Evaluating the benefits of the WHELF consortial approach to a library management system (LMS)

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Contents

Executive Summary

Background

In 2016, following a large-scale EU procurement, the Wales Higher Education Libraries Forum (WHELF) successfully completed the implementation of a library management system (LMS) and discovery interface, Ex Libris's Alma and Primo applications respectively, across 11 institutions.

The 11 WHELF institutions operating a common cloud-hosted platform comprise:

- Aberystwyth University

- Bangor University

- Cardiff Metropolitan University

- Cardiff University

- Welsh National Health Service Libraries

- Wrexham Glyndŵr University

- National Library of Wales (Wales's legal deposit library)

- Royal Welsh College of Music and Drama

- Swansea University

- University of South Wales

- University of Wales Trinity Saint David

Prior to the implementation of Ex Libris's Alma and Primo products, these same institutions operated six different library management systems and a range of proprietary and open source discovery interfaces. This limited the opportunities open to WHELF in delivering its mission '*to promote library and information services co-operation, to encourage the exchange of ideas, to provide a forum for mutual support and to help facilitate new initiatives in library and information service provision*'.

The procurement and implementation of a common library management system and discovery interface across these WHELF institutions was supported by a Joint Information Systems Committee (Jisc) funded feasibility study (Jisc, 2013), which highlighted the anticipated benefits from pursuing the procurement, implementation and operation of a single library management system.

These anticipated benefits included financial savings as well as opportunities to collaborate across a range of activities, from training to service delivery.

Further information on the background to WHELF's approach, including the anticipated benefits which underpinned institutional business cases, and the wider library management system environment are provided in ***Chapters 1*** and ***2***.

Introduction

In June 2016 Jisc funded an independent evaluation of the WHELF Shared Library Management System project to '*understand and identify the benefits of the WHELF LMS within a structured framework*'. Cambridge Econometrics (CE) was commissioned to carry out the project.

CE completed the final report in September 2017 based on a range of data, including costs associated with legacy systems and the actual costs for procuring and implementing the selected system. A further factor in determining benefits was the predicted costs for counterfactual scenarios which, in most cases, would have seen institutions procure systems separately and not as part of a consortium.

The focus of the CE report is on quantitative data.

The first task was to develop and present the framework in which to understand and identify the benefits of the WHELF project. *Chapters 3* and *4* and *Appendices A-E* provide further information on the approach and methodology adopted by CE.

Three complementary case studies carried out by WHELF provide further institutional insights on a range of other benefits achieved through the process of procuring and implementing as a consortium.

The case studies were from Cardiff University, the National Library of Wales and the University of Wales Trinity Saint David.

The case studies are published by WHELF to accompany the Cambridge Econometrics report, and some highlights are included in this executive summary.

Highlights from the Cambridge Econometrics report

Chapter 5 sets out the quantitative benefits accruing from WHELF's consortium approach to procuring and implementing a common library management system and discovery interface.

Lower costs for purchasing an LMS

WHELF achieved lower supplier costs by around **£76,000 in 2015/16 and £150,000 in 2016/17**, compared to the estimated purchasing costs in the counterfactual. Moving ahead, core subscription costs are expected to continue to be lower from operating as a consortium.

Lower costs for procurement

By sharing one procurement office, cost savings of around **£55,000** were achieved through procuring as a consortium, compared to predicted costs in the counterfactual.

In addition, Cambridge Econometrics concluded that a consortium approach enabled institutions to produce a more comprehensive and robust set of requirements, drawing on the expertise and knowledge across WHELF.

High quality system for staff and users

The procurement delivered a high specification system across WHELF.

Smaller institutions benefited from operating as part of the WHELF consortium, because they were able to procure a higher-quality system and benefit from the added functionality and features of a more powerful LMS (to

improve delivery of library services and workflows for staff). Students using more than one institution's library benefit from a consistent interface.

Under predicted counterfactuals, some of these institutions would not have been able to afford the selected system and would have continued with their legacy systems.

Sharing expertise to develop functionality

Institutions faced lower costs for bespoke developments from operating as a consortium.

For example, the National Library of Wales delivered the bespoke development of a fully bilingual front and back-end interface available to all consortium members, with initial translation costs estimated at **£19,700**, enabling staff and users to access the system in Welsh and English. Other institutions looking to utilise the bilingual functionality were able to save on equivalent local development costs.

In addition, institutions benefitted by sharing knowledge and expertise and training through adopting a cohort approach to implementing the system across WHELF.

However, it is recognised that implementing a new and functionally rich system required significant training across all institutions, and that in the short term, training costs would likely have been higher in the WHELF instance for some institutions (particularly those which would have continued with a legacy system under the predicted counterfactual).

Shared platform

WHELF members recognise the potential for deeper and wider collaboration, which is enabled through operating across a shared LMS, including around the key functional areas of cataloguing, analytics and resource sharing.

In addition, there are ongoing opportunities to share training, service developments and to lobby suppliers for functional enhancements.

Project management costs

The report recognises that implementing a new system generated additional project management costs at local and consortium level, but for many institutions, these decrease noticeably post-implementation.

At local level, costs were higher for some institutions than in predicted counterfactuals but lower for others.

At consortium level, the additional costs for a programme manager to coordinate activity across the consortium were mitigated in part by funding from external sources, including the Welsh Government.

Highlights from the WHELF Case Studies

Case studies for Cardiff University, the National Library of Wales and the University of Wales Trinity Saint David were completed by WHELF.

Better integration with other key IT systems

The new system facilitates better integration with other institutional IT systems. This is enabling Cardiff University, for example, to automatically update student data to the Alma patron database and the National Library of Wales to improve single sign-on functionality for patrons.

Flexibility of web-based system

The move to a cloud-based system has provided greater flexibility of interfaces, with access to the system no longer restricted to PC systems only.

In addition, Cardiff University has reported more manageable and less disruptive system upgrades.

Up-to-date reporting

The provision of analytics tools enables institutions to streamline workflows. For instance, at the University of Wales Trinity Saint David, analytics reports and dashboards have enabled staff to trace lost items and library staff to monitor activity more consistently.

Shared training and expertise

All three case studies mentioned that the sharing of expertise and knowledge across the consortium yielded benefits. The consortium approach provided new opportunities for training, and allowed the possibility of sharing implementation experiences and expertise.

Culture of collaboration

All institutions recognise the increased networks and relationships engendered by participating in a high-profile project and the benefits that this brings to service delivery. Learning from other consortia has been particularly beneficial.

Recommendations for the Future

The report concludes, at *Chapter 6*, with recommendations for future evaluations.

Here, Cambridge Econometrics recognises that the primary focus of the current report has been the monetary benefits from WHELF's consortial approach and that non-monetary outcomes, such as more efficient service delivery and more visible and better collection access, are not fully explored. This also reflects the timing of the project, which was initiated before all institutions had gone live with the new system.

Cambridge Econometrics recommends that WHELF agrees a set of standard indicators and collects data for these metrics, in particular relating to maximising workflows (such as in cataloguing and acquisitions activities), the costs and benefits associated with bespoke developments, and the impact of a consortial approach in a cloud hosted environment.

1   Introduction

1.1   Background to the project

Collaboration in libraries

University libraries, research libraries and public libraries are increasingly adopting a collaborative approach to library management and library management systems (LMS). Collaboration in this domain has been identified as an option that can deliver major benefits for institutions, with many examples of large consortia in Europe and the US, such as LIBISnet and the Orbis Cascade Alliance, providing shared services through a common LMS.

Collaboration for specific activities in UK libraries is common, but LMS-based collaboration in the UK has been more limited and at a smaller scale. In 2013, Showers and Enright (2013) assessed the library systems landscape, and established a high level of "interest and involvement…in using shared services for operational purposes" (pg. 4), echoing the desire for increased collaboration. One recent example of LMS-based collaboration in the UK is the framework agreement implemented by the Scottish Confederation of University and Research Libraries (SCURL), which, through a joint procurement process, established a preferred list of LMS suppliers that suited their members' bespoke needs[1].

Other partnerships between libraries exist within the HEI and research libraries domain. Examples include:

- an exploration of collaboration opportunities in collection management between King's College London and Senate House Libraries of the University of London[2];

- the Drill Hall Library shared between Greenwich University, the University of Kent and Canterbury Christ Church;

- the collaboration between legal deposit libraries in the UK and Ireland through collaborative cataloguing, web archiving and the identifying and collecting of legal deposit material, print and non-print; and

- a pooled thesis repository developed between the White Rose Libraries (consisting of libraries of the Universities of Leeds, Sheffield and York).

The implementation in all these instances is varied and bespoke, depending on the purpose and specific objectives of each initiative.

Changes in the library management landscape

In parallel to the increasing appetite for collaboration, the requirements of library staff and end users are changing what institutions are looking for from their library systems. Showers and Enright remarked a new "vibrancy" in the landscape of library management systems that marked a change in culture from half a decade earlier in the same domain (p.4). The 2016 Library Systems Report (Breeding, 2016) provides some indication of the major trends in the past year in the US. The report noted an acceleration of US academic libraries adopting full web-based platforms with a cloud system. In addition, the report noted that community-based development strategies are considered

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[1] While the SCURL initiative explored the possible benefits of sharing, there was no development of a shared platform or any arrangement for service or data sharing.

[2] More details of the scheme can be found at https://kclshlccm.wordpress.com/2012/07/23/aims/.

as another source of major developments in the sector, as some institutions choose to opt for open-source systems.

The WHELF adoption of a new LMS as a consortium

Against this background, CyMAL (now the Museum, Archives and Libraries Division, MALD) produced a research, scoping and specification study on the feasibility of sharing a Library Management System, focusing on the "scale, timetable and detailed costs" (p.1, CyMAL; 2012). It provided a detailed description of the rationale and business case for a "shared LMS" (p.7, ibid.).

Subsequently, the Welsh Higher Education Libraries Forum (WHELF), with financial support from Jisc, explored the feasibility and suitability of a consortium approach to purchasing a next generation LMS system between its members[3] in the same year. A feasibility report (Jisc and WHELF, 2013) was published, outlining the authors' assessment of numerous options for updating the members' library management systems. The option deemed most suitable was a "consortium with governance" format. This format involves "a formal establishment of a consortia for both purchasing and ongoing management of a LMS" (p.26, ibid.), and a shared platform with institutional instances that could vary, tailored to the institution's specific needs. A procurement process was undertaken to choose a preferred supplier. This supplier delivered a LMS back-end, as well as a front-end (the discovery interface) for WHELF.

In June 2015, as part of the first cohort, Swansea University went live with the shared LMS. The rest of cohort one (the National Library of Wales, Aberystwyth University and the University of South Wales) soon followed. The remaining seven institutions went live in two cohorts. The last cohort implemented the LMS system in August 2016.

1.2   **Purpose of this study**

In this context, Cambridge Econometrics was commissioned by Jisc in June 2016 to understand and identify the benefits of the WHELF LMS within a structured framework, and identify how best to measure the benefits and the impacts of the WHELF LMS.

Approach to the study

The research was conducted through a combination of desk-based research, stakeholder engagements, workshops, primary data collection and quantitative analyses. As part of the project, Cambridge Econometrics (CE) held two stakeholder workshops in Wales to validate its findings and develop a data template for collecting primary data. Details of these workshops can be found in Appendix C and Appendix D. CE collected primary data through developing a data template, which institutions populated with data and the modelled counterfactual. These findings were used to inform the analyses of the estimated scale of cost savings to date (the results from this can be found in Chapter 5). The data and our findings were validated with peer reviewers from SCONUL, Jisc, and the WHELF Steering Group, and consolidated from further

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[3] More specifically, the institutions involved in the shared LMS programme are: Aberystwyth University; Bangor University; Cardiff Metropolitan University; Cardiff University, including Welsh NHS Libraries; Wrexham Glyndŵr University; National Library of Wales; Royal Welsh College of Music and Drama; Swansea University; University of South Wales and University of Wales Trinity Saint David.

stakeholder engagements at all stages of the project. This final report summarises the main findings from the study.

1.3   Structure of the report

Chapter 2 of the report presents the findings from the literature review on the benefits of the WHELF LMS. Chapter 3 introduces and describes the concept of the logic map, and applies the logic map approach to the WHELF LMS. Chapter 4 introduces a suitable framework for measuring the scale of impacts and the most feasible design in the context of WHELF. Chapter 5 summarises the quantitative analyses undertaken by CE using the framework, which focuses on cost savings for institutions to date. Chapter 6 provides additional guidance and immediate next steps for future analyses. Chapter 7 offers some concluding remarks.

2 Existing work on benefits

2.1 Introduction

WHELF's collective decision to migrate to a next generation LMS, and the adoption of the particular consortium approach that WHELF chose, were partly due to expectations that these arrangements would yield additional benefits for all participating institutions. The available literature provides some indication of the types of expected positive impacts that are likely to occur as a result of this setup.

This chapter explores the types of benefits that have been mentioned in the literature and provides a qualitative description of the expected future benefits specific to the WHELF case. Dis-benefits (in the form of additional costs) are then also briefly explored.

2.2 Benefits of collaboration and adopting a next generation system

One rationale for developing a consortial LMS is the benefits that such an initiative would yield for front-end users, institutional staff and institutions more generally. The literature on benefits predominantly focuses on expected future benefits from implementing a shared LMS. These can broadly be divided into two main categories:

- those arising from purchasing and implementing a next generation LMS; and,
- those arising from operating at a consortial level.

An article by Owen and Dalling (2016) provides an indicative "long-list" of the full range of potential benefits for the members. In the article, they report benefits arising from implementing a next generation LMS, such as:

- new features, such as the bilingual back-end interface;
- fewer system outages;
- operational cost savings;
- hardware cost savings; and
- improved workflows.

They also report benefits from operating on a consortial level, such as:

- decreased staff requirements for the procurement process;
- single search across library collections;
- supplier discounts; and
- enabling further collaboration.

(pp. 15-6, Owen and Dalling; 2016).

The consortial arrangement in Scotland provided many potential benefits

An article by Jisc et. al. (2013) considered the benefits of a shared LMS in Scotland. It identified a large range of key benefits for front-end users, including improved user experiences from greater visibility of Scottish collections, and an ability for an open-source system to provide greater flexibility and choice because of the resulting scale of expertise and support available (p.1). The report also identified key benefits for content, including savings on subscriptions and purchases of e-content, more available e-content for all front-end users, and more streamlined content management (p.1). Finally, benefits for the system included a shared procurement process providing greater bargaining power and the sharing of staff expertise and knowledge (p.2). The article explored the potential benefits of a shared LMS, some of which align with the expected benefits of the WHELF project.

Cost savings are an important benefit for consortial cloud setups

One recently-published report (van der Graaf, 2016) provided a detailed assessment of the costs of ownership of various multitenant cloud systems. The authors compared these costs with that of a conventional single instance library management system and of a conventional shared cataloguing system. Among its numerous findings, the study concluded that, in migrating to a multitenant cloud system, the technical and operational management costs may not decrease, but workflow efficiencies, enabled partly by a change in policy and workflow management, can be achieved.

In particular, one area in which important gains could be made is in Electronic Resource Management. The case studies showed that efficiencies could be achieved through integrating management information into one system, and improvements can be made in the discoverability of e-book and e-journal packages.

However, out-of-pocket costs may increase if institutions purchase additional features as a result of moving to the cloud system (such as a web-based discovery tool).

The impact of discovery services can vary and are difficult to measure quantitatively

In a related domain, Spezi et al. (2013) found that there was substantial heterogeneity in the impacts of resource discovery services (RDS) on usage across a range of metrics. They combined case studies with analyses of usage reports before and after the introduction of RDS to examine the potential impacts, noting any changes in trends.

Overall, they found limited impact of RDS on the usage of e-journals, an increase in e-book usage, and inconclusive evidence on the impact on databases (p. 54). Crucially, however, the authors acknowledged that there were a number of potential confounding factors, including the importance of contextual considerations within these institutions that may also have affected usage.

2.3 Realised and anticipated benefits from the WHELF implementation of the LMS

In the WHELF implementation, benefits and potential benefits have been identified across all the different phases of the project, from pre-procurement and procurement, to the purchase and implementation of the software. Specific benefits range from gains associated with economies of scale, such as obtaining discounts on the price of software and sharing of licensing, development, infrastructure and staffing costs; to improving end-user services,

such as the opportunity to create a "level-playing" field across all institutions in relation to the provision of common core functionality (p.12, Jisc and WHELF; 2013). Opting for a consortium with governance also enables future opportunities for sharing services across the institutions (p.27, ibid.).

Evidence of realised benefits

Given that the last cohort of members only implemented the WHELF LMS in August 2016, the initiative can be considered to still be in its preliminary stages. Evidence of realised benefits is therefore limited, and tends to be drawn from the pre-procurement, procurement and purchasing stages of the process. One prominent realised benefit from implementing the "consortium with governance" option is the savings in procurement costs. From acting as a consortium, individual institutions were able to pool staff resources. Cardiff University led the procurement for the consortium, and estimated that procurement costs for the shared LMS totalled £25,000 in 2014-15 (p.15, Owen and Dalling; 2016). Using this methodology, other WHELF members estimated that they each would incur savings of this scale from not having to expend equivalent procurement costs.

Better specifications were developed through acting as a consortium

Stakeholders at the workshop also indicated that members were able to develop a better specification of requirements from sharing and reviewing across the consortium. One example of this is in the development of Electronic Resource Management specifications; Bangor University was able to incorporate its understanding of the domain to advise in the pre-procurement phase.

Acting as a consortium increased institutions' collective bargaining power

Another realised benefit relates to the supplier discount. Through acting as a consortium, WHELF members were offered a higher discount on supplier goods and services (this was set out explicitly as an expectation during the procurement process in the tender). Supplier goods and services for which lower prices were offered included software licences; warranty maintenance and support; implementation services; training services; and other associated costs (such as additional configurations and a licence audit) (Bangor University, 2014).

Some benefits expressed in qualitative terms have also already been realised. Owen and Dalling (2016) cite the provision of a bilingual back-end system, an additional feature offered to the institutions as a result of procuring as a consortium.

Quantitative estimates of future benefits

Beyond realised benefits, some institutions also estimated potential future financial cost savings. Cardiff University suggested a saving of approximately £270,000 over a seven-year period, in migrating to a new shared LMS compared to a hypothetical situation where the institution continued with the old system, and an efficiency saving of staff time equivalent to 30% of a grade 7 FTE per annum (p.13, Owen and Stanley; 2014). Of the expected £270,000 in savings over the seven-year period, approximately £40,000 were expected to be hardware cost savings in the first four years of use (p.15 Owen and Dalling; 2016). Similarly, Cardiff Metropolitan University estimated a potential saving of £15,585 in the first year after implementation (p.9, Cáceres-Soto and Thomas; 2014).

Some institutions estimated that the introduction of the new LMS would generate additional financial costs

However, it is worth noting that some institutions anticipate an increase in total financial costs compared to the continued use of their current LMS software. Beyond the sizeable initial implementation cost (that would not have been necessary had they continued to use the legacy LMS software), Bangor University estimated that a single LMS instance within the consortium would cost £27,613 more on an annual basis (p.7, Bangor University; 2014). It is worth noting, however, that the main rationale behind the university's decision to opt for the consortium approach was the expected qualitative improvements to the system. Most notably, Bangor University highlighted the provision of a better discovery system for front-end users, and better integration with existing services. This highlights the primacy of the quality of service as a key driver behind the move to the new system.

