distributed system that enables Internet users to provide disk space to store backup copies of the archived contents through the installation of a small application on their computers. If a failure happens on the central repository, the archived collection will be recovered from the backup copies stored on the users' computers. Any individual or institution can contribute to preserve the web by providing some disk space on their computers.
- **Archived data parallel processing system**: this service allows researchers to execute their programs over the archived web data using several computers in parallel.

As a complement, the Portuguese Web Archive also strives to achieve the following goals:

- **Train human resources** in web archiving to enable the maintenance of the system in the future
- **Export know-how, experience and technology** in web archiving to other countries, especially the Portuguese language ones
- **increase the number of domains registered under ".PT"**, the free historical archiving of the information published under this domain could be an additional motivation for registrars
- **Publish scientific and technical papers** that enable the sharing of the acquired knowledge and receiving feedback from the community regarding the work performed

The business services outlined above describe the core functionality of the Portuguese Internet Archive. Their business model canvas is shown in Figure 35.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Software providers

Hardware providers

Web-site owners</td>
<td>KEY ACTIVITIES
Preservation planning

Archive administration

AIP storage and Data Management</td>
<td rowspan="2">VALUE PROPOSITIONS
Provide evidence in court

Long term preservation of historic national internet data

Access to preserved national websites</td>
<td>CUSTOMER RELATIONSHIPS
Data access by universities and public organisations

Submission of websites through the use automatic procedures</td>
<td rowspan="2">CUSTOMER SEGMENTS
Universities

Public organisations</td>
</tr>
<tr>
<td>KEY RESOURCES
Web-site preserved data

Metadata on the preserved data

Archivists and Software Developers

Archiving infrastructure</td>
<td>CHANNELS
Online public access to the website data

Query service on the preserved website data to identify holdings of interest</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Archive development and maintenance

Wages and salaries

Storage and backup</td>
<td colspan="2">REVENUE STREAMS
Public funding

Training</td>
</tr>
</table>

Figure 35—Business model canvas of the Portuguese Web Archive

A.2.3.1 Key Partners

Software Providers

Software Providers develop and maintain the software according to the organisations requirements. These software products support the value propositions of the organisation. Part of the development of the archiving infrastructure is performed by an external provider who also maintains part of the system.

Hardware Providers

Hardware providers sell and maintain the hardware deployed in the organisation to support the value propositions of the organisation. These hardware providers provide mainly servers and storage along with the provision of maintenance. The interaction between the PWA and these providers is formalised through acquisition and support contracts.

Web-site owners

The web-site owners are the producers of the information that is automatically ingested in archive. Although there is no formal relationship established between the archive and the web site owner, the owners represent key partners of this business service. The conditions and rights of the archive are specified by national law. The website information is ingested into the archive automatically through the use of web robots and crawlers that collect all the relevant information from a website and save it into the

archive. There are usually several instances of the same web site in the archive, snapshots from different points in time.

A.2.3.2 Key Activities

Preservation planning

PWA monitors the environment of the archive and provides recommendations and preservation plans to ensure that the information stored in the archive remains accessible to, understandable by, and sufficiently usable by the customers over the long term, even if the original computing environment becomes obsolete. These plans are then put into operation by the internal team (in the case of minor changes to the overall infrastructure), or by external providers (when new requirements or major changes are needed).

Archive Administration

One of the PWA's main activities is to guarantee the services and functions for the operation of the archive system. This includes soliciting and negotiating submission agreements with customers, auditing submissions to ensure that they meet archive standards, and maintaining configuration management of system hardware and software. It also provides system engineering functions to monitor and improve archive operations, and to inventory, report on, and migrate/update the contents of the archive.

AIP storage and Data Management

Another of PWA's key activity is to receive AIPs from ingest and add them to permanent storage, refresh the media on which archive holdings are stored, perform routine and special error checking, provide disaster recovery capabilities, and provide data to customer to fulfil their orders.

It also provides the services and functions for populating, maintaining, and accessing documents in the archive, as well as administrative data used to manage the archive. This includes administering the archive database and performing database updates.

A.2.3.3 Value Propositions

Supply Evidence in Court

One specific value proposition of PWA is provide evidence in court, as the archive contains a collection of Portuguese websites at different points in time. This value proposition is directed at public organisations that potentially need the data in the archive as evidence in court.

Long term preservation of historic national internet data

PWA commits to preserve the information collected from websites for future generations to enable studies in the areas of history, sociology, or linguistics. The data can also be used to study the technological panorama across time in Portugal.

Access to preserved national websites

PWA allows public access to the websites preserved in the archive through the use of a query and order service.

A.2.3.4 Customer Relationships

Data access by universities and public organisations

Universities and organisations use online public access to identify holdings of interest and retrieve them for further analysis.

