Author(s): Clements, Kati; Pawlowski, Jan; Manouselis, Nikos

Title: Why Open Educational Resources Repositories fail - Review of Quality Assurance Approaches

Year: 2014

Version:

Please cite the original version:

Clements, K., Pawlowski, J., & Manouselis, N. (2014). Why Open Educational Resources Repositories fail - Review of Quality Assurance Approaches. In L. G. Chova, A. L. Martínez, & I. C. Torres (Eds.), EDULEARN14 Proceedings. 6th International Conference on Education and New Learning Technologies (pp. 929-939). IATED Academy. EDULEARN proceedings. http://library.iated.org/view/CLEMENTS2014WHY

WHY OPEN EDUCATIONAL RESOURCES REPOSITORIES FAIL – REVIEW OF QUALITY ASSURANCE APPROACHES

Kati Clements[1], Jan Pawlowski[1], Nikos Manouselis [2]

[1]*University of Jyväskylä, Mattilanniemi 2, 40014 Jyväskylän yliopisto, Finland.*
kati.clements@jyu.fi, jan.m.pawlowski (FINLAND)
[2] *Agro-Know Technologies, 17 Grammou Str., Vrilissia, 15235, Athens (GREECE)*

Abstract

Regardless of the amount of open educational resources (OER) available, many learning object repositories LORs fail to attract active users and sustainable funding solutions. Previous studies indicate that quality of OER plays a significant role in the success of the repositories; however, there is a lack of systematic deeper understanding of this connection. In this qualitative study we interviewed 35 managers/developers of 27 national, thematic and federated LORs in regards of the LORs' quality approaches and success. The key findings of this study show that comprehensive quality approach leads to success of the repository in most cases, the key instruments for quality assurance being expert and peer reviews. Contribution of this research is the review of LOR quality approaches. This study helps LOR developers to design sustainable quality assurance approaches.

Keywords: Open Content, Open Educational Resources, Learning object repositories, Quality assurance, Success

1   INTRODUCTION

In the last ten years, the number of open content or more generally Open Educational Resources (OER) as well as their availability and distribution via OER repositories (LORs) has rapidly increased. There clearly has been a general awakening in the e-Learning community regarding OER [1]. More LORs are built and metadata of existing repositories are harvested by federated repositories [2] to improve access to high numbers of OER. This process brings critical masses of OER available to users, at the same time raising an increasing need for quality control of resources [3]. Regardless of the amount of educational resources available, many LORs are not used to their full potential [4]. According to [2], not enough studies have been done to obtain an accurate idea of the nature and status of development of LORs, which motivated our study. Quality of OER plays a significant role in the success of the open content repositories (LOR) [5];[6]) therefore it's vital to study the quality approaches effects on the repositories' success.

Learning object repositories use three levels of quality approaches [7]: 1. The Generic Approach of Quality standards (e.g. ISO 9000 standards [8], European Foundation for Quality Management Excellence Model [9], 2. Specific Quality Approaches (e.g. Content development criteria or competency requirements)[9] and 3. Specific Quality Instruments (e.g. user generated quality approaches such as rating[11], peer review [12] or recommender systems [13]. In this study we investigated the use of different levels of quality approaches in LORs. Previous LORs reviews have often been on a general level, listing the features of repositories [12]or their characteristics [2]. OCRSs have also been quantitatively analyzed regarding their size, content growth and distribution [4]. Recent study by Atenas & Havemann [14] reviewed the OER Repositories technical and social quality approaches on a numerical level. However, the quality approaches have not been evaluated in a holistic level, which would also aim at understanding how quality approaches can affect the success of the repository. This study covers that research gap. The contribution of this research is a review and analysis of 27 LORs' quality approaches and their effects on the repositories' success and can give a recommendation on future developers of LORs regarding their quality assurance strategy.