2.4 **Concluding remarks**

Drawbacks with existing evidence on benefits

Previous work provides preliminary indications of the types of benefits expected from implementing a new LMS with consortial arrangements, but empirical evidence is scarce. Most of the evidence on identified benefits is still mostly qualitative. Where there has been quantitative evidence, a lack of detailed data, and the question of attributing causality, makes the evaluation exercise much more difficult. At the same time, the WHELF LMS is still in its early phases and so evidence on realised benefits is currently confined to benefits or costs measured to date.

In light of this, a more structured approach to measure and assess the benefits is useful. As a starting point for the benefits measurement and analysis, a logic map has been developed in order to understand, organise and model the process of implementing a LMS within WHELF. The logic map is presented in more detail in the next chapter.

3   The logic map approach

3.1   Introduction

Consistent with The Magenta Book (HM Treasury; 2011), and guidance on evaluating impact (Department for Business, Innovation & Skills (BIS), 2011), a "logic map" approach was adopted as a starting point to identify, explain and organise the theoretical understanding of the implementation of the LMS through WHELF. The logic map can provide a "consistent and systematic means to designing the evaluation, collating and analysing the existing evidence and the new data created, and generating and interpreting the results" (p.53, HM Treasury; 2011). Viewed from another perspective, the logic map offers an organisational and systematic framework for identifying and measuring the outcomes of the WHELF approach. Appendix A provides a more detailed explanation of the approach, as well as its application to the WHELF project.

3.2   The logic map approach

A conceptual diagram of the logic map is presented in Figure 3.1.

Figure 3.1: Structure of the logic map
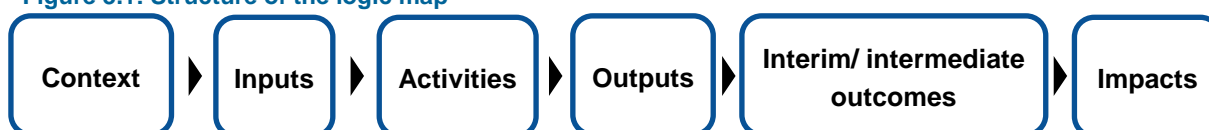
Source: Cambridge Econometrics.

Application to the WHELF project

The approach applied to the WHELF LMS project can provide a theoretical structure to organise and understand the different components of the initiative. The logic map applies to the consortium level, and, given the purposes of the project, focuses predominantly on the intermediate outcomes and impacts. Institution-specificities relating to their adoption of the WHELF LMS are also captured, albeit in less detail.

Mapping the structure of the logic map to the WHELF project:

- The **context** sets out the environment in which the LMS is implemented.

- The **inputs** cover the resources required to deliver the WHELF LMS.

- The **activities** describe how the inputs are converted to the outputs.

- The **outputs** of the WHELF LMS are, in the most basic terms, the provision of a new LMS for the institutions.

- The **intermediate outcomes** delineate the short- and medium-term expected results and gains from implementing the WHELF LMS.

- Finally, the **impacts** identify the wider, long-term aims and objectives of the WHELF LMS system.

CE's proposed representation of the WHELF LMS system can be found in Figure 3.2 and Figure 3.3**.** It should be emphasized, however, that the logic

map represents the **theoretical** outcomes and impacts of the project; these can encompass realised, anticipated, and possible future benefits.

The letters in Figure 3.3 denote the linkages between the different components of the logic map. The linkages can be thought of as the most likely mechanisms through which the WHELF LMS generates the outcomes and impacts.

For example, if there is a shared procurement process (output), then it is likely to lead to a higher quality service for front-end users (intermediate outcomes), because the institutions are able to obtain a system with more features at a lower cost. If a higher quality of service is being delivered to front-end users, then user satisfaction would be expected to increase eventually (impact).

Expected results of the project are categorised into intermediate outcomes and impacts

The logic map groups the expected benefits of the WHELF LMS project into (theoretical) intermediate outcomes and impacts. Intermediate outcomes are classed into broad categories, and are:

- **Monetary/financial outcomes**. Acting as a consortium could provide the scope for costs savings in areas such as procurement and library service developments.

- **Higher quality service from adopting a next generation LMS**. Institutions recognised that legacy systems were inadequate. Migrating to a next generation LMS system offered new options for institutions, including better collection management possibilities and better provision of library services for end users.

- **Outcomes beneficial at an institutional level, because of participation in a consortium**. The decision to adopt the consortium approach enabled some institutions, who would otherwise have migrated to a less-powerful LMS, to purchase a much more powerful LMS with increased functionality. This is true particularly for the smaller institutions, for whom it would have been unfeasible to have adopted such a powerful back-end system and front-end interface had they upgraded in isolation.

- **Pooling of information on library resource and use**. The consortium approach can offer further opportunities for collaboration, such as in the discovery options of library resources and use.

- **Higher volume of and better quality information available**. The next generation LMS can provide improved usage information and collection management tools, which has the potential to enable improved service delivery from better meeting the demands of library users.

- **Greater coordination through sharing information**. The consortium approach can facilitate better sharing of information and knowledge and foster opportunities for further collaboration.

These intermediate outcomes, under the right conditions, could deliver a range of impacts that align with the wider strategic objectives of institutions. Some of these objectives were highlighted in the business cases for the WHELF project. Specifically, through applying the WHELF consortium approach, the impacts that could theoretically arise are:

- better library management workflows for back-end staff; and

- improved service provisions and discovery options for front-end users.

Figure 3.2: Logic map for the WHELF single installation LMS (part A)

Context

• Institutions recognise the potential for efficiency savings from using next generation LMS software

• New features available in next generation LMS systems offer opportunities to improve library services

• Existing LMS systems used by institutions are considered inadequate

• There is a current lack of integration between printed collections and electronic resource

• There is an appetite for increased collaboration and risk within WHELF; there has also been a record/culture of successful collaboration within the consortium

• Precedence: there has been a history of shared LMS systems before across groups of libraries/ HEIs, and so WHELF are building on work previously done in other countries/institutions

• The Welsh government is keen for more collaboration opportunities among Welsh HEIs

• Shrinking university budgets

Inputs

Hardware (increased bandwidth requirements)

Infrastructure costs and maintenance costs

Software (systems)

Consortium governance staff
   Programme manager
   Steering group
   Management board

Funding, implementation and maintenance support (Jisc)

User feedback

Operational and procurement staff handling:
   Project manager tasks
   Pre-procurement tasks
   Procurement tasks
   Implementation tasks
   Operational tasks including:
      Library administration
      IT support
      External legal advice

Activities

Consortium-level activities

Governance and management team

Pre-procurement
   Procurement
      Purchase   Post-operational

Institution-level activities

Implementation
   Operational
      Post-operational

Tranche implementation

Staff training

Process and implementation refinements

Outputs

Source: Cambridge Econometrics.

Figure 3.3: Logic map for the WHELF single installation LMS (part B)

Activities → Outputs		Intermediate outcomes		Impacts

Outputs

Shared procurement process — A

Consortium-developed workflows, expertise and training procedures — B

System covering functions:
- Core LMS (circulation, cataloguing, serials management, patron management, acquisition, management information and inter library loan functions) — C
- Resource Discovery (incl. e.g. search across multiple resource formats) — D
- Open URL and Knowledge Base (for easy navigation to & desktop delivery of full text electronic resources) — E
- Consolidated search (searching across multiple data sources at once) — F
- Electronic Resource Management (assists in managing electronic subscriptions and information held by library) — G
- Joint analytics — H

With the features:
- Single installation based on cloud system — I
- Bilingual interface — J
- System able to be configured on a consortial basis — K
- System to be integrated to the greatest degree possible with minimal switching between differing product interfaces for key workflows — L

And potential development of:
- Consortial configuration e.g. analytics through network zone — M
- Top level 'bolt-on' software — N
- Collaboration apps — O

Intermediate outcomes

A, H, G, B — **Monetary/financial outcomes** — ε, η
- Reduced procurement costs (in terms of time/staffing requirements and effort)
- Savings from purchasing new LMS as a consortium
- Reduced hardware costs through operating a cloud hosted system
- Improved workflow generating improved efficiency, e.g. in management of e-resources (decreasing time spent by library staff on LMS administration)
- Shared costs of customisation and bespoke development.

A, B, O — **Higher quality service from use of next generation LMS** — β, α, ε
- Improved integration between printed collections and electronic resources
  - Reduced duplication of library management information
- A next generation LMS can be integrated more effectively with other key university business systems
- Flexibility of web-based system
- New skill requirements of LMS staff
- Fewer system outages from using a more resilient cloud-hosted system
- Open up collections for access

A, B — **Outcomes beneficial at an institutional level, because of participation in a consortium** — ε, η
- Smaller institutions can potentially expand their services
  - Better quality for a given/better price
- Reduce the risk of implementation overruns; reduction in mistakes of implementation

M — **Pooling of database of library resources and use** — α, γ, λ
- Improved potential for discovery
  - Improved visibility to all resources
  - Potential ability to search across collections in Wales from single point of entry.
  - Required and recommended reading materials available faster.

F, C — **Higher volume of and better quality information available** — α, γ, δ, ε
- Improved business intelligence:
- Up-to-date reporting on usage of collections and e-resources.
- Improved metrics for centralised resource management
- Shared management information and real-time analytics leading to improved service delivery
- Better collection development and management on a national level

A, C, F, B, J, H — **Greater coordination through sharing information** — λ, γ, η
- More detailed/better quality specification of the requirements
- Shared training and development of staff
- Options for additional features as part of consortial arrangements from increased buying power
- Increased influence in developments within the field
- Sharing of expertise and potential for sharing knowledge
- Sharing of best practice in management of library resources across consortium partners
- Potential for reciprocal arrangements for borrowing and licence management
- Improved prestige/status - as shop window for collections of interest

Impacts

α Improved front-end experience (leading to higher student/academic/other users' satisfaction)

β Improved back-end experience/workflows leading to higher staff satisfaction, and more staff time to devote to other projects

γ Enhanced institutional reputation leading to more student applications and bolstering success of Welsh universities

δ Enhanced libraries' reputation leading to increased usage of libraries and boosting cultural presence

ε Financial savings in LMS domain

η Increase collaboration within Welsh universities

θ Provide useful evidence of cross university LMS systems facilitating future implementations of shared LMS systems

λ Open collections up for wider (public) usage, boosting reputation of institutions and public knowledge

Source: Cambridge Econometrics.

3.3   Concluding remarks

This section provided a description of the logic-map approach applied to the WHELF case at the consortium level. The organising framework is helpful for structuring a method to conceptualise and analyse the WHELF project. It is designed to provide a succinct but informative summary in a standardised way that should be applicable to all institutions. It can also facilitate the categorisation of a range of benefits based on the expected outcomes and impacts.

In time, and on an institution-by-institution basis, the logic map may change, due to additional developments that may occur in the future, or because of specific decisions made by individual institutions. In explaining the different components of the logic map in a generalised way, it is hoped that WHELF will be able to continue developing the logic map for future evaluations.

4 A framework to evaluate the benefits of WHELF LMS

4.1 Introduction

The logic map approach enables a theoretical organisation of the expected benefits of the WHELF LMS. To proceed from this, it is necessary to develop a framework that facilitates the assessment of the extent to which the expected benefits were realised, as well as the scale of these benefits.

Although there is in theory a certain degree of flexibility to what frameworks can be chosen to assess the benefits, the requirements of each of these frameworks can vary greatly. Factors of consideration that may influence the framework choice include:

• the evaluation questions that the study is seeking to answer;

• the complexity of the logic model;

• the relevance and reliability of existing data (or the availability of resources to collect additional data);

• the measurability of outcomes; and

• time and resource availability[4].

These factors are considered in the context of the WHELF LMS and have partly informed the advocated approach in this study.

Overview of the section

The aim of this chapter is to present a framework that institutions and the consortium can adopt to quantitatively evaluate the scale of benefits of the WHELF LMS now and in the future (when a more complete picture of the full range of benefits is available). The recommended approach - the impact assessment framework - is consistent with the approach described in, for example, HMT (2003) and BIS (2011).

Within the impact assessment framework, there can be different designs, each of which is suited to different contexts according to the features of the policy, treatment, or programme that is being analysed. Depending on the context, different techniques may be possible, and different conclusions may be drawn. Furthermore, given particular evaluation objectives, it may be that some designs are stronger than others.

We firstly review what approaches have been adopted in the domain. We then describe the most robust design to explain conceptually what is achieved from adopting the impact assessment framework. We then assess the most feasible design possible in the WHELF LMS domain, as well as strengths and weaknesses associated with this design.

More details of the analyses undertaken, as well as more detailed explanations of the approach, can be found in Appendix B.

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[4] Adapted from The Magenta Book (p. 47, HMT; 2011).

4.2   **Existing approaches**

Based on the literature reviewed, there have not been many studies that aim to systematically evaluate or evince the scale of the benefits of implementing a LMS under a collaborative approach. Some alternative approaches have been adopted in related domains, but these approaches are considered unsuitable for assessing the WHELF project. More information on these approaches is available in Appendix B.

One recently published paper gives some indication of the approaches adopted to look at the benefits of cost savings.

Case study comparisons

A recent paper by van der Graaf (2016) explored the question: "what is the total cost of ownership of a cloud system in comparison with a conventional LMS?" (p.6). The study compared the costs of LMS across 14 institutions (of which some had migrated to cloud systems).

The case studies were chosen with a view principally to: compare libraries that use a cloud system with libraries that use a standalone LMS; and compare libraries that use joint cataloguing systems with libraries that use multitenant cloud systems.

Through disaggregating the different costs of the library (separated into cost of hardware and software and its technical management; operational costs; efficiency of the workflows; and long-term costs[5]), and examining each of these components in detail, the authors identified what the potential cost implications of migrating to a shared cataloguing system could be, and what the potential cost implications of migrating to a cloud system could be[6]. Gathering evidence from a wide range of experiences across different libraries, the authors of the study developed a general understanding of the mechanisms through which any identified benefits could be achieved.

High-level models

A tool developed for the higher education domain explores at a more general level the potential costs and benefits associated with sharing services across a variety of areas within institutions, covering a variety of qualitative and quantitative benefits. The Higher Education Realisation of Benefits interactive tool (HERBi) (Falmouth Exeter Plus and HEFCE; 2016) provides a method to analyse collaboration across a range of services, including library and ICT services. A framework is then applied to these services to assist users with analysing potential costs and benefits. Identified quantitative evidence within this framework include efficiency savings and economies of scale.

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[5] More detail on the definitions of these different components can be found in van der Graaf (pp. 8-9, 2016).

[6] Some of the conclusions of this study are described in Chapter 2.

4.3 Evaluating impact: true experimental and quasi-experimental designs

Impact evaluations examine the extent to which a policy caused the observed outcomes

According to BIS, "evaluation" can be defined as the retrospective analysis of a project, programme, or policy to assess how successful or otherwise it has been, and what lessons can be learnt for the future" (p.6, 2011). Impact evaluation is a specific type, which explores the extent to which observed results can be attributed to the project, programme or policy. In the context of the WHELF LMS, an impact evaluation should, as much as possible, ascertain the extent to which observed results can be attributed to the introduction of the WHELF LMS. The main evaluation question(s) of interest is the extent to which the identified expected benefits have been, or will be, realised.

The ideal experimental design

The design that facilitates a strong impact evaluation is the true experimental design, which is conceptually akin to a scientific experiment with

- random allocation of treatment; and

- adequate monitoring of outcomes before and after treatment for both the treated and untreated groups.

In the absence of the experimental design, quasi-experimental approaches can still attribute causality

Other, less robust, designs that try to attribute causality are available. Many of these are known as quasi-experimental designs, which rely on actual data that capture many of the features of a true experimental design, subject to a few simplifying assumptions. This is an approach commonly adopted in economic studies and evaluations.

4.4 Advocated approach for evaluations

However, in the context of the WHELF project, it is difficult to adopt an approach as robust as those highlighted in Section 4.3. Limiting factors in this context include:

- the identification of a suitable control group is prohibitively difficult;

- the mechanisms through which impacts come about from adopting the consortium approach can be conditional on many intermediate factors; and

- data collection efforts to date have been limited.

A more in-depth discussion of these limitations is available in Appendix B.

The "predicted vs. actual" evaluation design is recommended

In light of these limitations, CE's recommended impact evaluation approach is akin to the **"predicted vs. actual"** design (p.19, Campbell and Harper; 2012). In brief, the "predicted vs. actual" design relies on developing predicted outcomes against which actual outcomes can be compared. The predicted outcomes can be considered as the best estimates of what would have occurred in the absence of a "policy"; in this case, the "policy" is the collaboration approach.

The predicted counterfactual creates a hypothetical outcome of what would have occurred in the absence of the WHELF LMS.

Further refinements are necessary given the specific features of the WHELF project

However, there are contextual and practical difficulties associated with adopting the "predicted vs. actual" design for this project, and hence the scope of evaluation is refined further:

- The focus is on intermediate outcomes.

- The aim should be to isolate the most important intermediate outcomes across the long list of expected outcomes to focus on fewer evaluation objectives.

- Evaluations should aim to adhere to standard calculation conventions and existing data monitoring efforts to ensure internal and external validity of the results.

An explanation in further detail of the rationale for the refinements can be found in Appendix B.

4.5 Strengths and weaknesses associated with the approach

It is important to acknowledge the advantages and disadvantages of adopting the "predicted vs. actual" design. Any subsequent evaluation based on this technique should acknowledge the caveats and assumptions, as well as what the design is intended to achieve. Advantages include:

- The design focuses primarily on WHELF institutions

- The design extends beyond looking at the "before and after" outcomes of a WHELF LMS scheme.

- The approach is linked to simple monitoring efforts

- It is conceptually straightforward (and easy) to implement

Weaknesses associated with the approach include:

- The advocated design is "weaker/riskier" compared to those outlined in section 4.3 (p.17, Campbell and Harper; 2012).

- Data requirements remain substantial at present and in the future.

- Quantitative methods only capture specific outcomes of the project.

Case studies can help address some of the weaknesses associated with this approach.

4.6 Concluding remarks

The literature reviewed indicates that quantitative approaches to evaluate impact in the domain are relatively underdeveloped. Existing studies seem to use case studies as the main tool for assessing impact.

The "gold standard" of evaluation techniques is the experimental design (BIS, 2011), where randomly-selected treated and control groups are monitored, to

assess whether the outcomes observed in the treated group are caused by the treatment. In economic research, evaluations often use quasi-experimental approaches, which rely on situations that mimic the features of an experimental design to as great a degree as possible.

In the WHELF application, numerous difficulties limit the extent to which such designs can be adopted. Resultantly, a less robust but more feasible approach, the "predicted vs. actual" design, is advocated. Beyond the conceptual framework, additional refinements on the evaluation approach are expected to facilitate future assessments of impacts.