Submission of websites through the use automatic procedures

PWA uses web crawlers and bots to get the website data to ingest into the archive.

A.2.3.5 Customer Segments

Universities

Universities are one of the main consumers of the archive and they have specific requirements for the archive. Universities can use the information for research in the fields of sociology or information technology, for example.

Public organisations

Public organisations are another of the main consumers of the archive. They too have specific requirements for the archive. Public organisations, such as courts, can use the information to provide evidence in court cases and prosecution.

A.2.3.6 Key Resources

Website preserved data

The key resource of PWA is the preserved website data that was ingested into the archive, and which must be accessible by its customers for further analysis. This data must be continuously monitored to guarantee that there is no obsolescence or loss of information.

Metadata on the preserved information

In order for customers to identify holdings of interest in the archive there must be metadata collected on the archiving holdings that help to identify it.

Archivists and Software Developers

PWA uses an intricate technological infrastructure that is maintained by highly skilled staff. As a result, if there were to be a major change in staff that affects the skills available, this might affect the ability to continue delivery of long term preservation of information, one of the value propositions. The required skills to operate the archiving infrastructure are software developers, hardware maintenance professional and archivists (with knowledge of web archiving).

Archiving infrastructure

The PWA uses a collection of open source and proprietary systems that together provide the infrastructure including the storage for the Archive.

A.2.3.7 Channels

Online public access to the website data

PWA guarantees that the website data that is ingested into the archive and is made online accessible.

Query service on the preserved website data to identify holdings of interest

In order to identify holdings of interest in the archive PWA provides a query service to its customers.

A.2.3.8 Cost Structure

Archive development

One of the costs of the archive is development. This cost comes from the initial development of the archive the implementation of new functionality and requirements that arise from the designated community and modification when the need for new technology is identified. Part of the archive development is performed by the internal team, who apply small changes in the software and bug corrections. However, when new requirements are established or when there is the need to perform a major overhaul of the archiving infrastructure, an external software development team is contracted to perform these changes.

Archive maintenance

Another of the costs of the archive is maintenance. Maintenance of the archive is performed both by the external software and hardware providers and also by the internal archive staff. There is the need to perform periodic procedures to guarantee that the archive is running smoothly and the information in the archive remains relevant for the designated community. These periodic procedures deal mainly with data cleansing, database tuning, new metadata extraction, and software and hardware migration.

Wages and Salaries

One of the costs of running the archive is the wages and salaries of the staff that support the operation of the archive. There are employees with different qualification in the team and wages and salaries differences are also taken in consideration. There are archivists with academic degrees in archiving, software developers with academic degrees in computer science, and hardware maintenance professionals, either with a college degree or with high school diploma.

Storage and Backup

One of the main costs in the archive is related to storage and backups. As storage is not outsourced, there is the need to check and maintain periodically the hardware that deals with the information storage in the archive. This maintenance is performed by the internal hardware maintenance team on a preventive basis to maximize hardware life and on a repair basis when any malfunction is detected.

A.2.3.9 Revenue Streams

Public Funding

The main portion of the revenue of the archive comes from public funding. As the Foundation for National Scientific Computing (FCCN)[39], where PWA is homed, is a public organisation, there is budget allocated for PWA as part of the annual government budget.

Training

PWA offers training in the field of web archiving to enable the maintenance of the archive in the future. This is performed, not as key activity, but as a bonus for some public organisations.

[39] http://www.fccn.pt/en

A.2.3.10 Benefit/Indirect economic determinant as part of the value proposition

These are the indirect economic determinants of the PWA:

Risk—The PWA preserves websites, which prevents the loss of content of historical and social value for the Portuguese people. In the course of legal trials, a loss of this data would also be a substantial loss of evidence if the content of websites is relevant to the outcome of these trials. Key activities of the PWA comprise essential digital curation activities such as preservation planning, storage and data management as well as archive administration. These mitigate risks of obsolescence of information.

Discoverability—The historical collections are valuable sources for research in various fields of studies. Researchers need to be able to find and reuse the preserved content within the PWA. The archive adds metadata to the retrieved content to enhance its discoverability. Furthermore, search tools improve the usability of the archival content.

Trustworthiness—The stored AIPs of the PWA can be used as evidence in court to depict the state of a webpage in the past. The archive also provides access for universities and other HEI to retrieve data for further research. The collaboration with public organisations require trust in the PWA.

A.2.3.11 Collaboration and organisational boundaries

Figure 36 shows a visualisation of the relationships of the web archive with service suppliers and customers. The archive uses service providers outside their organisation for hardware and software. The web page owner can also be seen as external service providers. Internal services include, amongst others software development and storage. The primary customers of the archive are outside the organisation, namely universities and public organisations.