2   OPEN EDUCATIONAL RESOURCES

Open Educational Resources are often not clearly defined. UNESCO defined OER as "technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non-commercial purposes". [15] This is contrasted by the current use of equivalent approaches such as Open Source [16] or Open Access ([17];[18]). Downes [1] described OER: "In the

system implemented by Creative Commons (widely thought to be representative of an "open" license) authors may stipulate that use requires attribution, that it be non-commercial, or that the product be shared under the same license. So while "open" may on the one hand may mean "without cost," it doesn't follow that it also means "without conditions." Davis & al. [19] described educational resources as sets of resources, which have been assembled and described with the intention that they could be picked up and re-used by others. This study defines OER as "All resources for the purpose of learning, education and training which are freely accessible for the user". This means that the LORs business model does not include selling the materials themselves, but perhaps adverts, add-on services or other via other activities. OER can be literature and scientific resources (Open Access for Education), technologies and systems (Open Source for Education) and Open Content (actual learning materials / contents) as well as related artefacts (such as didactical materials or lesson plans).

2.1 Distribution and re-use: Learning object repositories (LOR)

The Internet has enabled OER to be available in large masses all around the world. To answer the question of "How the right OER might find users and how the OER might be re-used in various communities", LOR repositories were established. LOR are multi-functional platforms which are designed to facilitate access to reusable learning objects in a variety of formats, so users can search for, find and make use of this content ([20];[21]). LORs are databases full of OER, accessible for users via its interface portal. LORs in the last five years can be typed based on the community developing the service. In this study we look into the following types of repositories (see table 1):

Table 1: Typology of learning object repositories.

Type	Main characteristics	Examples
National repositories	Users are school teachers (& students of one country), often supported by the ministry of education of the country	Miksike's Lefo (Estonian national repository) http://lefo.net/
Thematic repositories	Focuses in providing content around a certain topic like 'Science, Music or Art'	Discover the Cosmos (Astronomy content) http://portal.discoverthecosmos.eu/
Federated international repositories	Typically harvest metadata of other repositories and bring critical masses of OER available	Open Discovery Space http://opendiscoveryspace.eu

Various studies on Learning object repositories have been conducted in the recent past, Tzikopoulos & al. [2] made a comprehensive investigation on LORs' characteristics. [4] analyzed quantitatively the size, growth and contributor bases of LORs. [12] compared features of LOM repositories. Several European Commission funded projects have also researched the success of LORs, most recently EdReNe network in their report "Building successful educational repositories" [22]. Many have focused in recommending how repositories should be built ([23]; [24]). Many have focused on the lifecycle or evaluation of the repositories ([25]; [26]).

2.2 Success of LORs

In previous studies, we have identified that repositories fail to create an active community around them [4]. How do we define a successful LOR? Most repositories gather data on success indicators, which typically take into consideration monthly daily user rates/page views, download counts or hits in the interface portal [22]. Various metrics the past have been proposed by previous literature for the Learning object repositories' ([27]; [28];[29]) success. In these studies, specific metrics, tools and methods are discussed that allow repository managers to assess the success of the deployed repositories. Perhaps the most extensive quantitative study by Ochoa & Duval [4] analysed LORs with metrics of "Content growth, Contribution growth, lifetime & publishing rate." The quantitative use analytics provide a restricted measurement of LOR's success. Information systems such as LORs can also be evaluated through Delone & McLean IS Success model [30][31] in which information, system and service quality can lead to use & user satisfaction, and through that towards net benefits. As previous research has not been able to agree on a stable definition of LOR success, in this paper we will define LOR success based on the previous literature metrics (Content growth, Contribution growth,

lifetime & publishing rate) enhanced with our findings - from the perspective of LOR developers – what is LOR success for the developers.

3   QUALITY ASSURANCE OF OER

Quality can mean different things to different people in different contexts. In this way, if we want to really understand quality, we cannot study it in a vacuum but rather as a part of a given community of practice and a specific product [3]. Quality can be defined as "[…] *appropriately meeting the stakeholders' objectives and needs which is the result of a transparent, participatory negotiation process within an organization.*" [32]. In the context of OER and LORs quality can mean that teacher finds a suitable resource for his/her teaching. Previous studies on LOR have highlighted the issue of quality assurance of repositories, as this is seen as key to provision of quality content to end users ([12];[33]).