To demonstrate the use of the advocated approach, and to measure an aspect of the expected outcomes of the WHELF project to date, the next chapter focuses on an assessment of the cost savings that are estimated to have arisen from participating in this project so far.

5 The costs from adopting the WHELF approach

5.1 Introduction

The framework and evaluation design developed over chapters 3-4 provides a description of the types of benefits expected from the WHELF LMS project. A proportion of these expected benefits would be in the form of cost savings, which have resulted from factors such as more attractive costing propositions from suppliers, and efficiency savings through sharing knowledge and expertise. This section of the report assesses the extent to which these cost savings have materialised, and provides estimates of the scale and value of any cost savings to date[7]. Overall, our analyses show that service subscription costs were substantially lower from operating as a consortium, compared to the predicted counterfactual.

Collecting primary data to assess monetary impact

The analysis in this chapter is consistent with the recommended approach described in the previous chapters. Primary data were collected from institutions, based on metrics developed to capture monetary data on different processes in the WHELF LMS project and the institutions' previous legacy systems. More details on the approach to collecting the data, as well as the methods, definitions, assumptions and calculations used to estimate and standardise the data, are outlined in Appendix E.

Section 5.2 frames the advocated approach in the context of monetary costs in this chapter. Section 5.3 provides summary information on what institutions would have sought to do in the absence of the WHELF LMS project. Section 5.4 provides some summary information on the scope of the WHELF LMS project. Sections 5.5-5.8 provide a breakdown of estimated costs so far in WHELF LMS project, including an assessment of the extent to which institutions experienced lower costs against their predicted counterfactuals. Section 5.9 offers concluding remarks.

5.2 Applying the approach to realised cost "savings"

The scope is to assess monetary costs, over 2011-17

The framework described in the previous chapters (and elaborated further in Appendix A and Appendix B) is used to assess the extent to which institutions face lower costs under the WHELF LMS case compared to their predicted counterfactual case (by comparing actual costs under the WHELF LMS with institutions' best estimates of what their costs would have been had they not proceeded with the WHELF LMS). The time period under consideration is 2011-17; from 2011 onwards, some institutions anticipated that the counterfactual would have differed in the absence of WHELF, as they would have upgraded their system to an earlier timeline.

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[7] The last institution went live with the next generation LMS in August 2016, and hence some outcomes are unlikely to be realised yet.

Applying the approach in practice

Figure 5.1[8] can help explain the application of the approach and the analysis undertaken. Data on costs were collected from institutions on the observed outcomes (represented as the solid (blue) line in the graph). In addition, institutions were asked to provide a best prediction of the counterfactual instance (represented as the dashed (blue) line in the graph). The quantitative distance between the lines (represented by the shorter arrow) therefore provides an estimate of the impact.

It should be emphasised that the approach adopted in this instance does not strictly measure the "cost savings" or the "impact" of the WHELF LMS. These terms imply a level of causality that cannot be ascertained from measuring the differences between the predicted and actual outcomes of the WHELF LMS project. While extensive time and effort had been dedicated to ensuring a counterfactual as close to what would have otherwise happened, it is nonetheless a weaker approach, and lacks robustness compared to other, stricter designs (which are not feasible in this instance).

Nevertheless, for brevity and ease of communication purposes, the difference between the predicted data and the actual outcomes are at times referred to as the "estimated costs savings" for the remainder of the chapter.

Figure 5.1: Considering the implications of counterfactual developments
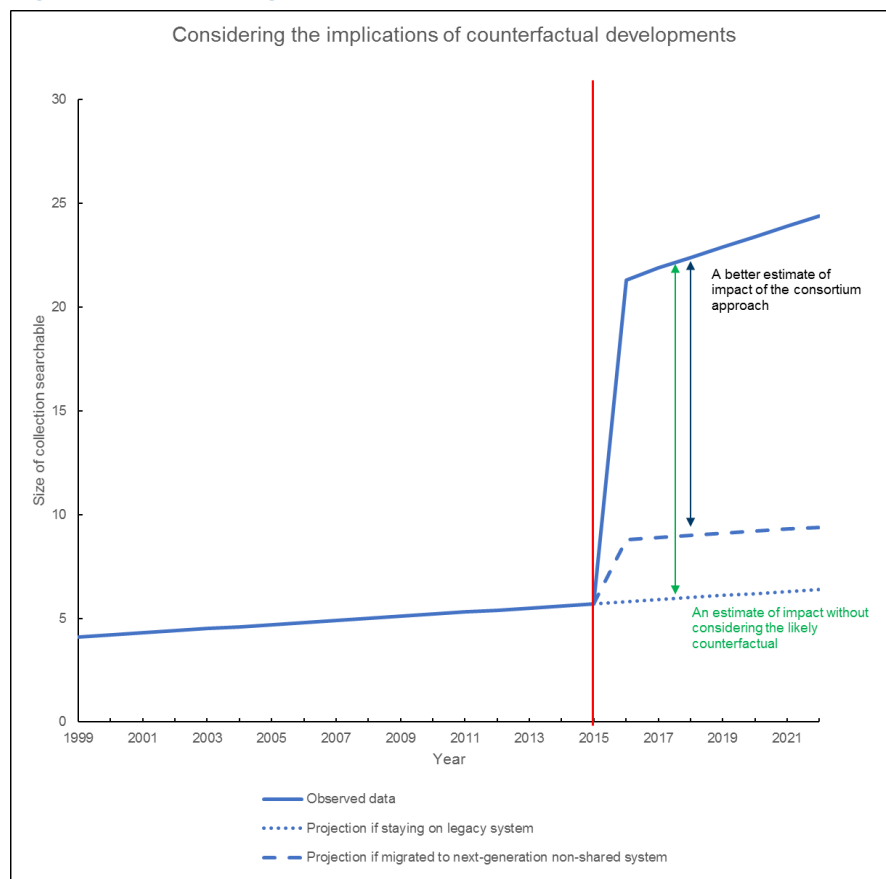
Source: Cambridge Econometrics.

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[8] This graph is reproduced from Appendix B, where it is used to explain the counterfactual approach.

5.3 What would the institutions have done in the absence of WHELF?

In assessing the outcomes for institutions opting for the "consortium with governance" approach, it is necessary to consider what institutions predicted they otherwise would have done (the counterfactual). The outcomes observed under the "consortium with governance" approach are compared against the expected outcomes under the counterfactual. Out of the eleven institutions participating in the project[9], seven institutions reported that in the counterfactual they would have likely procured for a next generation LMS as individual institutions.

One institution would be worse off under the counterfactual options it identified

One institution, the Royal Welsh College of Music and Drama (RWCMD), reported that the counterfactual was more uncertain. Their counterfactual would have likely been one of two options: to either collaborate with another institution, or to purchase a much less powerful LMS independently. What was evident, however, is that the consortium arrangement offered substantial advantages over either feasible counterfactual.

- In the instance where RWCMD would have collaborated with another institution, there would have been lower scope for them to customise the LMS. This is due to the fact that RWCMD would have likely partnered with a larger partner, and would have likely had to adopt the instance as purchased by the larger partner. In addition, it would have incurred additional costs for the collaborating institution to integrate RWCMD records into their system.

- If RWCMD had procured a LMS independently, investing in a LMS system as powerful as they have now would have been unfeasible. Although this may have resulted in lower (monetary) costs going forwards, this would have resulted in a LMS with less functionality. The LMS with less functionality would also have been unlikely to have the resilience of a cloud-based system, or contain equivalent discovery functionality, both of which are available in the WHELF instance.

For RWCMD, therefore, operating as a consortium enabled the possibility of additional features and additional flexibility that would otherwise not have been possible, even though a single counterfactual cannot be identified.

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[9] Although there are eleven members in the consortium implementing the next generation system, the data provided covered ten institutions; data for the NHS libraries are not comprehensive, and some of their inputs would have been subsumed by data provided by the Cardiff University. Based on these considerations, data for the NHS libraries were omitted from the analysis in this chapter.

Institutions which would have otherwise continued with their legacy systems in the predicted counterfactual would have upgraded their systems to a different timetable

The remaining three institutions reported that they would have likely upgraded their systems to an earlier timeframe, in the absence of the WHELF LMS project. For two of these institutions (Bangor and Wrexham Glyndŵr), in the absence of the WHELF LMS, they would have upgraded in 2011/2012, as a joint venture. This joint venture would have resulted in an upgrade of their previous LMS, which would have continued to be locally hosted. In this instance, these two institutions' predicted counterfactuals would likely have resulted in lower procurement costs, because they would not have necessarily had to go out to tender. Existing workflows would also not have had to change much, which would have lowered transition costs for their staff.

The third institution in this category – the University of South Wales – would have also had to migrate to one LMS system, as a result of the merger between University of Glamorgan and University of Wales, Newport in 2013/14. The possibility of migrating to a new system as part of WHELF meant that University of South Wales delayed the move.

5.4 Scope of the consortium approach

The consortium approach to purchasing a next generation LMS resulted in a major project covering a large scope of library collections and records. In total, library information resources within the consortium consisted of over 11.8m physical catalogued books, over 2.5m e-books, and over 250,000 serial titles in 2015/16. FTE library staff across these institutions was estimated to total 727 across the consortium in 2015/16. Figure 5.2 provides a summary of the distribution of information resources across the participating institutions.

Figure 5.2: Collection sizes across the consortium
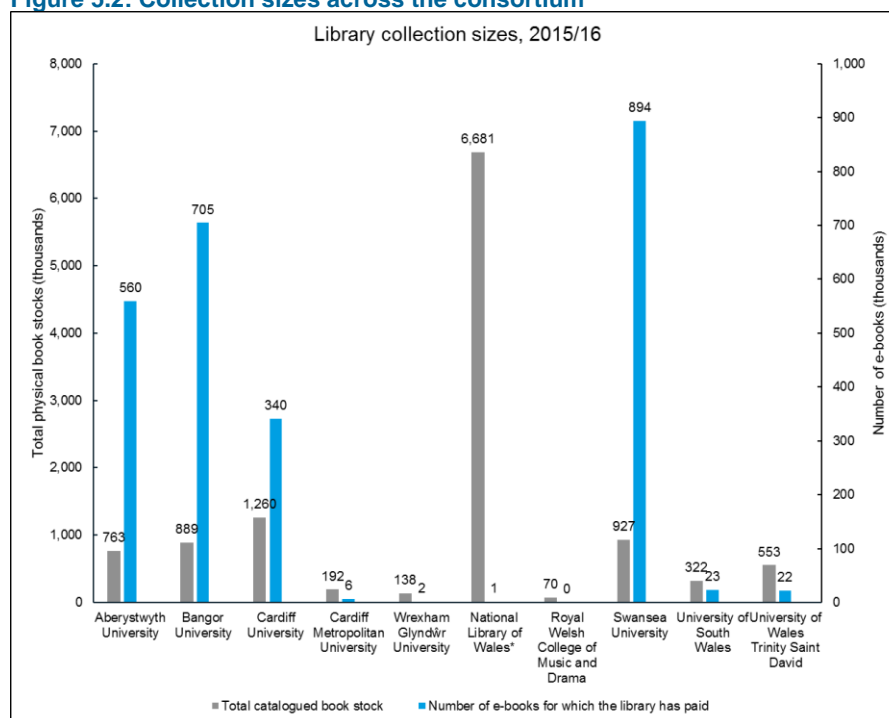
Notes: * National Library of Wales data is from 2016/17.
Source: Cambridge Econometrics analyses, based on WHELF data.

At one end of the spectrum, there are large institutions such as the National Library of Wales and Cardiff University, which house almost 6.7m and over 1.2m catalogued books respectively. Institutions with the largest collection of e-books are Swansea and Bangor University, with almost 900,000 and just over 700,000 e-books in 2015/16 respectively. At the other end of the spectrum, institutions such as the RWCMD and Wrexham Glyndŵr University in total house around 208,000 catalogued books, with just under 2,000 e-books.

The range in institution sizes is an important backdrop in assessing and quantifying the types of realised benefits to date. Smaller institutions in particular were able to benefit from operating as part of a much larger entity, through realised and expected future cost savings from efficiency gains and shared development. Smaller institutions can also benefit from the added functionality and features of a more powerful LMS, which could improve delivery of library services and workflows for staff.

5.5   Procurement phase impacts

The impacts of procuring as a consortium were identified as:

- enabling the possibility of developing better specifications and requirements, from pooling the expertise and knowledge across the institutions; and

- efficiency savings from not having to procure for new LMS services independently.

Quantitative data were collected to assess the occurrence of the latter benefit. Analysis of the former benefit is developed through the case studies conducted by WHELF. The data obtained suggest that procuring at a consortium level enabled costs to be lower than the predicted counterfactual outcome for institutions. Figure 5.3 indicates the difference between total actual procurement costs and the predicted counterfactual, for institutions which submitted data for both instances[10].

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[10] RWCMD and the NHS libraries were unable to provide the data for both instances.

Figure 5.3: Total procurement costs
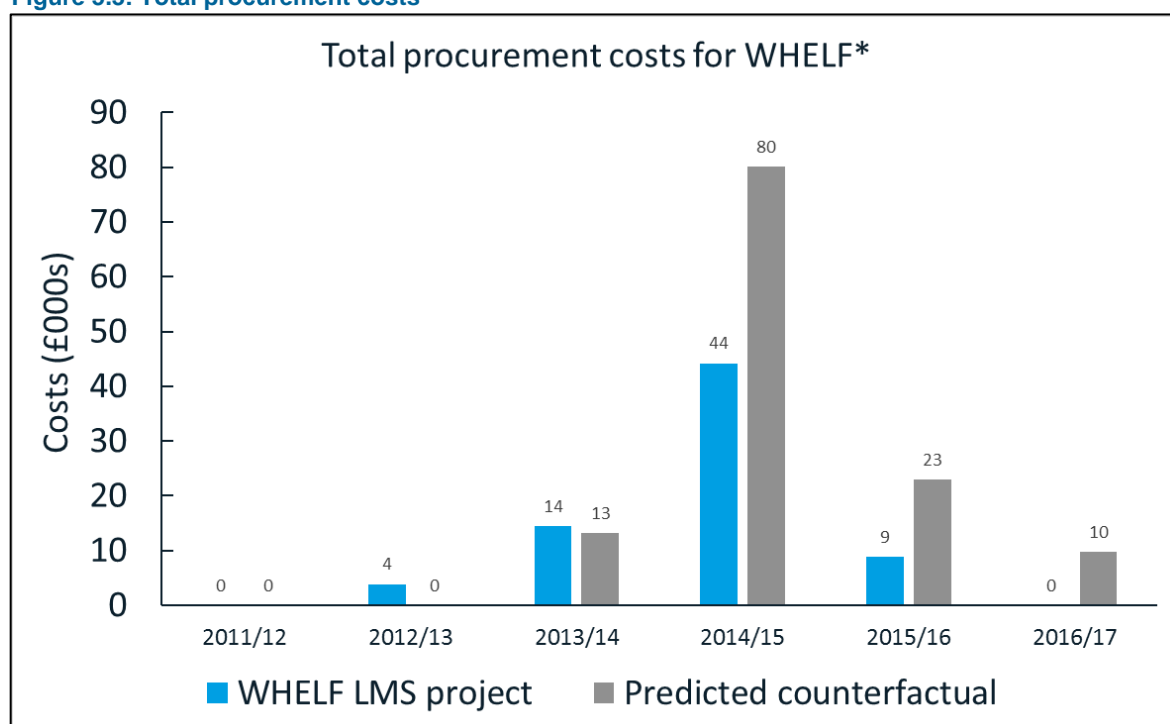
Notes: *Excluding the NHS libraries and RWCMD.
Source: Cambridge Econometrics analysis.

Cardiff University incurred the largest procurement costs, as the institution leading the procurement process

Most of the procurement costs were incurred by the institution leading the procurement on behalf of the consortium: Cardiff University[11]. In total, accounting for personnel costs and fees associated with obtaining external legal advice on the procurement process[12], estimated costs for the university amounted to just over £38,000 over 2013/14-2015/16, with just over £20,000 of those costs incurred in 2014/15. It is likely that procuring on behalf of the consortium increased their costs in this activity, given the more complex requirements of the process of procuring on behalf of eleven institutions.

There were also substantial costs for other institutions within the consortium from participating in procurement activities. Most of these were incurred in the development of suitable LMS specifications, and in each institution's contribution to legal fees for the procurement process. Labour costs at an institutional level ranged from £2,000 to £13,000 across different institutions over 2013/14-2015/16, excluding Cardiff University.

It is estimated that through operating as a consortium, costs were lower by around £36,000 in 2014/15 in total across the institutions, around £14,000 in 2015/16 and an expected amount of just under £10,000 in 2016/17 compared to the predicted counterfactual. The institutions that benefitted the most were those that would otherwise have procured independently. When only considering the institutions that would have had to procure independently, costs were lower by around £45,000 in 2014/15. In contrast, costs were higher

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[11] This is partly driven by the requirement of EU rules that one body has to procure on behalf of the consortium.

[12] Legal fees were paid by all WHELF institutions involved in the LMS project.

for institutions which otherwise would not have needed to undertake procurement activities. On balance, however, procurement costs for the consortium were lower against the predicted counterfactual. Therefore, for the consortium as a whole, the estimated data provided by institutions suggest that under the consortium set-up, costs of procurement activities are predicted to be lower by about £55,000 for the whole procurement process.

The results from this analysis are lower than the average procurement cost savings estimated by Owen and Dalling (2016) (see chapter 2), because in the counterfactual, some institutions' procurement processes would have been simpler and shorter than what was implied in Owen and Dalling (2016).

The exception to this is in the instance of the National Library of Wales, for which realised procurement costs exceeded the counterfactual procurement costs by more than £25,000, due to additional labour requirements of local staff to manage the process.

It should be emphasised, however, that there may be additional procurement costs for all institutions that were not comprehensively captured. Although there was a formal procurement process, discussion of tender specifications often occurred during project management meetings, and distinguishing procurement labour costs and project management labour costs can be difficult. Therefore, the procurement cost savings should be considered in conjunction with the project management costs from adopting the consortium approach (see section 5.8 below).

5.6   Supplier costs

LMS suppliers offered better terms and greater flexibility to a consortium, given the profile of the collective institutions and overall value of the contract. In addition, it is likely that the consortium will benefit from future discounts when looking at possible purchases.

Implementation and subscription costs

The discounts are particularly beneficial for smaller institutions, which in isolation envisaged that they were unlikely to be offered such beneficial terms and the same degree of flexibility had they not operated as part of the larger consortium. This relates particularly to implementation and subscription costs. Across the consortium, prices offered by the supplier were lower than the predicted outcomes in the absence of the WHELF project. Figure 5.4 provides a summary of total costs in both instances.