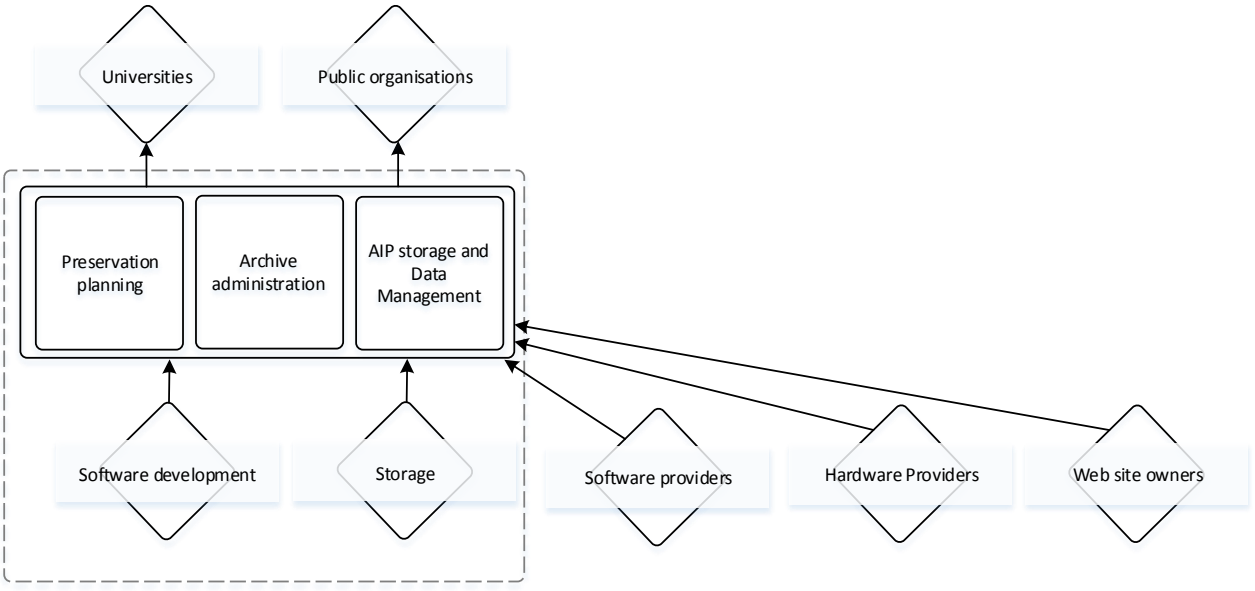

Figure 36—Collaboration and organisational boundaries of the Portuguese web archive

A.3 Commerce

Two business services are described in this section. The first shows the business model of a consulting service in the area of digital curation, while the second one demonstrates it for a digital repository solution.

A.3.1 Consulting services on ISO 16363 (Keep Solutions, Portugal)

KEEP SOLUTIONS[40] is a company that provides advanced services for managing and preserving digital information. The company began its activity in 2008 and attained the status of spin-off of the University of Minho. It is an enterprise that maintains close ties to research centres and departments of this university.

KEEP SOLUTIONS provides a wide range of products and services to support the creation of digital archives/repositories, museums and libraries. Its main services consist of the design and development of information management systems, consulting, research, and training. Its main clients are located in the public and educational sectors, for example ministries, archives, museums, institutes, military, local government, academic institutions, and foundations.

KEEP SOLUTIONS also carries out research in close collaboration with national and international organisations such as the Technical University of Vienna, the Austrian Institute of Technology, Microsoft Research, the Technical University of Berlin, The University of Manchester, University Pierre and Marie Curie, the British Library, the Austrian National Library, the Danish National Library, the Portuguese National Archives, Danish National Archives, amongst others.

The work carried out at KEEP SOLUTIONS is supported by the following value propositions:

- **Quality of service**—At KEEP, the customer always comes first. The management system ensures maximum customer satisfaction through a policy of continuous improvement, constantly striving to optimize processes and eliminate potential points of failure that may lead to client dissatisfaction.
- **Transparency**—KEEP advocates a policy of full transparency in relation to our processes, services, and methods of operation. An example of this value at work is visible in the way KEEP acts and communicates. We always use a straight and clear language so that the message we are trying to communicate can be understood by everyone.
- **Scientific and technical excellence**—The staff is made exclusively by graduated employees with an average age under 30. Being excellent is a requirement to work in KEEP. The company seeks to promote a culture of lifelong learning, as evidenced by the number of employees who participate in research projects, master and doctoral programs.
- **Creativity and innovation**—Creativity and innovation are part of the company's DNA. KEEP has an innovation department responsible for capturing internal knowledge and managing external sources of relevant information. It ensures knowledge is spread quickly and effectively across all employees through a process called "positive contamination". Ideas and designs for new products are generated in formal meetings where everyone is encouraged to participate.