Learning object repositories quality approaches vary on the level [14] of stakeholder involvement: Certain approaches are relying heavily on user generated quality, whereas other approaches are so-called 'Top-Down' solutions where the quality has been evaluated by an outside expect according to the quality criteria or framework of the LOR. In general, three levels of LOR quality approaches can be distinguished:

Table 2: Quality approaches (Enhanced from [7])

Approach	Purpose	Examples
Generic quality approaches	Quality standards present concepts for quality management, independent of the domain of usage	• ISO 9000:2000 [8] • EFQM [9]
Specific Quality approaches for TEL domain	Quality management or quality assurance concepts for the field of learning, education, and training, top-down approach	• QAA Framework Consortium for Excellence in Higher Education [34]. • Quality criteria, [35]
Specific quality instruments	User generated quality mechanisms for managing specific aspects of quality, bottom-up approach	• Ratings [11] • Recommender Systems [13];[6];[36] • Peer reviews [12] • Trusted networks approach [37]

Generic approaches (Quality standards) contain domain-independent quality approaches and can generally lead to trust in certified organizations. Those provide a consistent minimum quality of OER and technologies. If an organization uses for example the EFQM excellence model [38], it is assured that all products have been assessed and quality controlled. While the EFQM-Model is used for self-assessment, the ISO 9000 is used to prove organizations by external assessment to earn a seal of approval [39]. In the context of this study, we investigate the use of quality standards as a basis for the repository's quality approach.

Specific approaches differ in scope and methodology, ranging from quality marks for education [40] to content development criteria [9] or competency requirements [41]. They aim at achieving high quality of OER and related technologies. Specific quality approach is appointed by the LOR developer, but often approved by a community/counsel of experts reviewing the approach. In our study, we investigated four different types of specific quality approaches (Adopted from [7]):

1. Expert review (ER) – All OER in the LOR is checked by a thematic expert of the field

2. Quality Criteria (QC) – LOR has set itself quality metrics (which the OER is checked against)

3. Quality Mark (QM) – LOR adds a quality badge which allows users to recognize high quality OER

4. Quality framework(QF) – LOR sets OER quality by an existing, recognized quality framework

Specific instruments can be defined as user-generated quality. LOR developers set technical features to the repository which allows the community to contribute to the quality either directly (rating, reviewing, commenting, flagging etc.) or indirectly (The LOR portal can monitor the users' activities and based on that social data, make automatic promotions of content (recommendation systems) As OER repositories need sustainable solutions for quality assurance, specific quality instruments have become increasingly popular. Unfortunately, in voluntary settings in OER communities, it is not easy to

find adequate motivated reviewers; so specific quality instruments can only work with a strong community behind them **Virhe. Viitteen lähdettä ei löytynyt.**. LOR developers favor specific quality instruments because they are cost effective, however, they are problematic also because of the context nature of quality. In our analysis, we checked eight different types of specific quality instruments (Adopted from [7]):

1. User ratings (UR) – Users can give "stars" or "likes" to the OER

2. Peer reviews (PR) – Users can write longer reviews of the OER

3. Recommender systems (RS) – LOR recommends OERs to the users based on their previous activities in the LOR portal

4. Commenting (CO) – Users can comment on OER

5. Flagging/Disclaimer (FL) – Users can report bad content (e.g. broken links)

6. Sharing (SH) – Users can share OER inside the LOR/in social media with their friends and colleagues

7. Automatic metadata testing (AM) – LOR checks the lacking fields of metadata automatically

8. Trusted networks approach (TN) – LOR trusts the organizations or individuals creating the OER without checking the content (specially popular approach among federated repositories as they have too much content for reviewers to check)

4   METHODOLOGY & ANALYSIS CRITERIA

In this study, we interviewed 35 managers/developers (27 Europeans, 1 Northern American, 7 Latin Americans) representing 27 repositories. In some cases more than one persons were interviewed for one repository in order to catch both the perspective of managers as well as a person in charge of the user community building (sometimes these roles were taken by the same person and sometimes they were conducted by two or more persons). The repositories were selected based on a large variation sampling; we wanted to include both successful and less successful repositories, as well as representatives from each three types of repositories (National, thematic, federated – international) as well as different sizes of repositories. Our sampling method aimed to show country groups and context which are essential to fulfill the UNESCO goals of global collaboration [43]. The contribution of this research is a review and analysis of 27 LORs' quality approaches and their effects on the repositories' success. This research can benefit developers and managers of LORs regarding the choices towards their quality assurance approaches. In the case of Latin America, interviewed experts were asked to introduce the researchers to other colleagues in the field. This can be seen as a snow-ball technique for sampling [44].