Figure 5.4: Supplier costs for WHELF
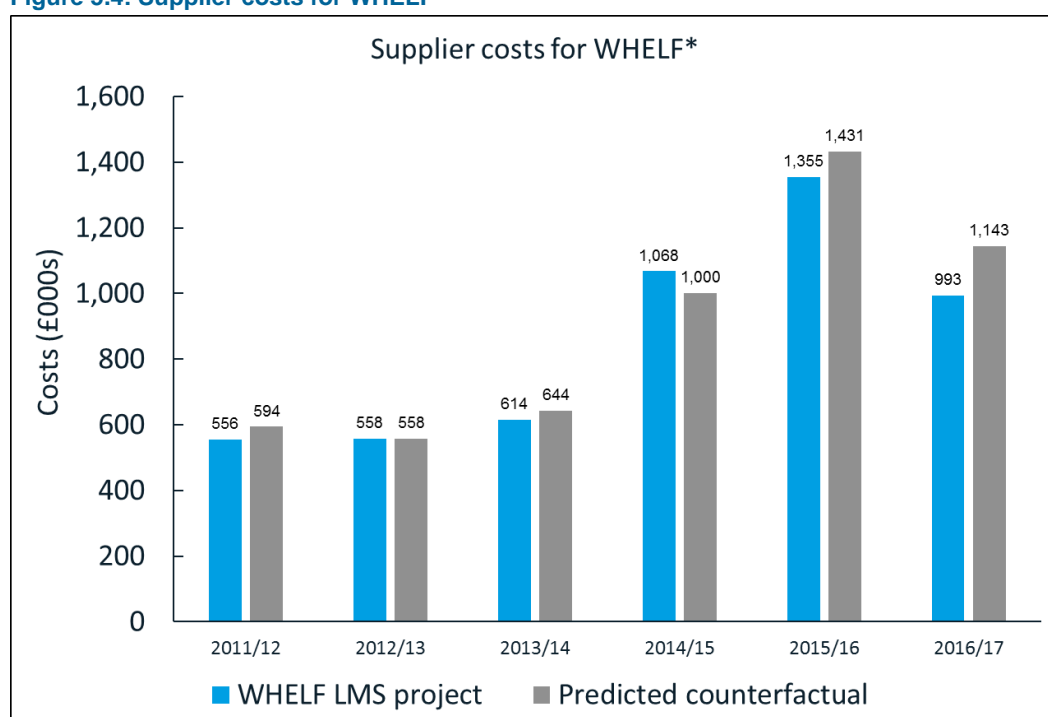
Notes: *Excluding the NHS libraries and RWCMD.
Source: Cambridge Econometrics analysis.

Under the consortium approach, total amounts spent on LMS implementation and subscription were higher than predicted counterfactuals in 2014/15. The higher costs in the WHELF instance were driven by the additional spending of institutions that would otherwise not have invested in a new LMS over the same period. In those cases, however, institutions would still have experienced decreased costs in 2011/12 and 2012/13 from not having the need for data migration activities.

Furthermore, for institutions that would have otherwise had to procure independently for a next generation LMS, the difference between actual and predicted costs were sizeable; actual costs were lower compared to the predicted counterfactual by around £226,000 in total over 2011/12-2016-17[13].

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[13] These estimated cost savings were estimated using institutions which were able to provide an estimation of the counterfactual against which the realised costs were compared; out of ten institutions, one institution was unable to provide a realistic counterfactual instance.

Breaking the costs down further, the results indicate that discounts offered for ongoing core[14] software subscription costs through operating as a consortium are expected to result in future cost savings, compared to what institutions expected to pay in the absence of the WHELF LMS project.

Nevertheless, expected future subscription costs are likely to exceed the historical subscription costs for most of the institutions. Figure 5.5 below shows the historical development of annual main software subscription costs[15] of institutions which have provided those figures. Out of the ten institutions within the consortium, three institutions – Cardiff Metropolitan University, University of South Wales, and University of Wales Trinity Saint David (UWTSD) – indicated that, going forward, they expect their annual subscription costs to be lower than those in the year before the introduction of the WHELF LMS. However, for two of these institutions (University of South Wales and UWTSD) the libraries inherited library systems from the "pre-merger" period, and it is conceivable that some of the fall in costs would have

Figure 5.5: Annual software subscription costs
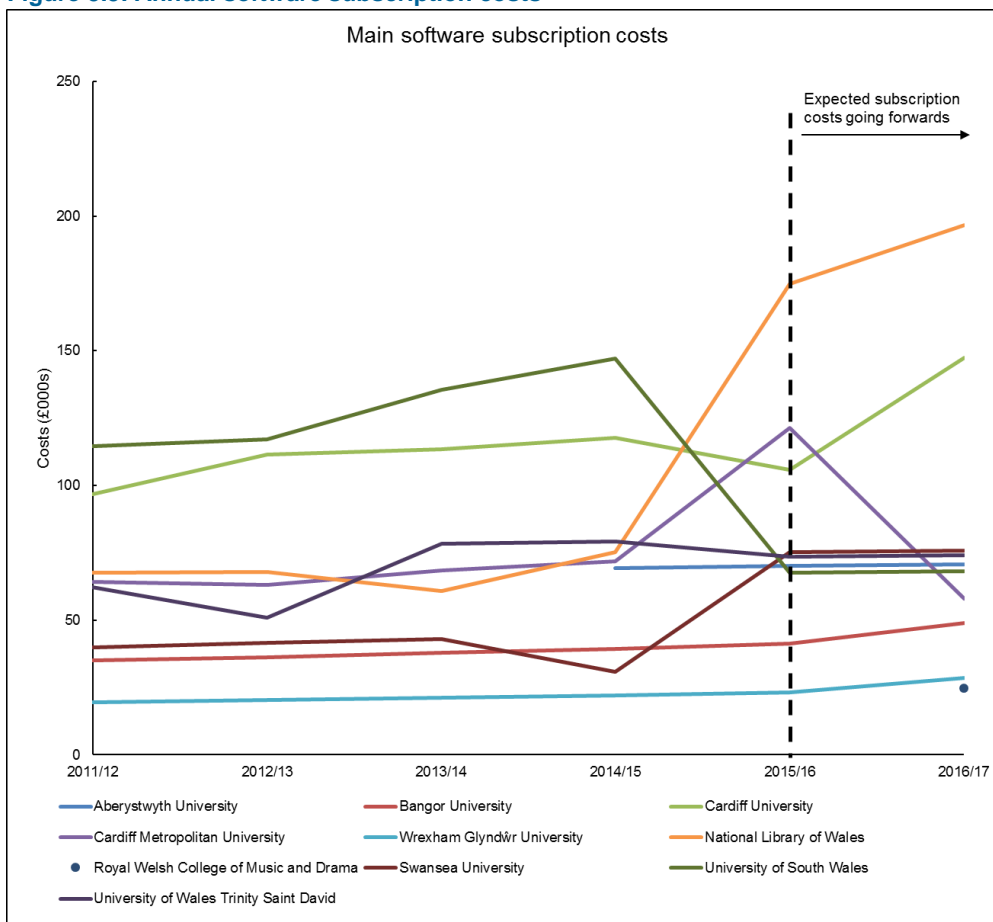
Source: Cambridge Econometrics analysis.

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[14] Core software costs in this instance relate to the subscription costs of the main software that is required for libraries to offer their primary functions.

[15] The subscription costs are only available for institutions who provided these figures.

existed in the absence of the WHELF LMS, driven by the merger of the libraries themselves[16].

Given that most institutions would have migrated to a next generation LMS regardless, the consortium approach likely lowered the ongoing subscription costs that institutions face. In total, it is expected that through operating as a consortium, institutions' core subscription costs are expected to be almost £148,000 lower compared to predicted outcomes in 2016/17. Moving ahead, savings of this magnitude are expected to continue.

Some institutions simultaneously subscribed to both the legacy and next generation LMS over the transition period

Some of the estimated savings will take time to materialise, or may not materialise for some institutions at all. Historical data for Cardiff Metropolitan University showed that they had to simultaneously subscribe to the legacy and next generation LMS over the transition period, boosting costs in 2014/15 on a one-off basis. Similarly, institutions which have purchased a more expensive (but one with more functionality) LMS are expected to face higher annual costs compared to the predicted counterfactual going forwards.

The consortium approach offered each institution options to customise and purchase additional software according to the specific requirements beyond the core services. This includes services such as those relating to better management of bibliographic records, and catalogue enrichment. The implementation and subscription costs of these services vary by the size of the institution and the degree to which the LMS adopted by WHELF aligned with institutions' previous LMS functionality. For example, costs are higher for some components than in the predicted case for Bangor University because they are required to purchase additional subscriptions to continue their provision of single sign-on services, which was included in their previous LMS set-up. On the other hand, the National Library of Wales estimated that better discounts were obtained for their other services from operating as a consortium, and hence faced lower costs overall.

Total supplier cost savings were sizeable

When considering all software-related costs over the period, including implementation fees, migration costs and subscription costs, it is estimated that institutions paid approximately £76,000 less compared to the counterfactual in 2015/16, and will pay approximately £150,000 less in 2016/17.

The institutions that seem to benefit the most from consortium discounts seem to be those which would have undertaken a similar procurement process to purchase a LMS with similar functionality in the absence of the consortium. Even though these are often the bigger institutions (and would thus have been likely to obtain some price reduction from the undiscounted price) the discounts would have been unlikely to be as high as what was achieved through negotiating as a collective entity of all universities in Wales, the Welsh NHS libraries and the National Library.

Figure 5.6 below shows the difference between WHELF LMS costs and costs in the predicted counterfactual, as a percentage of WHELF LMS costs. The differences between the WHELF LMS and predicted counterfactual were

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[16] Migration to a single system also mitigates some of the issues associated with operating two separate systems, as evinced in the case study for UWTSD.

calculated, where a positive number denotes lower costs for the WHELF instance. These numbers were divided by total costs that institutions are currently paying. This percentage is presented in the graph below; taller bars denote a difference (either negative or positive) that is large proportional to what institutions are paying in the actual outcomes.

Figure 5.6: Supplier cost savings as % of total supplier costs, 2013/14-2016/17

Difference between actual and predicted costs, expressed as a percentage of actual costs
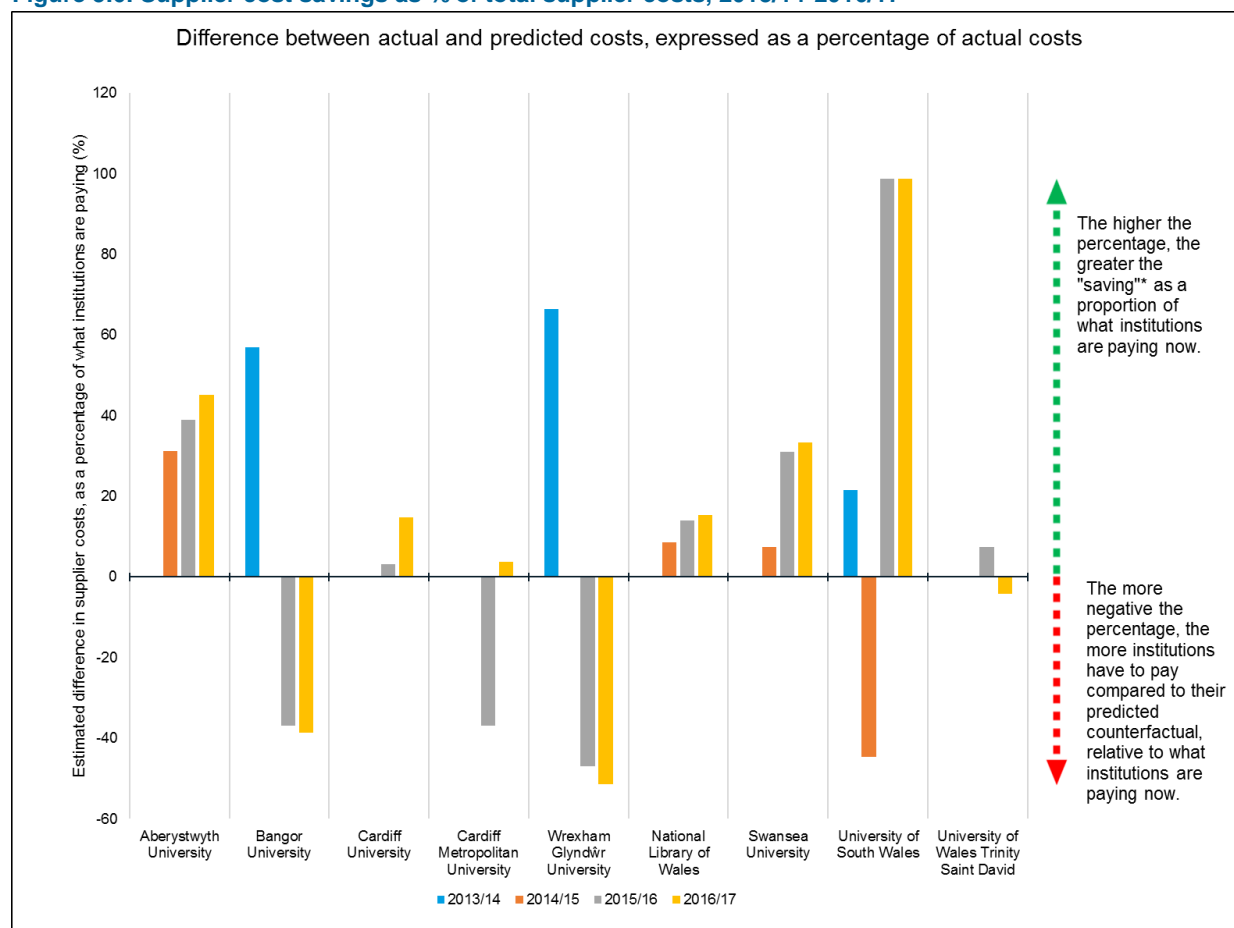
Notes: The 2013/14 results for Bangor University and Wrexham Glyndŵr University refer to savings over 2011/12 (for all other institutions, there were no cost savings for any years preceding 2013/14 from adopting the consortium approach).
Calculations of cost differences do not include RWCMD, as they were unable to provide a quantitative estimate of counterfactual costs.
* "Savings" in this instance do not strictly relate to the attributed savings, but as a convenient term to refer to the difference between the actual and predicted costs.
Source: Cambridge Econometrics analysis.

There is significant heterogeneity across institutions in the difference between actual costs compared with predicted outcomes, and it is evident that it varies according to when institutions implemented the WHELF LMS service, and what their legacy system arrangements were. On average, all institutions benefitted from operating as a consortium in at least one year. As a proportion of total supplier costs, the institution which was estimated to have the largest cost savings to date was the University of South Wales, relative to what it spent. In addition, it is evident that in most cases, efficiency gains from WHELF increased as a proportion of total spending over the years.

5.7 Labour costs

One of the benefits highlighted is the scope for internal efficiency savings, from pooling knowledge and sharing expertise across the institutions. This could, for example, result from mutual assistance in training on the system across institutions, or in enabling smoother implementation across the consortium if other institutions had undergone similar processes first.

However, estimates of the staff time incurred at the institutional level indicated that such benefits were likely more qualitative (such as the improvement in quality of training), as estimated quantitative efficiency savings were small. This is particularly noticeable for institutions in which the predicted counterfactual would have been to continue with legacy systems; in these instances, training costs were estimated to be lower in the counterfactual, given the existing expertise and familiarity with the systems.

Training costs across the consortium were sizeable, due to the need for most (if not all) library staff within the institutions to familiarise themselves with the software, and a small number of staff were required to achieve certification on how to operate the software. Estimates for the costs of staff time involved are very approximate, but labour costs involved for being trained approximated

Figure 5.7: Estimated training costs for library staff and number of staff trained, 2014/15-2016/17
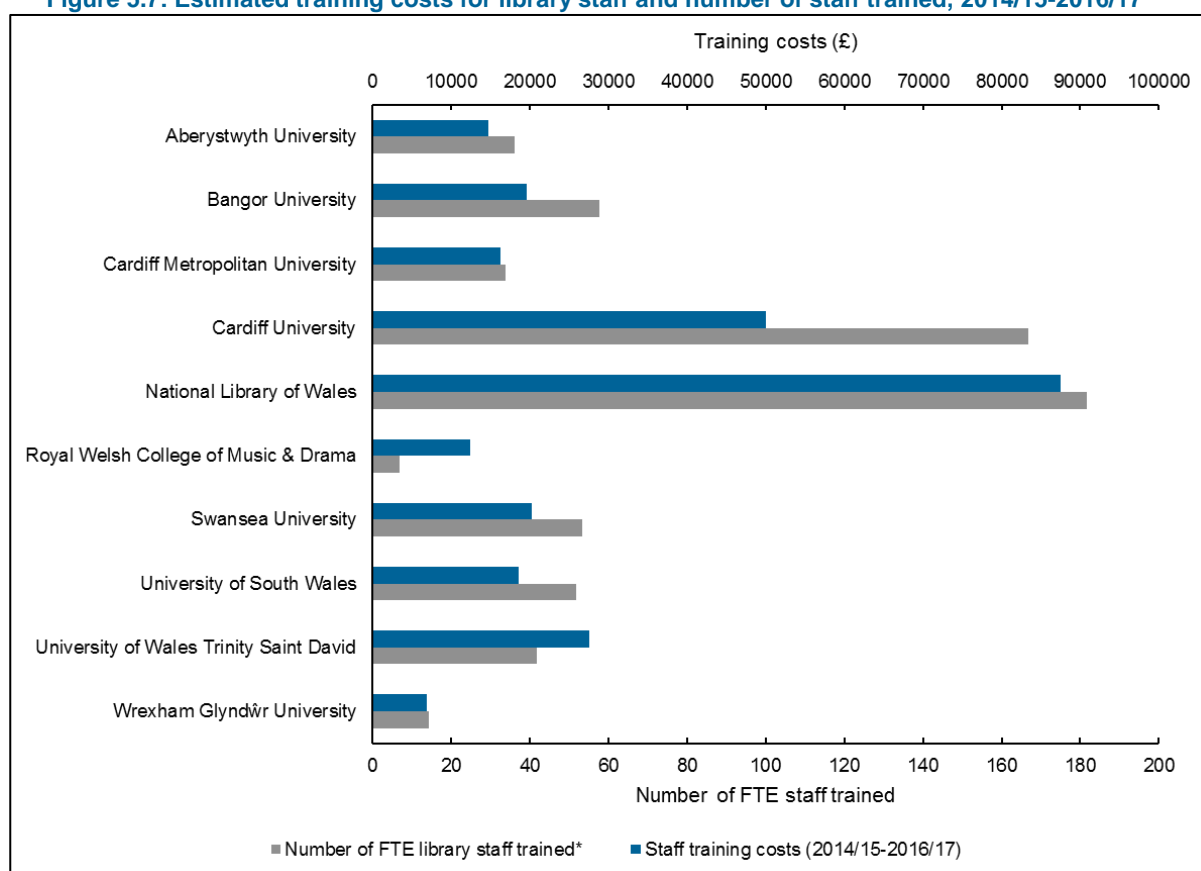
Notes: *The number of FTE library staff trained refers to the year in which the majority of staff received training. This was 2015/16 for most institutions, with the exception of Aberystwyth University, Swansea University, and the University of South Wales (for which it was 2014/15).

Source: Cambridge Econometrics analysis.

£274,000 in total across 2014/15-2016/17, due to the number of staff involved in the training. The breakdown of training costs by institution is shown in Figure 5.7 below. Based on the data available, the time taken for all library staff to be trained to a sufficient level costed far more than the time taken for specialist staff to be trained to achieve certification.