[40] http://www.keep.pt/?lang=en

In 2007, the Trustworthy Repositories Audit & Certification: Criteria & Checklist report was published. This document, generally known as TRAC, aimed at setting the requirements to assess the ability of a digital repository to store and ensure the continued access to digital collections. In June 2012, TRAC has been promoted to international standard, having been improved and republished under the name ISO 16363—Audit and certification of trustworthy digital repositories (ISO 2012). The implementation of ISO 16363 enhances trust among repository stakeholders (such as producers, consumers, operators, managers, etc.) and is crucial for the establishment of a climate of transparency regarding the underlying processes that support the digital repository. This assessment framework identifies and defines the requirements that a digital repository should warrant to be considered a "trustworthy" repository. The organisation responsible for a trustworthy repository must be able to demonstrate that it has all the necessary procedures in place to identify and mitigate threats to digital information. These threats may be different in nature (for example organisational, financial, technological, social, physical, environmental, and so on) so activities such as monitoring the repository environment, preservation planning, system maintenance and financial sustainability are constant concerns of any person that takes responsibility for a digital repository.

Based on their extensive experience and know-how in the field of digital preservation, KEEP SOLUTIONS provides a set of consultancy services for the implementation of the ISO 16363 standard. Among these are the diagnosis of compliance, internal audits to repositories and preservation processes, advising on the acquisition of necessary services and systems, and so on. The business model canvas for the consulting service is shown in Figure 37.

<table>
<tr>
<td rowspan="2">KEY PARTNERS
National certification agencies

International Organisation for Standardization

Network of preservation experts</td>
<td>KEY ACTIVITIES
Diagnosis

Actions planning

Implementation of actions

Internal audits</td>
<td rowspan="2">VALUE PROPOSITIONS
Better preservation services

Trustworthiness

Certified preservation services

Evidence-based digital preservation

Best-practice

Institutional prestige

Training</td>
<td>CUSTOMER RELATIONSHIPS
Presale: website, newsletter, TAB magazine, meetings with clients, customer references, marketing, participation in events

Aftersales: on-site consultancy services</td>
<td rowspan="2">CUSTOMER SEGMENTS
Repository owners

Data centres

Organisations that do digital preservation</td>
</tr>
<tr>
<td>KEY RESOURCES
Human resources

ISO 16363 standard</td>
<td>CHANNELS
Website

Newsletters

TAB magazine

Customer references

Advertising and participation in events

Social networks</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Human resources

Marketing

Event participation</td>
<td colspan="2">REVENUE STREAMS
Consultancy services

Internal audits</td>
</tr>
</table>

Figure 37—Business model canvas of KEEPS consulting services for ISO 16363

A.3.1.1 Value propositions

Establishing trustworthiness of digital repositories is of major concern to the digital preservation community as it makes threats and risks within a digital repository understandable. There are several approaches developed over recent years on how to address trust in digital repositories. The most notable one is the Trustworthy Repositories Audit and Certification (TRAC), which has later been promoted to an ISO standard by the International Standards Organisation (ISO 2012). The standard comprises of three pillars: organisational infrastructure, digital object management, and infrastructure and security management and for each of these it provides a set of requirements and the expected evidence needed for compliance.

Based on its experience and know-how in the field of digital preservation, KEEP SOLUTIONS provides a set of consultancy services for the implementation of the ISO 16363 standard. The goal of the service is to increase the maturity level of a repository in terms of its preservation capabilities, thus making it ready to face a complete certification process according to ISO 16363.

A.3.1.2 Customer Segments

Customer segments for this service are organisations that have an intrinsic or extrinsic need to keep digital information accessible for long periods of time (in other words more than 7 years). For the sake of this exercise we have selected the following customer segments:

- Digital repository owners (such as Universities that own an institutional repository)
- Data centres (such as large facilities that produce or host data)

- Organisations that hold digital information of any type and need to keep it accessible and authentic for long periods of time (such as e-accounting, digital archives, etc.)

All the identified customer segments share the need to keep authentic and accessible records of digital information.

A.3.1.3 Customer Relationships

Being a consultancy service, customer relationships are very close and interactive. Interactions are carried out in face-to-face meetings and also through e-mail conversations. Privacy is always a concern, so in certain cases a non-disclosure agreement is signed between both parties.

The process involves collecting evidence from the client that the requirements of the standard are met. Sometimes training is necessary to fine tune the terminology and raise the level of understanding of the client.

A.3.1.4 Channels

Normal communication channels of promotion include the company's Website, newsletters (sent to selected targets), TAB magazine (a monthly e-zine that delivers news about technology, archives and libraries, where product placement is done), face-to-face meetings with potential clients (when requested by them), and standard marketing operations through sponsoring professional gatherings or doing presentations in major scientific events.