Qualitative multiple case study [45] methodology was chosen because of the need for deep understanding for the various cases. All interviews were conducted, transcribed, coded and analyzed by two researchers to avoid subjective bias. The interviews were conducted online (70%) (via Skype, Flashmeeting) or face-to-face (30%) depending on the availability of persons. The duration of the interviews ranged from half an hour to one hour. The analysis of the interviews was done following [46] guidelines for coding. Additional information was retrieved after the initial interview round from 60% of the interviewees. Additional materials were also obtained on case-by-case basis from the repositories' websites. In order to simplify the two approaches of quality approaches and success, we developed a comparable metric criterion for this paper based on previous metrics as well as the repositories' reporting of the ways they measure quality and success. This part of the analysis can be described as data-driven. Qualitative data can be presented in a numerical format for clarification, for this the examples of presenting evidence by [47] were followed.

Success analysis level criteria (simplified from [4] and [22]):

1. Contribution growth & publishing rate: Active users after the original funding has ended (1 point = 500-1000 users per month; 2 = several thousands per month; 3 = tens of thousands per month)

2. Lifetime: Funding sustainability point for Repository has been successful at receiving funding after the initial project/initiative has ended/Has sustainable funding otherwise, like under a ministry or company (1)

3. Content life cycle: LOR resources are being harvested by other initiatives (1)

This metric allows us to judge the repositories into levels of success: 1 = Failed; 2 = Marginally successful; 3 = Steady use but not growing; 4 = Quite successful; 5 = Truly successful with a steady user base and contributions.

Quality analysis level criteria (Elaborated from [48] and [7]): 1-3 points = 1 point for each level of quality approaches (Generic, Specific, Instruments); 1 point = Expert review (usually needs most funding); 1 point: 50% or more of different types of approaches used.

5 RESULTS AND DISCUSSION

Table 3 presents the full summary of this analysis for all 27 repositories. Repository acronym has been selected to present the continental background as well as type of the repository. Scales in the middle of the table show the levels of Quality approach review (Q) and Success review (S).

Table 3: Cross review of Success and Quality approaches in LORs.

Repository acronymn	Quality approach review	Q	S	Success review:	Scale
Europe.Federation1	**Instruments:** UR, CO, SH, AM, TN	1	3	University teachers still uploading content and students are consuming the content after 5 years since funding has ended	*~1000000 ERs*
Europe.Federation2	**Generic:** Quality standards **Specific:** ER, QC, QM, QF **Instruments:** UR, PR, RS, CO, FL, SH, TN	5	4	Still more than 1000 users per month, original project ended Summer 2011	~1200 ERs
Europe.Federation3	**Specific:** QF **Instruments:** UR, PR, RS, CO, FL, SH, TN	3	3	Ended 2012, Still occasionally used from outside the original consortium; Contents harvested to on-going projects	~15000ERs
Europe.Federation4	**Specific:** QC, QM, QF **Instruments:** UR, PR, RS, CO, FL, SH, AM, TN	3	4	On-going projects support, still used	*~1000000 ERs*
Europe.National1	**Specific:** ER **Instrument:** PR, CO	2	1	Still harvested to other repositories, no users of its own	~1600ERs
Europe.National2	**Specific:** ER **Instrument:** PR, CO	2	1	Still harvested to other repositories, no users of its own	~5000 video resources
Europe.Thematic1	**Generic:** Quality standards **Specific:** ER, QC, QM, QF **Instruments:** UR, PR, CO, FL, TN	5	4	Initial project followed by a second funding, which has ended in 2013, still active users, harvested to other portals	~100 000 ERs
Europe.Thematic2	**Specific:** QC **Instruments:** UR, PR, CO	2	2	Funding ended in 2010, Harvested by other portals, minor user activity on-going	~3500ERs
Europe.National3	**Specific:** Expert review **Instruments:** FL	3	2	Funding has ended 2010, few active users, objects are harvested into other repositories	~86000ERs
Europe.Commercial1	**Generic:** Quality standards **Specific:** ER, QC, QM, QF **Instruments:** UR, PR, CO	4	4	Runs through company funding, has users	1500 ERs
Europe.Thematic3	**Specific:** ER **Instruments:** UR, PR, CO	3	2	Funding has ended 2010, few active users, objects are harvested into other repositories	~800ERs
Europe.National4	**Instruments:** PR, TN	1	5	Run by the ministry of the country, 10 000 visitors per day	~50 000 ERs
Europe.National5	**Specific:** ER, QC	2	1	Harvested by other repositories	~3500ERs
Europe.National6	-	0	1	Resources are not available	~180