The available data indicate that purchasing as a consortium resulted in some lower costs for institutional staff in implementing workflows and training. However, overall training costs are estimated to have been higher compared to the predicted counterfactual. Sharing knowledge across institutions curbed the training costs, but this is outweighed by the volume of training necessary, because most (if not all) library staff had to be trained on the new system.

One contributing factor explaining higher relative training costs is that for some institutions, opting for a consortium approach resulted in them purchasing a system that was unfamiliar to them. This is particularly relevant for institutions that would have otherwise migrated to a new LMS closer to their legacy systems. For example, in the case of UWTSD, opting for the LMS purchased within the consortium meant that more training was needed by staff to familiarise themselves with different workflows and functionality. Similarly, for Bangor University, Wrexham Glyndŵr University and University of South Wales, the migration to a next generation LMS necessitated additional training as well. There were no institutions that would have been able to adopt the WHELF system without any training required.

Implementation costs for institutional staff were mostly higher than in the predicted counterfactual

A similar picture emerges when examining the labour costs of institutional staff for implementing the next generation LMS. In many cases, institutions reported that they were unsure of the exact level of implementation costs, as workflows are yet to be determined. Current estimates of efficiency gains from operating as a consortium are small; again, given the lack of familiarity associated with the next generation LMS purchased as part of the consortium, additional staff resources were required to implement and develop new workflows. Higher labour costs associated with new workflows were required especially for institutions in which the counterfactual would have been to either stay with their current systems, or to migrate to a system more closely aligned to what they previously had.

As a result, estimated cost differences are small. For those institutions which were able to provide data on this metric[17], they fluctuated between lower costs of £21,000 in 2016/17 to higher costs of £86,000 in 2015/16 compared with predicted outcomes. It is likely that future assessments of workflow costs will provide a better indication of potential efficiency savings, given that workflows were still being developed when the data were collected.

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[17] Four institutions were unable to provide estimates of labour implementation costs for institutional staff.

One area where efficiency savings were observed is in labour costs in bespoke developments as a consortium. The National Library of Wales calculated the value of one-off back-end translation work in 2015/16 and ongoing translation costs undertaken by the institution, which contributed to the development of a fully bilingual back-end interface available to all consortium members. Labour costs involved to develop this functionality for the National Library of Wales totalled approximately £19,700 for the initial translation work, and then £1,200 on an ongoing monthly basis[18]. Through operating as a consortium, therefore, other institutions looking to utilise similar functionality are able to do so through sharing the expertise of the National Library of Wales, subsequently resulting in lower local development costs.

5.8 Governance and management team costs

There was potential for cost savings through managing the project through a consortium. On the one hand, the possibility of not needing a dedicated local project manager could reduce personnel costs for institutions. On the other hand, additional commitments to attend consortium level management board meetings, and requirements to contribute and liaise between the institutions, may potentially push costs up. Estimates of staff time spent on project management suggest that any reduction in personnel costs has likely not taken place yet. Three institutions posited that the consortium approach did not significantly reduce the time spent on project management requirements at the institutional level. In the case of Bangor University and Wrexham Glyndŵr University, the consortium approach necessitated much larger project management commitments than in the predicted counterfactual. The complexity associated with migrating to a less familiar system, and the resources required to coordinate at the consortial level, were far greater than if they had opted for a simpler upgrade in their counterfactual. Figure 5.8 below presents the total project management costs for WHELF.

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[18] There was also translation of the discovery interface for institutions.

Figure 5.8: Project management labour costs

Project management labour costs*
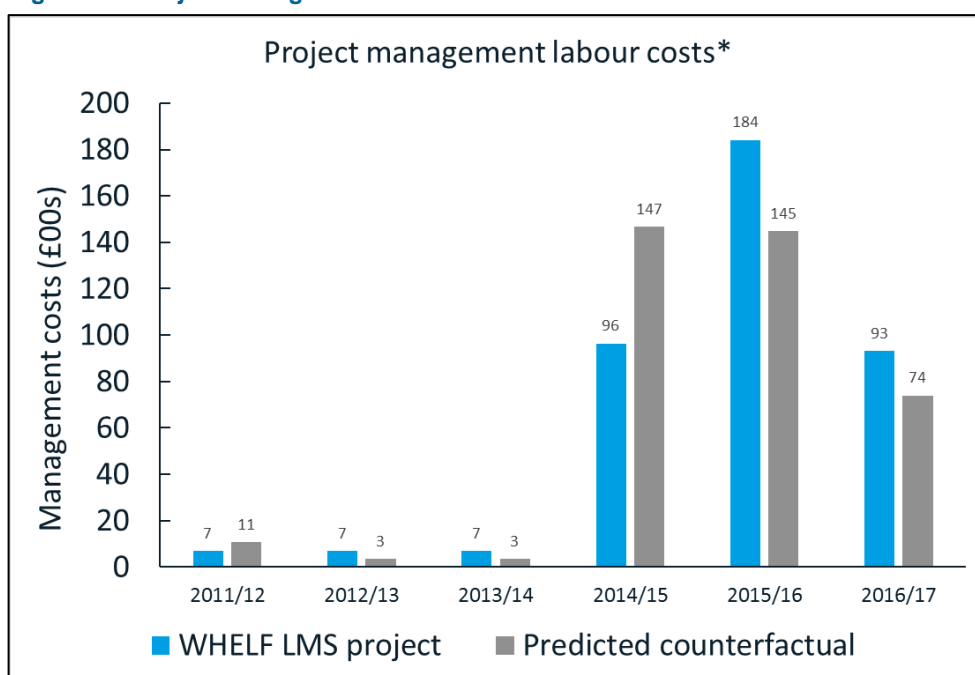
Notes: *Excluding the NHS libraries and RWCMD
** MALD and Wales Finance Directors provided additional funding over the highlighted years for project manager costs. These were not accounted for in this figure.
Source: Cambridge Econometrics analyses, based on WHELF data.

Some of the project management costs were not covered by institutions, but from external sources (MALD and Wales Finance Directors). As Table 5.1 below indicates, accounting for costs incurred by these external sources results in higher total project management costs over 2013/14-2015/16.

Table 5.1: Total project management costs

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Total project management costs to WHELF (£000s)	7	7	7	96	184	93
Total project management costs* (£000s)	7	7	77	132	204	93

Notes: * Including costs covered by external sources (MALD and Wales Finance Directors).
Source: Cambridge Econometrics analysis.

Compared to the predicted counterfactual, some institutions recorded lower project management costs, driven by lower management requirements at the local level. In the case of Cardiff University and Swansea University, they would have benefitted from cost savings of around £61,000 and almost £24,000 in total over 2014/15-2016/17 respectively.

However, in the majority of cases, it is estimated that there was very little scope for decreases in management costs from operating as a consortium. Most notably, for Bangor University, project management costs amounted to around £48,000 in 2015/16 alone, due to participation of senior staff in the project management of the implementation of the WHELF LMS at the local level, which in the counterfactual was predicted to not have been as resource-intensive. Nonetheless, the higher project management costs are unlikely to be sustained; for six of the ten institutions, project management costs were estimated to be lower for 2016/17 as the implementation phase of the project is complete.

5.9   Concluding remarks

In conclusion, the available quantitative evidence suggests that the choice to opt for a consortium approach to procure for the new LMS has yielded various monetary benefits for the institutions involved. There were efficiency gains in the procurement process, with costs lower by around £55,000 for the consortium in total. Purchasing as a consortium provided scope for substantial supplier discounts for every institution involved. Total supplier costs are lower for the WHELF LMS instance compared to the predicted counterfactual by around £76,000 in 2015/16 and £150,000 in 2016/17. Total supplier costs exceeded the predicted counterfactual in the earlier phases of the project for some institutions, because of the need to run two LMS systems (the legacy and the "next-generation" system) simultaneously during migration. In total across 2011-2017 for all institutions, actual costs were lower compared to the predicted counterfactual by £226,000.

Estimated impacts of operating as a consortium on project management and training costs, however, are mixed. While institutions were able to benefit through learning from and drawing on the skills and expertise of other institutions, it seemed that local project management requirements remained high, and training costs were substantial. The introduction of new systems across all the institutions prompted additional training requirements on institutions. Additionally, the complexity of the project meant that, for some institutions, local management costs were at least as high in the WHELF LMS case as in the counterfactual case; annual costs fluctuated between being higher by £48,000, and lower by around £44,000 compared to the predicted counterfactual for individual institutions. Nonetheless, governance and project management costs are expected to decrease in the future (with lower requirements once institutions move beyond the implementation phase of the project), while supplier discounts are likely to continue on a similar scale.

Nevertheless, there are indications that there may be ongoing opportunities for future monetary savings, through, for example, efficiency savings in bespoke development and through discounted subscription costs.

In addition, it is important to stress that cost savings constitute only one aspect of benefits that the consortium is intended to achieve. Perhaps of more importance is a higher quality service offered by the library, as well as providing the foundations for further collaboration by the institutions.

6 Recommendations for future evaluations

6.1 Introduction

The work to measure the estimated effect of the WHELF LMS project on realised outcomes has focussed primarily on monetary savings. Part of this is driven by the available data, which are mostly financial (in some cases, monetary estimates of non-financial data were derived).

Beyond monetary savings, non-monetary outcomes are still an important component of the expected outcomes of the project. These relate to, for example, better visibility of resources and better access, more efficient library workflows, and higher quality of service provided for users.

Conceptually, the framework provided over Chapters 3-5 describes the necessary thought processes and mechanisms through which this design can measure the effect. On a practical level, some of the challenges, difficulties, and recommendations were outlined in the same chapters, as well as directly to stakeholders who took part in the data collection process.

To record some of the discussions that were held, and to further assist with future monitoring efforts, this chapter provides supplementary guidance and recommendations for WHELF and its members for future evaluations.

6.2 Key discussion points for future monitoring efforts

Based on the analyses undertaken so far, it is useful to highlight some practical considerations and recommendation that may be of use for evaluating future benefits, in the specific context of WHELF and in light of feedback on previous data collection efforts.

It would be useful to distil further the list of quantitative metrics to measure

Although the logic map provides a comprehensive starting point to assess what metrics are needed to measure the scale of impact of the WHELF LMS, work on the non-monetary, quantitative monitoring efforts thus far is less advanced, and there is not much precedence on which to build. Therefore, it may be beneficial for institutions to distil further the list of (intermediate) outcomes, in order to focus on a small group of metrics going ahead, to test the feasibility of wider and more in-depth data collection.

Additional data collection efforts should start as soon as possible

It is evident in this study that the data necessary for a comprehensive quantitative assessment of the scale of impacts of the project is unavailable. Hence, in order to assess the scale of impacts for some aspects of the WHELF LMS, it would be advisable for the consortium to start developing metrics that institutions can monitor as soon as possible.

Even though the advocated approach ideally requires data monitoring before and after the introduction of the new LMS (Section 4.3 provides a short explanation of why), there is scope for future evaluations to accurately capture the outcomes, even if additional data collection efforts start after implementation of the system. This is because some of the expected benefits

are more long-term, and hence have not have been realised yet; in other words, there is a lag between the treatment occurring and researchers observing a change in monitored metrics.

A long time series can help mitigate the influence of skewed data in calculating the scale of benefits

One additional advantage of introducing new metrics for monitoring as soon as possible is the possibility of deriving long time series of data. A long time series can be beneficial, to help inform what the (future) counterfactual might look like, and to mitigate the influence of skewed data due to confounding factors. To give an example in the context of the data already collected, a long time series helped inform whether some institutions who would have otherwise continued with a legacy system would have upgraded their systems, and if so, what implications this had on their subscription costs in comparison to the WHELF approach.

Participants at the second workshop also commented that in the years immediately preceding the introduction of the WHELF LMS, development activity on legacy systems slowed down, anticipating the implementation of a new library system. Therefore, if data was only collected for the years in which development activity had already slowed down, the observed impact on development activity of the new LMS system would resultantly seem larger. This is possibly an inaccurate representation of the size of the impact, because it is caused by an additional factor of the expectation that the legacy system will be replaced, inducing behavioural changes in development activity. In a counterfactual scenario where institutions continued with the legacy systems, it could be argued that the intensity of development activity would not have dropped over the same periods.

Standardisation across institutions is important

It is beneficial to have as much standardisation as possible in measuring quantitative metrics going forwards. Standardisation in this context refers to the *framework* or *method* in monitoring or calculating the metrics, rather than the exact numbers used for each institution to derive their data.

Standardisation in approach is useful; it allows for comparisons across different institutions, and facilitates analyses of results at the consortium level. Standardisation is also useful for providing clarity of definition and approaches, that can facilitate future monitoring should there be any changes in the personnel handling any monitoring efforts.

Build on existing experiences where possible and feasible

Although many of the conceptual elements of this project seem to be unfamiliar to institutions and WHELF, different institutions have different expertise in the LMS domain that will be useful for informing the development of metrics, or in obtaining information on modelling a suitable counterfactual. Drawing on the experience of individuals within each institution and across the consortium may be useful for facilitating data collection and analyses efforts. It may often be useful to seek advice from experts in domains that are not directed-related to library systems. One example from the data collection process of this study was in estimating the counterfactual procurement costs; institutions were advised to seek information from their institutions' procurement department, for guidance on estimating the personnel and other resource costs required for projects of a similar scale to their counterfactual.

"Bottom-up" approaches vs. "top-down" approach

In developing approaches to calculate quantitative metrics for ongoing monitoring, a likely key trade-off in any data collection efforts is whether to adopt a "bottom-up" approach to compiling the data, or to adopt a "top-down" assessment. The former relies on collecting data for individual units, and adding them up to derive an overall number, while the latter approach commonly is applied by taking aggregate figures and approximating the average value through dividing by an appropriate denominator.

One example highlighting the difference in approach may be in calculating average staff time spent on cataloguing activity. A bottom-up approach may be to recommend recording the amount of time spent every time a library staff member engages in cataloguing activities. With data on time spent for each staff member, it is possible to take an average of time spent. Alternatively, a top-down approach would be to approximate the *total* amount of time spent on cataloguing and acquisitions activity, and then dividing by the number of staff responsible for such activities. In both approaches, it is possible to consider a breakdown by different types of items, if it is the case that the process for cataloguing differs according to the nature of the item, or if the introduction of the new LMS affects the processes for cataloguing different items non-uniformly. If possible, either approach should seek to account (or adjust) for the quality of the cataloguing as well, if there are quantitative measures that can capture this.

Generally, bottom-up approaches tend to be more resource-intensive, but are likely to be more accurate than top-down approaches. The merits of both approaches should be considered on a case-by-case basis, and assessed in the context of how the approach would influence the data, and in the context of the analyses with which the collection of the data is designed to assist.

6.3 Specific areas for further development

To facilitate further refinements of the quantitative metrics, suggestions on how to continue development of particular metrics are proposed in Table 6.1 below.

Table 6.1: Additional recommendations on metrics

Outcome to measure	Findings to date	Possible immediate next steps
Time spent on cataloguing and acquisitions activity to date	This outcome was identified as one of the metrics to assess in an earlier stage of the study, but it was evident that there are differing interpretations on how cataloguing and acquisitions activities should be defined and measured. In addition, for institutions which do not have dedicated staff for these workflows, there is an additional	The two approaches – measuring the time it takes for an item to arrive at the institution and monitoring staff time spent on acquisition and cataloguing activities - are both feasible; however, the latter is more focused towards cataloguing and acquisitions specifically.

	practical obstacle of how best to approximate the time spent, when there had been no monitoring efforts previously. When institutions attempted to collect this data, institutions had different approaches on how to estimate the time spent; some institutions adopted a bottom-up approach, while other institutions used a top-down approach. An alternative suggestion during the study was to measure the time from when a library item is discovered, to when it is available for access (minus time of delivery).	It should be established whether staff from any of the WHELF institutions have any prior experience in monitoring such activities, and if so, what approaches were used. If such approaches could be plausibly adopted by all institutions (and the definitions are universally understood and applicable), then pilot institutions should attempt to implement the monitoring efforts into their workflows. A useful check would then be to compare the results of the monitoring efforts across institutions, to see whether the values are realistic and sensible.
Bespoke development	There is preliminary evidence in this study that bespoke development costs for the LMS can be much lower when institutions are operating within WHELF rather than as individual institutions.	Calculations of translation costs provide a useful example for monitoring in this area going forwards; for any bespoke development requiring staff input, the costs of staff time should be monitored and costed accordingly, to derive an estimate of the reduced costs involved for other institutions. If commercial rates for the equivalent service are available, then they should be taken as the best estimation of the avoided costs for other institutions.
Workflow monitoring	Although this is related to cataloguing and acquisitions activity (see above), better monitoring of workflows related to LMS activities may be beneficial. Examples include (in addition to cataloguing and acquisition from above) time and other resources spent on electronic resource management, the potential for improved discovery of collections within the library, and better management of inter-library loans	The main challenge in these workflows is how to define the activity. For example, in the case of electronic resource management, it would be useful for institutions to derive a consistent definition of the components which constitute this activity, and encourage institutions to attempt to collect data of time spent on

		each of these constituent components, either through a top-down or a bottom-up approach.
		Furthermore, it would be useful to establish what the main expected benefit of adopting the LMS would be, such that it is possible to monitor the right metrics. For example, it may be useful to look at staff time spent on particular activities if the LMS is expected to bring efficiency savings. Otherwise, for outcomes associated with improved discoverability, it may be useful to monitor the usage statistics of library collections instead.
System outages and updates	It was identified through discussions with the institutions that a next generation system would reduce incidences of unplanned system outages.	It would be useful to identify how this has benefited institutions, because that may influence what metrics to monitor. For example, in the case of higher user satisfaction, it may be useful to monitor number of issues of system outages raised by users of the library system. Alternatively, if it enables smoother workflows for institutional staff, then it may be useful to track incidences of unplanned system outages, or the average response time of the system supplier from when an institution has logged an issue.

Source: Cambridge Econometrics.

7 Conclusions

7.1 Overall findings

This study developed a suitable design based on the impact evaluation framework to systematically assess the quantitative benefits of the WHELF LMS project. It also applied the design in practice, to give a preliminary assessment of the estimated cost savings of the "consortium with governance" approach to the project to date.

Existing analyses in this domain are limited, and there seems to be little evidence from the literature of any research that systematically evaluated the range of benefits from a consortium approach to procuring and implementing a library management system.

An assessment of the business cases made by individual institutions within the WHELF consortium provided some indications of the types of expected advantages from adopting the chosen approach, as well as the likely benefits that are expected to arise from this choice in the future. Institutions emphasised the numerous benefits for operating staff and end-users along two main dimensions;

- the adoption of a next generation system, which brings additional functionality and more resilience; and

- the consortium approach, which provides scope for collaboration, mutual support and efficiency savings.

7.2 Key findings from an assessment of cost savings

Evidence on the outcomes and impacts of the WHELF LMS is limited, as many of the benefits of the project are expected to be longer-term. The study examined the difference between costs in the WHELF LMS project and costs in the predicted counterfactual situation. The quantitative analysis focused on realised cost savings to date:

- during the procurement process;

- in subscription cost savings from bidding as a consortium;

- in institutional labour costs for implementation and training; and

- in labour costs associated with governance and project management.