Post-sales channels include e-mail, mailing lists, telephone, Skype and face-to-face meetings.

A.3.1.5 Key Partners

The effectiveness of the consultancy services depends of the existence of a well-established network of experts and partnerships with key stakeholders.

One type of relevant stakeholders is national certification agencies. The long-term goal of the consultancy services is to allow clients to obtain certification for their repository operations. ISO 16363 is a fairly recent standard, therefore all national certification bodies are capable of carrying out audits and issue certifications on this domain. In order to instigate the certification process it is necessary to do some liaison, training and lobbing.

Another key partner is the International Organisation for Standardization (ISO). Service providers must be aware of any changes made to the standard and when necessary participate in the revision process.

Preservation experts can be considered as key partner. In order to deploy consultancy services at a national or international level, trained preservation experts must be identified and their availability at any given time must be known. Having a well-established network of experts enables the quick set up of the consultancy service over a large geographic area.

A.3.1.6 Key Activities

Key activities inherent to this service are:

- **Diagnosis**—A preliminary assessment to determine the level of compliance of the repository with the ISO 16363.
- **Action plan**—Development of an action plan aimed at increasing the compliance of the repository with the ISO 16363 standard.
- **Implementation of actions**—Implementation of actions reported in the action plan.

- **Internal audit**—Internal audit to the repository, inner processes, infrastructure and software to ensure that they meet the requirements of the standard.
- **Audit report**—Final audit report where we report all the non-conformities detected, as well as potential improvement suggestions.

A.3.1.7 Key Resources

Being a consultancy service, the know-how of the human resources assigned to the project is crucial for the success of the operation. The ISO 16363 standard is also a key resource.

Internally, KEEP SOLUTIONS has created assessment templates and training materials that help the customer understand the procedures and all the involved concepts.

A.3.1.8 Cost Structure

The cost structure of this service includes the costs of the service itself on an hourly rate and the costs of overhead (marketing, sales and other internal support processes). Overhead costs are around 35%.

Service costs depend on the complexity of the project, amount of travelling and consultancy effort. This depends of number of people that work in repository, size of the repository in GB, and complexity of the infrastructure.

A.3.1.9 Revenue Streams

In this particular service, revenue streams are direct and associated with the delivery of service itself. Human resources assigned to the project are priced by the hour. The price per hour is higher than the costs of the operation, as the service provider is a profit-driven company.

A.3.1.10 Benefit/Indirect economic determinant as part of the value proposition

Trustworthiness is the most relevant value proposition in this business case. KEEP SOLUTIONS is not a certification body. Instead, they provide best practice and counselling to repository owners in order to increase their level of compliance with the ISO 16363 standard, thus making them ready to be audited by an official certification body.

Another important indirect economic determinant is the improvement of **skills** of the client's staff. A certification process is always a learning exercise—new skills are acquired as new processes are implemented or existing ones are enhanced by improvement actions, thus resulting in greater **quality of service** (in other words, continuous improvement).

The service also focuses on **risk management.** Institutions that acquire this service will be able to manage their intrinsic risks related to data safety more effectively. **Transparency** also plays an important role in ISO 16363. This indirect economic determinant is always associated with trustworthiness. The consultant is seen as are more trustworthy if they display a posture of transparency in front of our stakeholders.

A.3.1.11 Collaboration and organisational boundaries

Figure 38 illustrates the collaboration and partnerships for the consulting services. Different external partners and services are used to provide the consulting services, such as international standardization organisation and a network of domain experts. The consulting service is used only by external customers.