				except through other portals	courses
Europe.National7	**Specific:** ER, **Instruments:** FL, TN	3	4	Is providing a service through LMS, which has an active user base.	~2700ERs
Europe.National8	**Specific:** ER, QC **Instruments:** AM	3	3	Funded by the ministry, active daily use	~1000
Europe.National9	**Instruments:** PR, FL	3	3	Funded by the ministry, active daily use	N/A
Europe.National10	**Specific:** ER, QC **Instruments:** PR, SH	3	4	Funded by the ministry, active users	~100 000ERs
Europe.Thematic4	-	0	1	Not actively used on its own, but harvested to other collections	~300ERs
US.Federation1	**Specific:** ER, QC, QM, QF **Instruments:** UR, RS, CO, FL, SH, AM, TN	4	5	Run by a non-profit organization for over 7 years,	~70 000 ERs
Latinam.national1	**Specific:** ER, QC **Instruments:** UR, PR, CO, TN	4	4	Active users, run by the ministry	N/A
Latinam.federation 1	**Instruments:** UR, RS, AM, TN	1	2	Has minor use	N/A
Latinam.thematic1	**Specific:** ER, QC **Instruments:** RS, TN	3	2	Has minor use	180 ERs
Latinam.thematic2	**Specific:** ER,QC **Instruments:** PR, FL	4	3	Fairly new repository, has active user base	32 courses
Latinam.federation 2	**Instruments:** UR, CO, FL, SH	1	1	Owned by a university, experimental stage	N/A
Latinam.national2	**Specific:** ER, QC, **Instruments:** UR, PR, CO, FL, SH, TN	4	5	55-60 000 visits per day, supported by the ministry	N/A
Latinam.thematic3	**Instruments:** UR, RS, TN	1	1	SME run, very small amount of users	13000ERs

5.1 Quality approaches & success review cross analysis

We can see a pattern when comparing the two measurements for quality approach and success. In most cases the difference is (+1, -1 or 0). This study indicates that **quality approaches can be seen as a critical success factors for most LORs**. On average, the repositories analysed got 2,6 on their quality approaches and 2,8 on their success, which actually means just a 0,2 difference which points to the quality approach being highly indicating the success of the repository. Of course as previous studies [49] have shown, there are various barriers for LOR use, one must take into consideration that the quality assurance approach is just one aspect of the full success story. However, maximising the variation of quality approaches alone cannot make LORs successful, the combination of quality contributions from both developers (specific level) and users (instrument level) has the most cost-effective, sustainable solution.

Based on our analysis, three repositories reached the five points, indicating that these three repositories are successful: Europe.National4; US.Federation1; and Latinam.National2. Both the two latter repositories relied heavily on expert review, on their quality approaches, but also had put in place community-driven quality instruments such as peer reviews, ratings and flagging. It seems, as **quality assurance needs a mixed-approach with at least both the levels of expert review (Specific level) and user-generated (Instrumental level) activities in place**. All three had a strong 'peer review' approach, which could be seen as an emerging top assurance measure. Three most popular measures for quality assurance were: Peer reviews 18 (Out of the total 27 Analysed repositories used it); Expert review 17/27; User ratings 17/27.

Generic standards approaches are mainly ignored by the LOR managers/developers. Only three LORs used them as a basis for their quality assurance. Findings were that Generic quality approaches such as standards are not really considered by most repositories – they are seen as a costly, too complex solution.

> *"…we need to survive and we need to keep these kinds of cost as low as possible, otherwise it wouldn't live long. And all these kind of standards, they are, as I said, they are very good on the organizations that are rarely having big kinds of budgets, and you can explain a lot why you need additional money, but I don't think the sustainability is in that." -- Manager of Europe.National4*

Overall popular among the federated repositories seems 'trusted networks' approach 6 out of 7 used it. This means that they claim to 'trust the content that comes in from the repositories that they harvest, saying ultimately that quality should be the problem of whoever is producing the content in the first place. This approach is understandable due to vast quantities of content being harvested by the repository – expert review for large amounts of data seems to cost too much, however this issue is also problematic because sometimes the quality simply is not checked at any point in the uploading process. Many of the LORs have an expert or expert board either hired or volunteering to check all content that goes into the repository. This quality approach takes a lot of efforts/funding to maintain. **The national portals run by the ministries of education seem the most sustainable regarding both their funding background and through that also their quality approach.**