Procurement and subscriptions were lower compared to the counterfactual

Based on this analysis, it is evident that costs were lower in the WHELF LMS project in the procurement phase. As a result of supplier discounts, institutions' subscription costs were also lower than in the predicted counterfactual by approximately £76,000 pa in total in 2015/16, and by an estimated £150,000 pa in total in 2016/17. Many institutions predict that subscription costs for supplier services will continue to be lower in the future. In both cases, it seems that the consortium approach enabled lower costs compared to the counterfactual (as institutions were able to pool efforts for

procurement and, as a unit, the consortium was offered lower prices from the supplier).

Project management costs were not estimated to have been lower in the WHELF case, and required additional labour inputs at the management level

Conversely, project management costs were estimated to have been higher compared to the predicted counterfactual. In addition to local project management requirements, institutions found that they had to devote more resources contributing to management at the consortium level than they would have done in the predicted counterfactual. However, high project management costs may reflect the amount of resources required for the implementation phase of the project only, and may therefore decrease going forwards.

In addition, training costs were substantial, and were higher compared to the predicted counterfactual. This is predominantly driven by the need for all staff from all institutions to be trained on the new systems. Training for all staff was predicted to not have been necessary for some institutions in the counterfactual, as some institutions would have purchased a system more aligned with their previous workflows. Overall, staff training costs were estimated to range between £7,000 and £87,000 in total, across the different institutions.

These results point to a few common findings:

- The differences in costs compared to the predicted counterfactual across the institutions tend to be heterogenous, with no prominent trend according to their size or location. What seems most important in determining the occurrence of higher or lower costs compared to the counterfactual are institutions' previous LMS arrangements and that system's similarity to the next-generation system adopted as part of the WHELF project. In addition, whether the institutions would have otherwise continued with their legacy systems in the counterfactual is important as well.

- Collaboration and operating as a consortium could yield efficiency benefits, given the possibility for institutions to pool resources and expertise. Bidding as a consortium contributed to the supplier offering lower prices. Beyond subscription costs, bespoke development may also be lower compared to the counterfactual, as institutions could pool expertise, and the work undertaken by one institution could more easily be shared and transferred to others, as observed for the Welsh back-end translation. The more institutions that the bespoke developments are applicable to, the higher the potential gains could be.

- However, collaboration may result in higher "one-off" costs. In particular, if institutions opt for a LMS option that differs substantially from their legacy systems, then it is possible that costs would have been higher compared to the counterfactual (because in those instances, the counterfactual option would have enabled a continuation of similar workflows and would have required less training). That said, additional resource requirements for institutions to provide inputs at the consortium level could result in better quality processes. In this instance, higher costs compared to the counterfactual were observed in institutional labour costs for project management, training, and implementation.

- The advantages of opting for "next-generation" software can be mostly qualitative and long-term. Case studies point to the presence of realised evidence during the procurement, implementation, and early operational phases of the project.

7.3 Undertaking evaluations to understand the scale of benefits

To date, research to evaluate the realised benefits of the WHELF LMS project has largely built on qualitative assessments of benefits in the domain. As such, during the early phases of this study, effort went into building the framework on which to assess quantitatively the extent to which expected benefits have arisen.

This comprised of the following stages:

- develop a logic map to identify, on a theoretical level, the expected benefits, and the mechanisms through which they are expected to occur;

- assess the feasibility of adopting different approaches to evaluate impact; and

- implement the most suitable approach, balancing the feasibility and robustness of different designs.

Data availability underpins the feasibility of many quantitative approaches to evaluating benefits

What is most suitable depends on the specific features of the domain. A key consideration is data availability. Data from institutions are critical in measuring performance quantitatively:

- Monitoring key indicators which capture the performance of the new project should ideally begin as early as possible, preferably before the inception of any activities related to the new LMS.

- Monitoring should be continuous over the course of the whole LMS project. Given the long-term expected impacts of such projects, regular monitoring before and across the lifetime of the LMS is important.

- If the project concerns multiple institutions, then it would be useful to ensure that the data is collected consistently (i.e. at the same time intervals, and according to the same definitions) to ensure comparability.

The participation of project teams from the different institutions that are involved in the LMS project is also useful, as their domain knowledge and practical experience of being involved in the processes can help improve contextual understanding of the data.

7.4 The advocated framework

The developed logic map provides a theoretical organising framework to elaborate and explain systematically the expected and perceived impacts of the WHELF LMS project to the individual institutions.

The logic map extends beyond looking at expected benefits alone

The logic map divides the project into six main categories:

- the context of the project;

- the inputs of the project;

- the activities that convert those inputs into outputs;

- the expected outputs of the project;

- the intermediate outcomes that are expected to result from the outputs; and

- the end impacts of the project.

The different elements facilitate the understanding of mechanisms and processes through which the benefits are expected to occur.

The logic map covers all stages of the WHELF project

The consortium approach to migrating to a next generation system has implications beyond the operation and management of the system. The WHELF approach affected how the consortium procured and implemented the project, and it has opened up (and is expected to continue opening up) opportunities for further collaborative arrangements in the future. Resultantly, the logic map covers the phases leading up to the operation of the LMS, in order that the organising framework considers and accounts for potential benefits at all relevant phases of the project.

The logic map is aimed at the consortium level, but is flexible to cater for analyses at the institutional level

The logic map has been designed to apply to the consortium as a whole, while not omitting benefits to individual institutions. At the consortium level, additional components should be considered, such as the inclusion of the governance and management team. These components are important considerations given the implications on costs, as well as accounting for the management approach of the project.

The "actual vs. predicted" approach

Beyond the logic map, an evaluation framework is necessary to translate the understanding of the project at a theoretical level to an understanding of whether the theoretical expected benefits were realised, as well as the scale of these benefits.

Quasi-experimental approaches are often adopted to evaluate the impact of projects, policies and programmes. However, it is difficult to apply this design in the WHELF instance, given the lack of comprehensive data and the difficulty in identifying comparable institutions that could pose as the counterfactual.

Instead, the chosen design is the "predicted vs. actual" approach, which tries to estimate the difference in outcomes from what happened, and what would have happened in the absence of the WHELF LMS project. The difference in estimated outcomes can provide an indication of impact from participating in the consortium.

To adopt this approach, it is necessary to have metrics of actual outcomes for comparison. However, the range of available metrics is currently limited. But further work on monitoring and developing metrics will hopefully continue, and build on the findings from this study.

7.5 **Looking ahead**

The evidence and work undertaken for this study do not comprehensively measure the scale and extent to which all the expected benefits materialised. Implementation of the WHELF LMS project was only completed in August 2016 and so there is limited evidence on outcomes and impacts thus far. Further work is required to develop metrics to measure quantitative, non-monetary outcomes. These non-monetary outcomes are also expected to be much longer-term, and hence unlikely to be observed yet (especially for cohort 3 institutions).

The logic map and evaluation design developed here, together with additional guidance and a practical application to cost savings, should help efforts to assess the benefits of WHELF in the future. As the operational period of the new LMS lengthens, and with more comprehensive monitoring efforts that can inform more aspects of outcomes related to the system, it is anticipated that there will be scope for more in-depth analyses in the future, especially of the non-monetary outcomes that result from adopting this particular arrangement.

Appendices

Appendix A   Additional details on the logic map approach

A.1   A more detailed description of the logic map approach

Basic structure

The logic map approach adopted for this study defines a program using six main categories[19]:

- context;

- inputs;

- activities;

- outputs;

- intermediate outcomes; and

- impacts;

with linkages provided between the components where informative. This helps inform the mechanism through which outputs can lead to which outcomes, and which outcomes feed into which impacts.

A.2   Rationale for the logic map

The development of the logic map provides a theoretical basis on which to build subsequent efforts to measure the benefits of the new LMS and to recommend appropriate methods to assess its impacts.

In the logic map, the primary focus is on the intermediate outcomes and impacts as a way of understanding the expected benefits of the system

The focal point of the logic map will be on the understanding of intermediate outcomes and the impacts. This understanding will motivate the different quantitative aspects of outcomes that need be measured, which, where possible, will then be mapped to indicators for tracking the extent to which those outcomes have been realised.

From these indicators, it should be possible to assess the degree to which potential benefits are realised over the process of implementing and using the next generation LMS across the different institutions.

The other dimensions (that is, the context, the inputs, the activities and outputs) may also provide useful information for the evaluation of benefits. In general, it provides a convenient organising structure for thinking about and grouping aspects of the WHELF LMS project. For example, understanding the context helps inform the counterfactual against which realised outcomes can be compared, to evaluate the scale of benefits. Similarly, understanding the types of inputs into the shared LMS may inform the dimensions of data that could be collected when assessing the cost savings of a new system.

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[19] A more detailed exploration of what these different components represent is available in the following section.

The logic map is most applicable at the consortium level

It is worth bearing in mind that the logic map framework as applied in this context is general to the consortium level. In outlining the anticipated impacts across the different institutions, particularities and contextual factors specific to the implementation within each institution are omitted. In this sense, accompanying qualitative assessments, or additional work to adapt the logic map to relate to individual institutions, may be informative.

A.3   Detailed description of the logic map applied to WHELF

Context

The context motivates understanding of why the next-generation LMS was implemented, and what the consortium members' objectives were in updating to the new system. The context also provides some indication of what some of the intended functions of the project are designed to address or resolve.

Legacy system limitations and technological developments were important factors driving the migration to the new LMS

The understanding of the context in which WHELF is implementing the LMS came primarily from the research, scoping and specification study (Hughes et al., 2012), the feasibility study, and the workshop. In many ways, staff and users at institutions felt it was necessary to switch to a next generation system. The feasibility study emphasised that some systems were reaching their "end-of life", and staff were looking for suitable ways to upgrade or modernise (p.11, Jisc and WHELF; 2013). One part of the problem was the strain that using these outdated systems had on library staff; the business case made by Wrexham Glyndŵr University suggested that staff and workflows are "struggling to adapt to developments in the provision of information and resources" (p.3, Wrexham Glyndŵr University). The business case developed by Cardiff Metropolitan University provides some indication of what these developments are; it specified in its objectives that the project should "…enable staff to optimise workflows, with the flexibility to support customised task lists, workflows and workflow alerts, the ability to automate key processes, and support for choosing between automation and mediation of key decision points in workflows" (p.7, Cáceres-Soto and Thomas; 2014). Technological improvements and changes in library collections and services included the need for better management of digital and print assets, and a wish to use functions which take advantage of rapidly-available information on collection use and volume (p.2, University of Glamorgan).

Appetite for collaboration is also an important factor

Complementing the demand for functions available in next generation software was the desire within WHELF to collaborate more. WHELF emphasised a "holistic approach to higher education library services in Wales" (p.10, Jisc and WHELF; 2013), which, more concretely, focussed on:

- "opportunity for sharing library services across Wales;

- development of consortial purchasing deals for electronic resources; and

- collaborative working on other key initiatives such as Welsh repositories."

(p.10, ibid.).

Inputs

The inputs for the LMS process can largely be classified into five main categories:

- hardware inputs;

- infrastructure inputs;

- software inputs;

- financial inputs; and

- labour inputs.

Although hardware inputs are expected to be minimised as a result of migrating to a cloud system, there may nevertheless be additional IT hardware that need to be installed. One example may be the necessity of installing hardware to increase the bandwidth within an institution, if internet usage is expected to drastically increase from use of the cloud system.

Members' feedback from the workshop suggested that staff costs are best classified by the tasks that those staff members undertake. Separating staff inputs to different roles, operating at either consortium or the institutional level, adds granularity to cost calculations of the human resources required for different aspects of the WHELF LMS. Labour costs also include those external to the institutions, such as those relating to external legal advice during the procurement process, or supplier training costs.

Activities   The activities convert the inputs to outputs. Through iterations of the logic-map, pre-procurement and procurement activities were included in the logic map, because of the benefits obtained during those processes. The logic map therefore represents the whole process of migrating to the next-generation LMS (including the pre-procurement, procurement and purchasing phases), rather than only representing the implementation and operational use of the new system.

The logic map covers all aspects of the WHELF LMS, from pre-procurement to post-operational activities

The activities are also expected to extend beyond the operational. WHELF institutions report an appetite and desire for further collaboration after the collective procurement and purchase of the LMS, to promote additional development and collaborative opportunities. This is defined within the logic map as "post-operational" activities.

Aside from the purchase and use of the software, activities also cover devising and implementing best workflows and practice. The next-gen LMS software offers new functionality and information, for which best practice procedures and optimal workflows must be developed. A common LMS platform also opens up opportunities for more added value collaboration around resource sharing (such as, for example, shared cataloguing and reciprocal borrowing).

Outputs   Consistent with the approach taken for the activities and inputs, the shared procurement process is considered as an output. The functionality and features of the system are primarily based on the ex-ante requirements as outlined in the feasibility study (p.14, Jisc and WHELF; 2013), which were revised in light of suggestions at the workshop, based on changes to the characteristics and features of the implemented LMS.

Suggestions during the workshop of future development initiatives included an app-based interface, and an additional software-layer, operating at the consortium level.

Intermediate outcomes

Building on the "long-list" of outcomes from the feasibility study (pp.20-1, Jisc and WHELF; 2013) and the business cases[20], the intermediate outcomes focus on the short-term results, categorised into six main types.

The first category lists intermediate outcomes that result from a migration to a next generation LMS software. The option that WHELF chose to purchase was also a cloud-based system, which provides additional benefits for institutions and users. Some of the short-term outcomes likely to come out of a next generation system are the possibility of integrating different library collections, and integrating the new LMS with other internal systems[21] on an institution-wide basis.

The consortium with governance format results in WHELF-specific intermediate outcomes

Four categories focus on intermediate outcomes resulting from adopting the 'consortium with governance' format chosen by WHELF. These intermediate outcomes can broadly be classified along two main dimensions:

- outcomes that occur in some institutions as a result from acting as a consortium;

  - this provides one set of outcomes, defined within the logic map as "outcomes beneficial at an institutional level, because of participation in a consortium". For example, some smaller institutions were able to benefit from the resources provided by larger institutions to obtain features and functionality for their LMS that they would otherwise have been unlikely to purchase or develop independently.

- outcomes that occur in all institutions as a result of acting as a consortium, split along thematic lines into three categories;

  - one category is associated with pooling of library collection databases, to allow better discovery among users;
  - another category focuses on the increase in, and better standard of, analytic data available to library staff. This data is pooled at the national level across all members of WHELF;
  - a third category of benefits pertaining to all consortium members focuses on the outcomes resulting from greater coordination in the implementation and use of the new LMS. The most prominent examples within this category are shared staff skills; from sharing experiences and training, there are likely to be efficiency gains (in terms of time and other resources needed) than if each institution worked independently.

Monetary and financial benefits may be of secondary importance but they should not be ignored

Finally, related to but distinct from the other categories are the financial and monetary outcomes. Even though the financial benefits can be considered as being of secondary importance compared to the "real driver" of user experience improvements (p.15, Owen and Dalling; 2016), monetary gains are nonetheless potentially sizeable, and may be of particular importance to specific stakeholders at the institutional level. One prominent example of this is seen at Cardiff University, where the shared LMS is seen as a contributor to

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[20] For example, see p.8, Owen and Stanley (2014); pp.1-2, Wrexham Glyndŵr University; and p.2, RWCMD.

[21] Representatives from the National Library of Wales suggested that a useful benefit could be the harmonisation of the LMS with their wider financial systems.

the wider university target of achieving a 5% cash surplus per annum (p.6, Owen and Stanley; 2014). Furthermore, financial savings may be the most measurable aspect in quantitative terms of the benefits of the project, and in some situations, it may be appropriate to represent other quantitative measurements in monetary terms (such as, for example, staff time).

Impacts

In contrast to the intermediate outcomes, it is envisaged that the impacts are longer-term in nature, and much more uncertain. Furthermore, beyond the new system, many different factors may influence these impacts. It is not a straightforward exercise to attribute the change in impacts that arises from the implementation of the new LMS. For example, should student satisfaction with the library increase or decrease, it would be a challenge to isolate the impact of improved user experience of the new LMS, from other confounding factors that could possibly affect a change in students' satisfaction with the institution's libraries. More qualitative approaches, such as undertaking case studies, may improve understanding of the extent to which impacts are realised on an institution-by-institution level.

The impacts can be thought of as "end-goals" to which the introduction of a new LMS is expected to contribute

The impacts identified are drawn mostly from the feasibility study and the business cases. Although the benefits of adopting the shared LMS are broadly comparable across all the different institutions, it is evident that the relative importance of the expected impacts can vary from institution to institution. For Cardiff University library, on top of looking to achieve a cash surplus, the business case emphasised the target of attaining high student satisfaction (ibid.). The University of South Wales shares similar targets of enhancing National Student Survey scores from the implementation of the shared LMS (p.2, Glamorgan University). Wrexham Glyndŵr University emphasised a key strategic benefit was improving "student and academic access to all the learning resources on reading lists, which will have a direct and positive impact on student experience" (p.1, Wrexham Glyndŵr University). The National Library of Wales lists many objectives, such as "addressing the requirements of current patrons and staff" for the next seven years, and decreasing time spent on administrative LMS focused tasks by 50% (p.8, Murphy et al.; 2014). Subsequently, the list of impacts within the logic map was developed at a broad level, such that they can apply or be adapted to all the institutional-level objectives.

Who benefits?

Through the impacts, the logic map also highlights the main groups of interest in the context of the WHELF LMS. Primarily, the key populations of focus are:

- front-end users, who are mostly students and academic staff in universities and members of the public in non-academic institutions;

- back-end users of the software, who commonly are the library staff who use the software for library management tasks.

Appendix B Additional details on the evaluation framework to evaluate the benefits of the WHELF LMS

B.1 Alternative approaches in related domains

Alternative approaches considered from related domains

There are alternative frameworks which have been applied to similar domains, for example, in quantifying the value of public libraries, and in quantifying the value of data. While there are useful concepts and techniques within these approaches that may be of interest in evaluating the benefits of the WHELF LMS project, they were not identified as the best approaches going forwards. A summary of these other frameworks can be found in Table B.1.