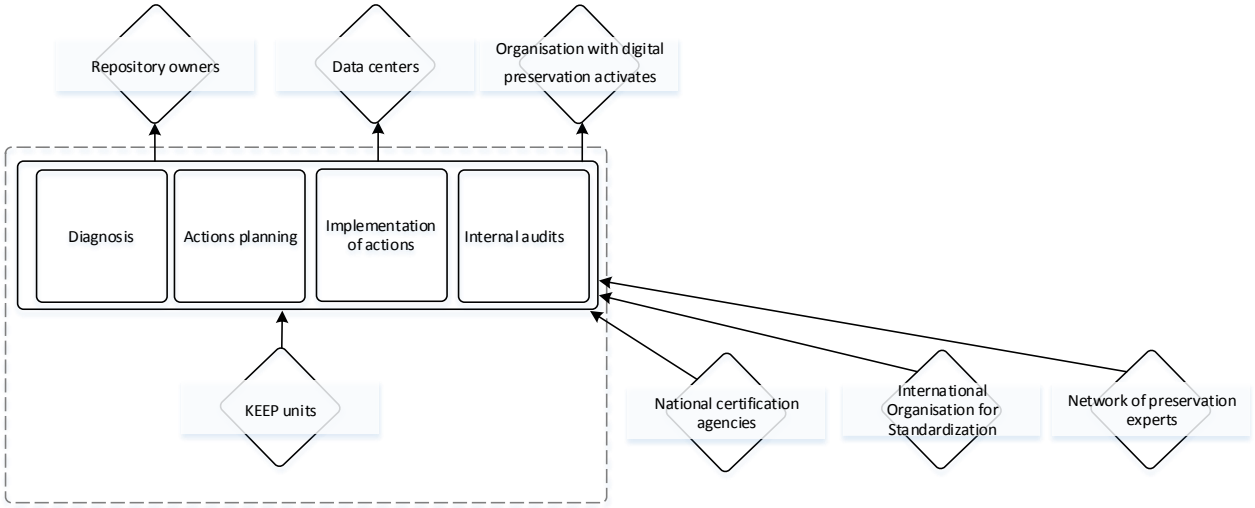

Figure 38—Collaborations and organisational boundaries of the KEEP SOLUTIONS consulting service

A.3.2 RODA repositories (Keep Solutions, Portugal)

KEEP SOLUTIONS is a company that provides advanced services for managing and preserving digital information. The company is introduced in Section 0 presenting their business service and value propositions.

KEEP SOLUTIONS provides services for RODA[41], a digital repository solution that delivers functionality for all the main units of the OAIS reference model (CCSDS (Consultative Committee for Space Data Systems) 2012). The business model canvas of RODA is shown in Figure 39. The product can be adapted according to customers' requirements and is compliant with existing standards (e.g. OAIS, METS, EAD, PREMIS and ISO 16363).

[41] http://www.roda-community.org

<table>
<tr>
<td rowspan="2">KEY PARTNERS
Community developers

Cloud service providers

Users and customers (for feedback and roadmap definitions)

RODA executive and technical boards</td>
<td>KEY ACTIVITIES
Software development

Marketing

R&D</td>
<td rowspan="2">VALUE PROPOSITIONS
Capability to preserve digital assets for long periods of time

Active digital preservation

OAIS compatibility

Ability to inspect and change the source code (i.e. supported by open-source technologies)

Compliance with existing standards, e.g. OAIS, METS, EAD, PREMIS and ISO 16363.

Adaptable ingest workflows

Ability to maintain authentic digital records

Integration with 3rd party systems</td>
<td>CUSTOMER RELATIONSHIPS
Presale: RODA community portal, vendor website, mailing lists, TAB magazine, meeting with clients, customer references, promotional events

Aftersales: helpdesk, phone, e-mail, client satisfaction surveys</td>
<td rowspan="2">CUSTOMER SEGMENTS
Large memory institutions

Universities

Government

Media firms

Any organisation where digital information is a valuable resource</td>
</tr>
<tr>
<td>KEY RESOURCES
Human resources

Digital preservation standards</td>
<td>CHANNELS
Website

Newsletters

TAB magazine

Customer references

Advertising and participation in events

Social networks</td>
</tr>
<tr>
<td colspan="3">COST STRUCTURE
Human resources

Hosting

Marketing

Event participation</td>
<td colspan="3">REVENUE STREAMS
Branding and design

Installation and configuration

Data migration

Training

Feature development

Maintenance and support

Hosting

Funding for R&D (FP7)</td>
</tr>
</table>

Figure 39—Business model canvas for RODA repositories

A.3.2.1 Value propositions

The main value propositions associated with this product are:

- **Conforms to open standards**—RODA follows open standards using EAD for description metadata, PREMIS for preservation metadata, METS for structural metadata, and several standards for technical metadata (for example NISO Z39.87 for digital still images).
- **Vendor independent**—RODA is 100% built on top of open-source technologies. This means that customer may use the hardware and Linux distributions that best fit the institutional needs.
- **Scalable**—The service-oriented nature of RODA's architecture allows the system to be highly scalable, enabling the distribution of the processing load between several servers.

Furthermore, current development is underway to enable RODA's preservation actions to be run over Hadoop[42] clusters for even higher performance.