The interesting case that does not fit the success pattern is "Europe.National4" repository, which has used only peer reviews as a quality assurance approach, but is still extremely successful initiative. For this we explored the interview transcriptions. Their peer reviewing technique seems to have been quite successful in the past:

> *"…for our free content we have already in 2001 to 2003, when we had a lot of free content coming in, what we did was that we called this process the washing day, so we invited any users, including pupils and teachers, whatever to check these contents and when they found a mistake, we gave them a prize. So this is… we "washed" the mistakes out of the free content, and this process was very successful, so we corrected thousands and thousands of mistake, including grammar and concept mistakes. So this is like a community checking, but no we are not doing that, these kind of large things anymore, because we do have very much free content coming in at the moment. " -- Manager of Europe.National4*

However, when looking deeper into the case of Europe.National4, we can notice that their approach on motivating teachers to contribute towards resource contributions is unique among the evaluated 27 repositories – their salaries depend on how many international or national publications they make, which explains the success of their approach. Teachers all around the world would probably be motivated to contribute and re-use OER if their money depended on it. This country has put to place a '*reward system'* for the teachers, which seems to be one of the themes rising also in other interviews. Teachers would like to get something extra for their 'free work' if they are contributing towards or even using OER instead of normal course books. **LORs need new reward systems for contributions & publishing rate growth**. Perhaps the school world will soon move towards similar salary raises through publications as the academic world already has done for years.

> *"…I think we missed opportunities to reimburse good contributors, for example by awarding some "chocolate medals" to some good authors" -– Technology developer of Europe.Thematic2*

5.2 What is LOR success for repository managers/developers?

It's important to understand that quantitative metrics do not necessarily explain the entire success of the LOR (compare [49]). This finding regarding repository managers' point of view for success might be wider than user statistics; the repository **developers might see *additional success value (such as using repositories as test beds)***, which is not obvious:

> *"…Ok, it's not been THAT used, but nevertheless it is a success for me as it is, and also an element in the evolution of the community in didactics and education and among the secondary teachers, an evolution in the way they see resources and how to use them." – Technology developer of Europe.Thematic2*

> *"…**It is more like a learning lab for us**, it has allowed us to… we see ourselves as the premier curators of OER. We feel that we developed a lot of expertise of what is out there, and that our goal is to showcase that and to display dynamic ways, enable people to search through it fluently" --Technology developer of US.Federation1*

These examples would indicate that a repository might be successful even after contributions are not showing increases in use or content contribution. 'Being able to use LORs as testbeds' would fit under the Delone & McLean IS Success Model's construct "net benefits" [30][31]. Since the beginning of the OER movement, there has been some indication that Success indicators can also be tied together into user-generated quality instruments [22][7].

> *"Our main, what we are considering **criteria for success right now is user engagement.** -- Meaningful is for users to go through this facilitated evaluation process and evaluating large amounts of resources, so right now that's the big criteria, **the number of resources that get evaluated.**" --Technology developer of US.Federation1*

This type of findings indicate that LOR success factors and metrics should be brought together to today's level. Many OER success reviews have been conducted more than 5 years ago, in which time the social media activities have changed the way users consume portals. Further research on this topic should be made.

6   CONCLUSIONS AND FUTURE WORK

This study reviewed both LOR quality approaches as well as their success factors and showed a clear connection between them. The key findings of this paper indicate that both specific top-down and instrument bottom-up user-generated quality level approaches are needed for maximizing the cost-effectiveness of the approach. However, generic standards quality approaches are often forgotten. It is vital to remember that user-generated quality assurance instruments can only make repositories successful if the community around the repository is strong enough to support it. Based on our findings the success of a federated LOR in most cases require expert reviews for all content coming in, however overall the most effective single approach seems to be peer reviewing the content. These research findings benefit developers and managers of LORs regarding the choices towards their quality assurance approaches. In this study we also touched the field of LOR success, which still seems to be somewhat in debate in the TEL research community. Regardless of many previous studies, there is still a lack of comprehensive Success theory for LORs, including solid success factors and metrics. This research identified the need for deeper understanding of what success is for repository managers, which should be studied further in the future.

ACKNOWLEDGEMENTS

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