Table B.1: Alternative approaches

Method	Brief description of method	Advantages	Disadvantages	Suitability for WHELF project
Contingent valuation method	The definition provided by the Green Book defines the method as "directly asking people how much they would be willing to pay for a good or service, or how much they are willing to accept to give it up" (p.101, HMT; 2003). In the context of WHELF, this would provide a single number that can be interpreted as the total value of the service.	• A single number in monetary terms is derived; the result is relatively simple to understand, with options for further calculations (e.g. return on investment). • This approach has precedence in related domains.	• The method is complex to execute satisfactorily, involving a rigorous questionnaire design process to obtain appropriate responses. • Results may be unconvincing to stakeholders. • It can be time-consuming and expensive to design and implement.	• This method is deemed not suitable for the WHELF project, because there are components of the library system which are already priced. • It is also not a framework that can realistically be taken forward by WHELF without specialist knowledge in the technique.
Econometric techniques	This is a more robust design than the advocated approach. It would involve matching the attributes of WHELF institutions with other institutions (which have not implemented the WHELF LMS). These identified institutions, if they fulfill all the conditions, can pose as the counterfactual case at the institutional level.	• It introduces the possibility of attributing causality to the impact of the treatment. • It can inform the average scale of impact and significance.	• More data intensive and difficult to execute than less robust designs. • Requires involvement from experienced economists on an institution-by-institution (and outcome-by-outcome) basis to determine suitable counterfactuals and to implement econometric techniques. • Requires involvement of institutions outside of the WHELF consortium.	• This method is not very suitable because of the lack of sufficient data in the WHELF project, and because of the low sample size (ten institutions in total). • It is also not a framework that can realistically be taken forward by WHELF without specialist knowledge in the techniques.

| Indirect benefits | Focussing solely on potential cost savings, this method advocates calculating increased efficiency costs as a direct benefit comparing before and after the intervention. Then, by making certain assumptions on how the efficiency savings are subsequently used (e.g. on further R&D work), the "indirect" benefits could be calculated as the additional value/benefits that the usage of fund consequently provides. | • Cost efficiencies (financial savings) are relatively straightforward to calculate, and can provide an easily interpretable result of costs before and after the intervention.
• The use of comparable methods has precedence in the domain. | • Causality is not established.
• Strong assumptions have to be made about how the financial savings are subsequently spent in order to derive convincing values of the indirect benefits.
• The value of the indirect benefits can be difficult to calculate.
• It is a very narrow focus of the direct benefits of the treatment. | • Cost savings are a useful consideration, but the indirect benefits can be considered quite speculative, and perhaps harder to quantify within this domain. |

Source: Cambridge Econometrics.

B.2 Evaluating impact: the counterfactual and the true experimental design

The counterfactual, validity, and reliability

BIS (2011) lists two main conditions to undertaking a strong impact evaluation:

- the correct identification of a counterfactual instance; and

- that evaluation results should be robust; that is, as "valid" and "reliable" as possible (pp. 21-2, BIS; 2011).

The counterfactual is a hypothetical supposition of what would have occurred in institutions in the absence of a WHELF LMS. In practice, the counterfactual is never observed[22]. Sometimes, data observed for similar units that have not been 'treated' are used to approximate the counterfactual. In the case of WHELF, this may be other higher education institutions, or public libraries. These libraries are expected to behave similarly to institutions that have received the treatment in every respect, other than that they were not given the treatment.

Validity is defined as when the study has "measured what it was intended to measure" (ibid.). Consistency is a key element of this; definitions of measures and of indicators, as well as methods of calculating values, should generally make reasonable sense in the context of the evaluation questions and objectives. The results should also be relatable outside of the context of the study as well. Reliability can be thought of as whether the same conclusions can be drawn, if a similar study was undertaken using the same approach.

The true experimental design

The (hypothetical) perfect evaluation design can indicate the motivation and rationale behind the counterfactual approach. The "gold standard" (p.26, BIS; 2011) for undertaking a strong impact evaluation is the "true experimental" design. The true experimental design involves randomly allocating the treatment[23] to a selection of institutions within a larger cohort of institutions. The random allocation is important; given a random allocation, any differences in attributes before treatment would be evenly distributed across the treated and untreated groups. There should not be other changes occurring in either the treated and untreated group during the intervention.

The most robust set-up would require random allocation and observations pre- and post- treatment on treated and control groups

The performance of both cohorts would be observed before and after the treatment; if differences in performance between the cohorts are observed in the period after the treatment, then it can be convincingly argued that the difference in performance between the treated and untreated group is *caused* by the treatment. In other words, the performance of the untreated group acts as the counterfactual against which the performance of treated institutions can be compared.

An example diagrammatic representation of the true experimental design is available in Figure B.1. In this example, the evaluation objective is to measure the impact of a consortium-level LMS on resource use in institutions, to assess

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[22] This understanding also motivates the "quasi"-experimental design, described in more detail below.

[23] The "treatment" can be understood as the policy or intervention, which, in this case, is the introduction of the WHELF LMS.

whether the expected benefit of improved efficiency in workflows has been realised.

Figure B.1: Diagrammatic example of the true experimental design in the context of WHELF

	Time		
	Time A	Time B	Time C
R1 = Random group 1 or treatment group	**O1** = Observation 1: Measure of resource use before the intervention	**X** = Treatment: Introduction of the shared LMS	**O2** = Observation 2: Measured improved efficiency in resource use
R2 = Random group 2 or control group	**O3** = Observation 3: Measure of resource use before the intervention	No treatment or introduction of placebo	**O4** = Observation 4: Measured lack of efficiency improvements in resource use

Source: Adapted from BIS (2011).

Figure B.1 also emphasises the data that need to be collected in this instance:

- observations on resource use of the (randomly allocated) treated group before and after the introduction of the WHELF LMS; and

- observations on resource use of the (randomly allocated) untreated group before and after the introduction of the WHELF LMS.

It is difficult to achieve the true experimental design in a policy environment, and hence alternative assumptions must be made

In practice, the true experimental design typically cannot be implemented. Therefore, "quasi" experimental designs are adopted. Quasi-experimental designs rely on identifying an untreated group which can act as a suitable counterfactual, even though the treatment was not randomly allocated. In this sense, quasi-experimental designs aim to get as close to the true experimental design as possible, even if the policy was not implemented under true experimental conditions.

In these evaluation models, a key consideration is attributing causality of outcomes to the treatment of interest.

B.3   Limiting factors in the instance of a WHELF evaluation

In the context of the WHELF LMS, there are various factors that limit the feasibility of implementing the strongest impact evaluation design.

Contextual difficulties

The WHELF consortium lacks a suitable counterfactual group for comparison to enable a quasi-experimental design. All institutions in Wales received the "treatment" (that is, the adoption of the WHELF LMS), which mean that there are no adequately comparable libraries which have not implemented the WHELF LMS at the national level. It may be possible to widen the scope of the cohort of institutions for consideration (to include, for example, other institutions in the UK), but the allocation of the LMS could not be assumed to be random in that instance.

Identification of the counterfactual, and isolating the effect of the new LMS, may be difficult

Migrating to the new WHELF LMS was also not the only significant change that occurred to some institutions during the implementation phase of the project. For example, at around a similar time to implementing the WHELF LMS, some institutions underwent mergers that affected the provision of library services; Swansea Metropolitan University merged with UWTSD in 2013, with the library formally merging in 2016. This violates the condition that no other changes should occur to the treated or untreated group during the treatment. Therefore, given the observed outcomes, it is subsequently difficult to attribute causation of observed outcomes on the introduction of the WHELF LMS alone.

If the mechanisms through which the treatment generates impacts are complicated or conditional on a range of other factors, then it may be difficult to attribute causality

The extent to which an observed result is attributable to the treatment depends directly on the complexity of the relationship between the outcomes of interest and the treatment. The mechanisms through which the impacts[24] can occur are quite complex. For instance, one potential mechanism through which the WHELF LMS can improve user satisfaction is the availability of better analytics data of library use. This data may enable institutions to better meet the demands of users, which may result in improved user satisfaction with library services. The benefit of better analytics data in this instance is likely to be contingent on the ability of staff to make best use of the analytics data and to develop optimal workflows to better meet the demands of users, which may or may not occur. Consequently, given the complexity of the relationship, and the necessary actions by staffs to realise the benefit, it is expected that it would be difficult to ascertain the scale of impact of the WHELF LMS on user satisfaction with the library. Furthermore, the estimated scale of impact may be small, and measurement error or lack of detail may compound the issue.

Practical difficulties

The timing of any evaluation is important. In this instance, given that the project is already at the implementation and operational phase, it may be difficult to obtain data on indicators before the treatment, if those indicators were not already monitored for other purposes.

Data availability is limited

While there is some available data, data scoping efforts throughout the course of this project suggest that apart from some monetary data, the data for many of the other metrics associated with WHELF LMS are not currently in place. In the cases where data are available, it may be patchy, inconsistent, or not comprehensively documented in terms of derivations or definitions. In addition, the data available seem not to closely align with the specific areas of interest of this study.

B.4   Details on the refinements to the chosen approach

The refinements outlined in Chapter 4 are based on the specific structure and circumstances of the WHELF project:

- **The focus should be on intermediate outcomes.** The mechanisms through which the pre-procurement, procurement, implementation, operational and post-operational phases of the WHELF LMS can generate the end impacts are complex, circumstantial, and contingent on various

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[24] The impacts in this instance are synonymous with the impacts identified using the logic map.

enabling factors. More qualitative assessment techniques may be able to describe and understand the impact of the WHELF LMS on the expected impacts.

- The aim should be to isolate the most important intermediate outcomes across the long list of expected outcomes to focus on fewer evaluation objectives. While any impact evaluation should try to evaluate the extent to which all types of expected benefits have been achieved, each objective requires a careful assessment of suitable assumptions and what the counterfactual may look like. Focussing on a few selected outcomes would decrease the requirements and burden on individual institutions.

- It is important to keep to standard calculation conventions and existing data monitoring efforts to ensure internal and external validity of the results. It is important that the terminology and definitions used within the study are clear and consistent with domain definitions and conventions more generally. It is also beneficial to ensure that consistent definitions are applied across all the participating institutions within WHELF which are recording data on outcomes and performance, to ensure that scale of impacts are comparable and additive (when evaluating the total scale of impacts for the consortium).

B.5 Details of the strengths and weaknesses associated with the approach

The strengths and weaknesses of the approach outlined in Chapter 4 are explained in further detail below:

Strength of the approach

The design focuses primarily on WHELF institutions. In more robust designs, data on performance of what would have otherwise occurred (the counterfactual) would have required gathering data on institutions that are comparable to WHELF institutions, but which have not received treatment. However, given the heterogeneity of attributes of different institutions (within and outside of WHELF), it is difficult to find a comparable group of institutions that can pose as a suitable approximation of the counterfactual case. In the instance of SCURL, for example, the collaborative efforts observed in the SHEDL scheme to achieve a "shared digital library in Scotland" (SCURL, 2017) is the "first super-consortial purchasing scheme of its kind in the UK" (ibid.). Given those experiences, it would be difficult to convincingly argue that data observed for SCURL institutions would be similar to WHELF institutions' experiences in the absence of their LMS project.

In addition, even if such counterfactual instances can be found, the lack of existing common and consistent data collection efforts[25] would have meant that additional work is needed by institutions outside of WHELF to start collecting data according to the same definitions and approaches. One strength of the suggested approach, therefore, is that the data monitoring efforts can be devoted to WHELF institutions.

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[25] The exception to this are SCONUL returns, but they are perhaps not focussed enough in many instances to pinpoint the impact of the changes to LMS services. In addition, SCONUL statistics are not applicable to all institutions in the WHELF consortium.

- **The approach considers additional, alternative developments**. The advocated approach gives some thought to and consideration of any changes or developments that would have occurred over the same timeframe in the counterfactual. This implies that the method motivates an understanding of the quantitative data beyond looking purely at metrics before and after the implementation of the next generation system, as this may over- or under-estimate the impact. For instance, take the example of collection sizes represented graphically in Figure B.2 below. If a researcher observes a permanent increase compared to historical trends in the number of searchable record, then this may over-estimate the impact of the consortium approach, especially if in the counterfactual situation, the institution would also have adopted a next generation system that improved the discoverability of their existing collections.

Figure B.2: Considering the implications of counterfactual developments
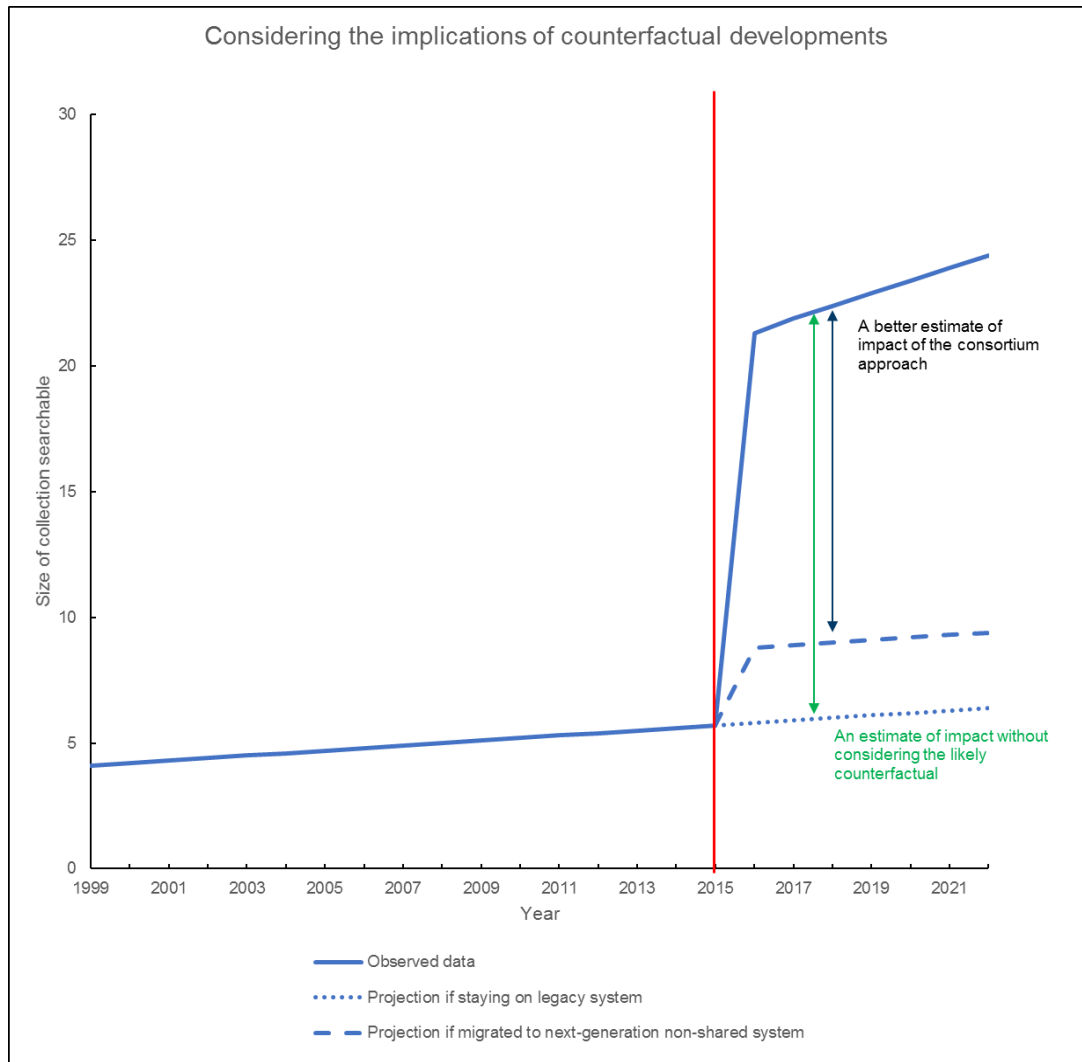
Source: Cambridge Econometrics.

The advocated approach is linked to simple performance monitoring, which will be useful for future assessments

The approach is linked to simple monitoring efforts. The design encourages evaluators to conduct simple monitoring efforts, with additional attention devoted to modelling the counterfactual. This design can therefore build on existing and ongoing efforts to develop key performance indicators (KPIs) to monitor the progress and development of the WHELF LMS project, without having to impose too many additional resource requirements for institutions (which would be necessary for more robust designs).

It is conceptually straightforward (and easy) to implement. The approach does not require in-depth knowledge of economics or econometric techniques to take forward, and hence, in the future, the WHELF consortium should be able to undertake similar analyses independently. That said, there may be preferences that may not be obvious to individuals who are less familiar with evaluation methods. As part of the project, CE developed a data template with guidance notes (more on this in Appendix E below) that can be developed further for future monitoring.

Caveats and weaknesses

The advocated design is "weaker/riskier" compared to true and quasi-experimental designs (p.17, Campbell and Harper; 2012). The advocated design is limited in the extent to which causality can be proven quantitatively. That said, this is perhaps the strongest design given the data available and the lack of random allocation of treatment.

Resource requirements to locate, identify and collect the relevant data can be substantial

While the quantitative approach advocated here has lighter data requirements than other impact evaluation designs, the data requirements are nonetheless not insubstantial. There is the risk that there is insufficient data to undertake such evaluations in the future.

Another related risk is that there may not be sufficient resources to continually monitor outcomes. To facilitate this, clear documentation should be developed to explain existing data collection efforts, to facilitate further development and ongoing monitoring going forwards. The metrics developed in this study are explained in Appendix E.

There are drawbacks with quantitative methods

The design and framework advocated in this study relate to the use of quantitative methods in order to measure the outcomes, which can subsequently be used to understand the scale of benefits. However, the quantitative results themselves may provide only a partial picture of the full scale of benefits, in instances where quantitative measures do not appropriately or accurately capture the full scale of benefits. Quantitative data alone may also omit important qualitative factors when assessing the benefits. Therefore, qualitative assessments techniques, such as case study analyses, may provide added understanding.

Appendix C   Details of the first workshop

C.1   Background

In order to validate and test the applicability of the findings from the literature review, CE engaged with representatives from WHELF members in a workshop organised by WHELF in July 2016. The workshop ran for one day, and mostly focussed on collection of opinions, thoughts and suggestions on the ideas in the logic map, metrics to measure specific outcomes, and the counterfactual scenario for institutions.

C.2   Participants at the workshop

The workshop was attended by representatives from:

- Aberystwyth University;
- Bangor University;
- Cardiff University;
- Cardiff Metropolitan University;
- National Library of Wales;
- Swansea University;
- University of South Wales;
- University of Wales Trinity Saint David; and
- the WHELF project manager.

C.3   Details of the workshop

In total, there were four main sessions, all lasting between 30-60 minutes each. The sessions for the whole day were:

- Introductions and project overview;
- Session 1: Logic framework discussion;
- Session 2: Intermediate outcomes and impacts: linkages, importance and scale;
- Session 3: Measuring the intermediate outcomes and impacts: existing structures, metrics, and collected data;
- Session 4: Discussion of counterfactuals; and
- Concluding remarks, and next steps

Much of the thinking and feedback obtained from the first two sessions fed directly into the logic map.

Appendix D   Details of the second workshop

D.1   Background

In order to validate and test the use of the data template, CE engaged with representatives from WHELF members in a workshop organised by WHELF in September 2016. Robert Francis, an independent consultant working with WHELF on the case studies, also presented his findings to date.

D.2   Participants at the workshop

The workshop was attended by representatives from:

- Aberystwyth University;
- Bangor University;
- Cardiff University;
- Cardiff Metropolitan University;
- National Library of Wales;
- Swansea University;
- University of South Wales;
- University of Wales Trinity Saint David;
- the WHELF project manager; and
- Wrexham Glyndŵr University.

D.3   Details of the workshop

In total, there were four sessions.

- Introduction and current progress
- Session 1: Methods for assessing benefits
- Session 2: Case study
- Session 3: Guidance on how to think about counterfactual
- Session 4: Presenting the data template
- Session 5: A worked example of using the data template
- Post workshop actions

Much of the thinking in the second workshop was used to inform the layout of the data template, and to develop the counterfactual approach and advocated design. Some of the thinking also fed into the findings of the final report.