- **Embedded preservation actions**—Preservation actions and management within RODA are handled by a task scheduler. The task scheduler allows the administrator to define the set of rules that trigger specific actions and when these should take place. Preservation actions include format conversions, checksum verifications, reporting (to automatically send SIP acceptance/rejection emails for example), notification events, and so on.
- **Authenticity**—RODA uses preservation metadata (PREMIS) to create a trust chain between all format migrations and content verifications. The preservation metadata, together with the establishment of trust of its surrounding environment (ISO 16363)[43] ensures reliability of the service and authenticity of the enclosed digital records.
- **Support for multiple formats**—RODA is capable of ingesting and normalizing (according to the preservation plan in place) text documents, raster images, relational databases, video, and audio. A plug-in mechanism enables RODA to support additional formats easily.
- **Copes with the rapid changing nature of technology**—The plug-in and task scheduling mechanism provides an easy way to add more functionality to the system (for example new preservation events, alerts, tools, etc.). Also, the service-oriented architecture allows RODA base components to be updated incrementally, allowing a heterogeneous use of technologies at all levels: hardware, operating system and applications.
- **Advanced access control**—Users must be authenticated before accessing the repository. All user actions are logged for future accountability. Permissions are granular and can be defined at repository level, all the way down to individual data objects.
- **Integration with 3rd party systems**—RODA exposes all its functionality by means of Web Services. Convenient Java libraries are available to allow developers to interact with RODA via its Core APIs. Several tools exist to create and manipulate the SIPs and submit them to RODA's ingest workflow.
- **Advanced ingest workflow**—RODA supports the ingest of new digital material as well as associated metadata in 4 distinct ways:
    1. online submission (self-archiving)
    2. off-line submission using an client application called “RODA-in” (off-line self-archiving)
    3. batch import by depositing SIPs via FTP or SMB/CIFS, and
    4. integration with third-party document management software via invocation of SOAP Services or client API.

A.3.2.2 Customer Segments

RODA is a powerful digital preservation system that implements several security layers and heavy processes such as checksum verification, virus check, format normalisation, representation viewers, etc. Because of this, the infrastructure necessary to support the system is composed of several servers and large storage appliances.

[42] https://hadoop.apache.org

[43] http://www.roda-community.org/trustworthiness-certification

RODA is mostly targeted to the following customer segments:

- Large memory institutions (for example national archives)
- Universities
- Government (central or local)
- Media firms that host large volumes of digital data
- Any organisation where digital information is a valuable resource that needs to be accessible for large periods of time

A.3.2.3 Customer Relationships

In an implementation service effective communication between the service provider, end-users and the IT staff if fundamental. Cooperation is important for a successful implementation. Relationships are carried out in face-to-face meetings, but also through mailing list conversations and telephone services such as Skype.

Generally, a primary contact is selected for liaison between all the involved parties. These people are responsible for keeping an open dialog and take decisions that influence the progress of the project.

A.3.2.4 Channels

Communication channels for promotion include the website (both the company's website and the product website[44]), newsletters (for selected targets), TAB magazine (a monthly e-zine that delivers news about technology, archives and libraries, where product placement is done), face-to-face meetings with potential clients (when requested by these), and standard marketing operations through sponsoring professional gatherings or doing presentations in major scientific events.

Post-sales channels include e-mail, mailing lists, telephone, Skype and face-to-face meetings.

A.3.2.5 Key Partner

Open-source projects are typically not governed by a central entity or group of people. They usually evolve in a semi-controlled form, driven by the common wishes of its own community of users and developers. However, in order to build such a community, core people must exist so that the project can start, prosper and grow. For that reason, RODA is governed by an Executive and a Technical coordination board. The Executive board is composed of a small group of people responsible for establishing the mission and the vision of the product. The approval of the roadmap for each major version of the software is one of the main responsibilities of this board. The Technical coordination board is composed of a group of developers and project managers responsible for defining the roadmap of the product, and validate source-code developed by third parties.

Open source products are mostly driven by the common requirements of users and customers. They provide valuable feedback to developers and product owners, which help them to shape the future of the product. Another key stakeholder are community independent developers that provide bug fixes and enhancements to the product.

Finally, hardware vendors and cloud providers are key partners in deployment process. Having those pre-identified and assessed may save a lot of inconveniences and time during an implementation project.

[44] http://www.roda-community.org

A.3.2.6 Key Activities

The implementation process of a RODA instance is usually accompanied by the following set of key activities:

- **Branding & design**—This service encompasses the development of a design proposal to adapt the software to the graphical identity of the client institution. It also includes all the necessary work to implement the approved design in the software.
- **Installation & configuration**—This service includes the analysis of requirements from the client, and the correct installation and configuration of the whole system in the production site, this being at the client location or in the cloud.
- **Training**—The training course for users of the product will be undertaken on-site at the client's location. Certificates of participation are awarded to every participant.
- **Data migration**—This service entails the extraction, transformation and transfer of data from legacy systems to the newly implemented system. The data migration service follows a well-established methodology[45] that ensures predictability and the success of the migration process.
- **Maintenance & support**—This service encompasses the diagnosis and resolution of problems, user support, and changes to the system's settings in order to cope with modifications in its execution environment.
- **Feature development**—This service consists of the analysis and development of new software features in order to cope with additional client requirements, for example development of modules to interoperate with existing systems in the organisation.

A.3.2.7 Key Resources

RODA is an open-source product and, as such, relies upon human resources for the implementation, development and training aspects of the product.

Infrastructure is also a key resource, but in most cases this is provided by the end-customer.