Appendix E   Details on the data collection for the project

E.1   General description

In applying the suggested evaluation approach, Cambridge Econometrics (CE) collected data associated with the LMS from the WHELF institutions. This was done through designing and distributing a data template for each institution to fill in.

This appendix outlines what data were collected, how institutions arrived at the counterfactual, and definitions and guidelines for approximating the actual data and the predicted counterfactual for the metrics.

E.2   The data template

Purpose   The data template was designed for collecting and holding data on indicators that help to measure the benefits of the WHELF LMS. The implementation of the WHELF LMS was completed in mid-2016 and so, as of February 2017, the availability of data for indicators will be limited.

For collecting data to calculate the realised benefits to date, the main focal point is on monetary indicators. These monetary indicators cover the pre-procurement, procurement, purchase and implementation phases of the project.

For ongoing monitoring of the performance of the WHELF LMS, the data template also provides a structure for recording other quantitative metrics going ahead.

General features of the template   CE designed a data template for institutions to input data on outcomes now and in the future. The general features of the data template include:

- **Scope to provide data for the observed outcomes, and to provide modelled data for the counterfactual outcome.** Within the data template, there was scope for institutions to provide as much data for the counterfactual as for the observed outcomes.

- **A long-time series to collect data for periods before the introduction of the shared LMS.** Institutions were invited to input a long time series of historical data, to aid any modelling or estimation efforts to inform the counterfactual. The template has columns for users to input data over 2010/11-2016/17, where data from 2015/2016 onwards are at present expected (rather than realised) outcomes. The years can represent academic or financial years, depending on how institutions currently collect data

- **The data values entered should be at the institutional level** (i.e. for the institution on whose behalf the template is being completed). Individual institution's data were aggregated together to draw conclusion on the consortium as a whole.

- **Quantitative indicators have been suggested where possible on the full scope of intermediate outcomes.** The structure of the data template loosely mirrored the intermediate outcomes of the logic map developed during the earlier tasks of this study.

- **Some of the general information provided are definitionally the same as those collected for HEI's SCONUL returns.** These metrics were used to provide an understanding of the general landscape of the different institutions libraries; adopting SCONUL definitions ensured a high degree of standardisation and consistency of definitions across the different institutions' data.

Refining the data template with a pilot institution

In developing the final data template, CE worked closely with a pilot institution (University of South Wales) to try and understand the practical challenges of populating the template. The work undertaken in collecting and approximating the relevant data for the pilot institution provided a lead for other institutions during their own data collection efforts.

Basic structure of the data template

The data collected from institutions consists of the following elements:

- basic data about the institutions' library costs and provisions, as well a qualitative explanation of the counterfactual;

- a sheet to capture data on cost metrics

- sheets to capture non-monetary benefits (not-filled in).

E.3   Basic data collected

Table E.1 below describes the basic data collected by CE, including descriptions of the definitions and assumptions.

E.4   Cost metrics data collected

Table E.2 below describes the cost metrics for which CE collected data, including descriptions of the definitions and assumptions.

For each cost metric, CE tried to collect information on:

- a description of the cost metric;

- a WHELF LMS row (for actual data) and a counterfactual row (for predicted counterfactual data);

- values over 2010/11-2016/17, on an annual basis; and

- a row for qualitative explanations and assumptions adopted by the institution in providing the data.

For clarity and ease of completion purposes, the data template categorised each intermediate outcome according to the main (or primary) effect that would most likely result. This means that, in instances where features have secondary outcomes, there was no provision in the template to provide data on these.

For example, one intermediate outcome of discounts provided by the software providers as a result of WHELF operating as a consortium is that smaller institutions purchased additional software that they otherwise would not have been able to afford. Whilst the monetary value of this new software may be of interest, the main effect is a higher quality of service provided to library users, because the library did not spend any less money, but instead purchased a higher quality software to provide an improved service. Hence, this would be filled in in another sheet related to 'institutional gains from operating as a consortium', rather than the 'monetary indicators' tab.

Table E.1: Description of general information data collected

Basic information collected	Description of metric
General information collected	
Contact name	Contact name of the people populating the data template
Contact email	Contact email of the people populating the data template
Contact telephone number	Contact number of the people populating the data template
Date	Date the template is updated
Estimate of wages as a % of total staff costs faced by the institution (if applicable)	CE wanted to capture the total personnel costs to the institution, which include costs additional to staffs' salaries, such as employers' social security and pension contributions. This was difficult and too labour-intensive[26] to acquire accurately.
	Conversely, wage or salary costs were mostly readily available (even in instances where exact values for wage or salary costs were unavailable, they could be approximated as the average salary of that staff's grade).
	Therefore, institutions were advised to provide a percentage of wages to total personnel costs for the institutions. A figure of 80% was recommended after consultations with the institutions, although CE emphasised that institutions should adopt different percentages if there was a better approximation specific to their institution.
Start month of reporting year	This was defined as the start month of the institution's financial year, and was captured to ensure that data across the different institutions reflected the same years.
Library data	
Total library expenditure	This corresponded to question 6.5 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.
Library operating costs	This corresponded to question 6.1 + question 6.4 (library staff costs and other library costs) from annual SCONUL returns. Institutions remarked that this normally included costs of training and development for library staff, as well as stationary. Heating, lighting and other utility costs are normally accounted for in other university budgets.
Library total staff costs	This corresponded to question 6.1 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.
Number of FTE library staff	This corresponded to question 1.5 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.

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[26] Institutions remarked that it may be especially difficult to obtain total personnel costs for the full history; data for many historical years were preferred, but not essential.

- Number of e-books for which the library has paid	This corresponded to question 3.3 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.
- Total catalogued book stock	This corresponded to question 3.1 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.
- Total number of serial titles purchased	This corresponded to question 3.4 from annual SCONUL returns. For non-higher education institutions, the definitions adopted in SCONUL were provided and the data were collected according to the same definitions.
Information on the counterfactual data	
Description of the counterfactual at an institutional level	Institutions selected from a list of defined options on the most likely counterfactual situations: procuring new LMS independently; procuring new LMS with another institution; continuing on with legacy systems. This helped refine and categorise the number of options of the counterfactual instance.
Additional details:	This provided additional space for institutions to develop a qualitative explanation of the counterfactual.
	CE considered that a "reasonable" approximation of the counterfactual was sufficient, and that primary attention should be given to monitoring WHELF outcomes. CE did not expect that it is possible to construct a counterfactual case for every indicator or outcome.
	Advocated approaches to "construct" the counterfactual included:
	• extrapolating from existing data within the institution; or,
	• approximating based on data from other, comparable, institutions.
	CE emphasised the importance of considering components that would have existed in the counterfactual case but are not observed in the realised outcome. One example may be project manager requirements at the institutional level, which have to some extent been reduced because of the consortium-wide governance and management team.

Source: Cambridge Econometrics, with input from WHELF.

Table E.2: Description of costs data collected

Expected intermediate outcome	Cost metric	Description of metric
Savings from purchasing new LMS as a consortium*		This outcome captured any possible monetary savings from purchasing a new LMS as a consortium. For institutions that would have otherwise continued with their legacy systems, the costs in the counterfactual would be 0[27]. In the counterfactual instance where new LMS would've been purchased independently, CE recommended that the hypothetical costs would depend on how much institutions would've been willing to pay for their new LMS, which may be higher or lower than what they paid in reality for the WHELF LMS.
	Software and hardware implementation and subscription cost	This covered implementation costs only; the indicator below ("Software maintenance costs") covered annual subscription costs.
	Software maintenance costs	This covered maintenance costs for the main software and for other software purchased. One way of defining what the main software costs were (as opposed to other software costs, for example) was to consider what the core services delivered by the library were, and what were the essential software required to deliver those services.
	Software maintenance costs – other associated software costs	The software included was intended to be based on what is required in addition to delivering the institutions' core library services. Institutions were advised to describe and outline the different software and hardware included in the explanations/assumptions column. Institutions, where possible, included all the individual costs associated with delivering library services related to the LMS (even if they do not change in the counterfactual). CE had no preference on whether institutions provided software costs in "Other associated software costs" indicator, or the "Software maintenance costs - Other software costs" indicator, as long as the inclusion/exclusion of these other software were consistent across both the counterfactual and the WHELF LMS rows, within the same indicator.

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[27] There are exceptions; purchasing and implementation may occur in the counterfactual (despite the continuation of use of a legacy system) if, for example, there were mergers of or split between a group of institutions.

	Labour implementation costs (supplier technical specialists and institutional staff)	This was defined as total labour costs of supplier staff to install and implement the new LMS. Onsite and offsite services were covered; onsite services covered implementation services from within the institution, whereas offsite services covered implementation services from outside of the institution. This could have been derived from the total bill of labour costs, or approximated using day rates of the supplier staff multiplied by the number of days required. In addition, labour implementation costs of institutional staff time would have been considered. Activities defined under this category included time spent on implementation by institutional staff, and/or time spent reviewing process implementation and related workflows by institutional staff.
	Training costs (supplier technical specialists and institutional staff)	This metric related to the cost of training courses purchased from the supplier on how to run the system. Training costs were provided by the supplier, and therefore any quoted training costs covered the total costs that institutions paid for training (including, for example, training material costs). In addition, training costs in terms of time spent by institutional staff undertaking (or providing) training were covered. The main elements of training that should be accounted for in this context were the training involved to achieve accreditation, and any other forms of necessary training undertaken by staff who would be operating the software. One example of other necessary training may be formal staff training sessions; in these cases, costs could have been approximated through estimating staff time spent (per grade), multiplied by the approximate number of trainers and participants. Other forms of informal (or ad-hoc) training should also be accounted for, if sizeable and calculable. Institutional training costs may have been substantial, but were difficult to capture. It was decided that institutions should aim to capture two types of training costs separately: training to achieve certification, and more general training for all members of staff. Accounting for the training required to achieve certification should be as accurately captured as possible. For all other library staff who had to undertake more basic training on the software (to learn how to operate it, for example), institutions adopted an assumption of 1% of annual staff costs (of staff who undertake training) as an approximation of the training time needed (as an approximation of the average time spent by each library to be trained on the systems)

		In relation to the counterfactual where institutions would have opted for a next generation cloud hosted system, it was agreed that there is a need to reflect benefits of sharing experience and knowledge during implementation (but that this would have differed, according to cohort). A fixed percentage was added to training for this type of counterfactual: 0.2% (of total staff costs) for all staff in cohort 1, 0.3% for cohort 2 and 0.4% for cohort 3. However, if institutions felt like it may more accurate to estimate it for their own institution directly, CE recommended that they should adjust the values accordingly. Similarly, for institutions that would not have adopted a next generation cloud-hosted system, the counterfactual would not have adopted these assumptions.
	Other associated costs	This covered: • additional software; and • other fees charged by the supplier that are not covered in the other categories (such as, for example, provisioning fees).
	Management costs	This related to the institution's own project management costs for handling the LMS project. This covered the costs of the project management team, approximated as the staff cost of a particular grade multiplied by the amount of time they spent on project management tasks for implementing and running the WHELF LMS (or the counterfactual equivalent), as well as contributions to the WHELF project manager.
Reduced procurement costs from acting as a consortium**		Procurement costs concerned the efficiency savings derived from the process of procuring the good/service, rather than the discounts offered by the chosen supplier and outcome (which are captured separately). From another perspective, procurement costs captured the efficiency savings from procuring as a consortium rather than individually, such as, for example, less time spent on developing the tender specification and administrating the tender process.
	Procurement costs	Procurement costs covered all essential elements of procurement. Individual institutions may have different workflows or policies relating to the procurement process. CE's advocated approach and definition centred around defining possible activities which should be accounted for under procurement, and encouraging institutions to calculate the costs of these activities.

Institutions ensured that calculation of procurement costs should encompass (not exclusively) the following activities:

- time of library and IT staff time in developing requirements;
- evaluating responses;
- negotiating with internal stakeholders; and
- external legal advice.

According to a paper[28] prepared by the National Audit Office (NAO), procurement covers the following activities (not specific to Higher Education institutions or libraries):

- "Understanding the demand and business requirements for goods and services;
- Sourcing of the required goods and services from qualified suppliers at best value and in accordance with the appropriate tendering regulations;
- Ensuring that contracts and service levels are agreed and clearly defined with suppliers;
- End users are able to raise requisitions which result in approved purchase orders transmitted to the supplier; and
- Supplier performance is managed against contractual standards and Service Level Agreements" (p.1, NAO).

Institutions therefore ensured that their calculations and considerations of procurement costs captured these aspects of procurement.

An alternative but less accurate approach was to adopt industry-wide assumptions to ensure consistency. This was not the preferred approach and was only used as a back-up if the advocated approach was not feasible. If it is adopted, the Efficiency Measurement Model (EMM) is a standard model used to capture procurement efficiencies in the Higher Education sector. In the context of the WHELF LMS, for every institution, the most relevant cost savings are:

- claim per complex collaborative arrangement for each institution (£12,500).

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[28] The paper also provides guidance on and insight into a variety of other indicators on procurement, that explores value beyond monetary terms. This could provide some motivation for further exploration of capturing non-monetary benefits of operating as a consortium during the procurement process. This paper was prepared as part of the Public Audit Forum performance indicators (more information is available at https://www.nao.org.uk/report/public-audit-forum-performance-indicators-3/).

		For the institution which led the procurement process, savings include: • claim per tender if it is advertised electronically in OJEU (£150); • if Tender Documentation is downloaded from a published URL rather than photocopied and posted out in hard copy (£400); and • claim per complex collaborative arrangement that the institution leads in the year that it is set up (£20,000). No institution opted for the "back-up" option for calculating procurement costs
Reduced hardware costs through operating a cloud hosted system		One of the anticipated outcomes of moving to a cloud system as part of the new LMS was the potential infrastructural and IT cost savings of the project. Measuring this outcome would capture the operational savings of the WHELF LMS in comparison to the operational costs of the counterfactual.
	Building space costs	Costs were drawn from the institutions' standard costing models, if applicable.
	Software and hardware costs	Hardware costs encompassed the costs of the infrastructural requirements of the LMS. In the WHELF LMS case, this was exactly the same as the software and hardware subscription costs outlined within the "Savings from purchasing new LMS as a consortium" section; the difference comes from what the counterfactual would've been; the counterfactual instance for this category would have been to opt for a non-cloud system, which would've resulted in higher local software and hardware requirements. Drawing heavily on existing efforts to derive infrastructural costs of library management systems, the hardware costs were defined as any infrastructural costs of the platforms required for the library management system. In the example provided to CE (of legacy system hardware costs), this consisted of the application server platform, and the database platform; the costs included estimates of the cost of rack space and networking, storage costs, physical server costs, virtualisation licence costs, OS licencing and database licensing, backup and associated licensing and load balancer capacity. The cost of the software itself and staff operating costs were not included in the calculation of hardware costs. Costs could be drawn from institutions' standard costing models, if applicable.
Shared costs of customisation and bespoke development		This outcome related to any additional development work that occurred in the context of WHELF. Institutions were recommended to add relevant additional costs that fell under this category. Institutions added bespoke costs for translation, Alma Network Zone and Primo Consortial View, as well as local costs such as Resource discovery interface development and Primo UI.

Source: Cambridge Econometrics, with input from WHELF.

Additional guidance provided to institutions

Implicitly, CE assumed that the introduction of the new LMS system would not generate additional revenue for the institution. Hence, all monetary/financial benefits were considered to be cost savings. All outcome metrics were measured as costs, from which CE can calculate the degree of cost savings, where appropriate.

Ranges of figures (e.g. number ± x%) were accepted in cases where the numbers were highly uncertain. Again, institutions were expected to provide clear explanations on where the uncertainty comes from.

Calculating (approximating) costs

In cases where it was difficult to come up with a precise figure for costs, costs were approximated by scaling accordingly, where appropriate. For example, costs of staff time on specific tasks could have been approximated using the wages of the staff grade multiplied by the time spent.

Costing staff time

CE suggested using a simple mathematical calculation to derive the costs of staff time:

$$\frac{Number\ of\ hours\ spent\ on\ LMS\ activity\ over\ the\ year}{Total\ number\ of\ working\ hours\ in\ a\ year} \times Annual\ staff\ cost$$

$$= Cost\ of\ staff\ time\ on\ LMS\ activity$$

for each staff involved in LMS activity.

Calculating staff time

CE advised that staff time could be calculated as the number of hours spent on activity X over a year. If such data was not monitored, then it could be approximated as the average number of hours per week, multiplied by the number of working weeks in an academic year. This metric can be converted to numbers of hours spent as a proportion of total working hours in a year (as the number hours contracted in a week, multiplied by the number of working weeks).

Shared costs

CE advised that costs data inputted should record the total costs at the institutional level, irrespective of whether the institution was responsible for paying the whole cost.

E.5   Post-collection data manipulation

The data was reviewed and harmonised after a second round of discussions with WHELF institutions. In addition to this, CE had to make certain assumption to collate and process the data, based on the quantitative and qualitative information available. Manipulations of the collected dataset included:

- **Alignment of all data to the same financial years.** This consisted of taking simple proportions of costs (where appropriate) for each financial year covering August to July to ensure that the year covered the same months for every institution. Ongoing supplier costs were not scaled.

- **Ironing out discrepancies between different sources of data.** There were instances where the data did not correspond from multiple sources, such as, for example, individual institutions' project manager contributions. Where there were discrepancies, the data belonging to more comprehensive datasets were used.

- **Reallocating costs to different parameters.** Where the qualitative information seemed to suggest that data belonged to another cost metric, the data were moved. This was uncommon; the main reallocation occurred when institutions placed procurement costs in project management costs, and did not incorporate legal costs in their calculations of procurement costs.

- **Adjusting inconsistencies based on a misunderstanding of how to fill in WHELF LMS/ counterfactual rows.** Unless the counterfactual would have resulted in a change in actions before the introduction of the next generation LMS system, historical data for the WHELF and counterfactual case before implementation should be equal. Where it was probable that the data should have matched, but did not in the data template, the data was overwritten.

- **Adjusting inconsistencies based on a misinterpretation of assumptions adopted for the indicators.** One area where there were large discrepancies was in the potential efficiencies in staff training from operating as a consortium. An assumption was recommended and adopted to estimate efficiency savings (see Table E.2 above), but this was not uniformly applied. The calculations were redone where it was possible and appropriate to do so (that is, there is enough information in the data template to suggest how that calculation could be done; the counterfactual for that particular institution also would have had to be the purchase of a next generation cloud-hosted system). Nonetheless, because of the assumption-based nature of these calculations and the relatively large uncertainty associated with them, they were not reported in the quantitative analyses of the main study.

- **Missing counterfactuals.** One of the institutions was uncertain on what to include for the counterfactual. Therefore, quantitative data for that institution were included for describing total WHELF costs, but were not included in predicted total savings.

- **Total personnel costs were calculated using the "% of salary to total staff costs" metric.** The exception to this was for staff training costs; this was approximated as a proportion of total staff costs obtained from SCONUL statistics, and that statistic already includes on-costs.

- All purchases or subscription costs were converted to exclude VAT.

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