A.3.2.8 Cost Structure

The cost structure for this service involves the costs of the services hired by the client, and the providers overhead (such as the costs of marketing, sales, and other internal support processes).

Service costs depend on the size and complexity of the project and are determined on a case by case basis. Each individual service has an associated fixed cost. However, the distance and number of visits to the client may have a considerable influence on the overall cost.

There are different cost rates per role. Managers tend to be more expensive than developers. Consultants and trainers are usually the most expensive roles.

A.3.2.9 Revenue Streams

In this particular business case, revenue streams are directly associated with the appointed services. The cost of the project depends on the amount of services and effort involved.

The total price of the service is higher than the costs of the operation, as KEEP SOLUTIONS is a profit-driven organisation.

[45] http://www.keep.pt/servicos/migracao-de-dados/?lang=en

A.3.2.10 Benefit/Indirect economic determinant as part of the value proposition

Some of the indirect economic determinants associated with the implementation service of RODA and associated services are:

- **Authenticity**—The RODA repository system implements a set of internal procedures and preservation metadata that ensure that ingested data remains authentic throughout time.
- **Efficiency**—RODA comes with several internal preservation processes that make information management and long-term accessibility easy and efficient. For example, formats are automatically normalised during ingest according to the pre-installed preservation plan, and internal monitoring procedures notify managers if a file unexpectedly becomes corrupt. All of these automatic procedures make digital preservation procedures efficient.
- **Transparency**—RODA internal procedures are transparent to its users. All actions performed on digital representations are recorded as PREMIS events, which can later be inspected by end-users on the graphical user interface of the repository system.

A.3.2.11 Collaboration and organisational boundaries

The collaboration of service providers for the business service of RODA is shown in Figure 40. Cloud providers services of are used for operating RODA. The contributions from community developers and the feedback from users and customers are vital partnerships of this business model canvas. All users of the service are external customers outside KEEP SOLUTIONS.

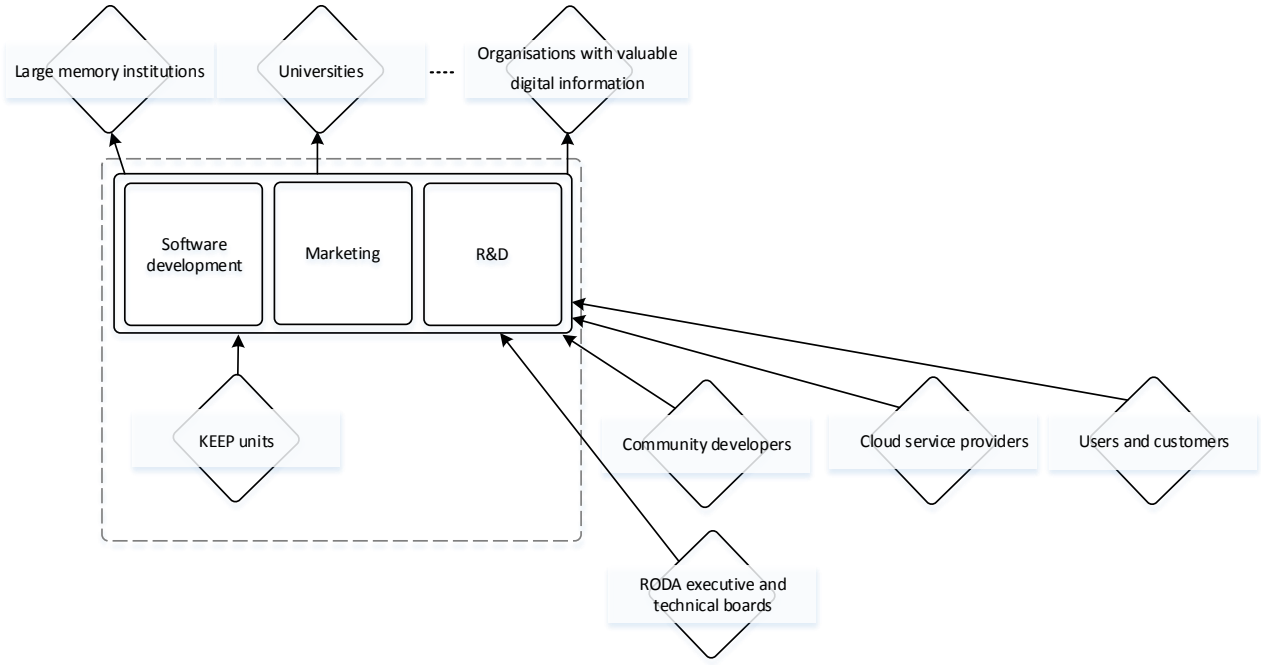

Figure 40—Collaboration and organisational boundaries of the RODA repository