

Applying AI to Increase Cultural Accessibility: The Postcard Project at the Royal Danish Library



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Abstract This chapter provides an overview of the Danish Royal Library as well as an overview of AI adoption and implementation initiatives taking place at the library. Finally, the chapter presents details of a specific AI project, the postcard project. The Postcard project comprises the digitalisation of the postcard collection of the Danish Royal Library. It includes the digitalisation of approx. 350,000 topographical postcards from the period 1887 to the 1990s from all parts of Denmark and making them accessible to the broader public by using AI. The chapter provides insights into the needs of the project, the actors involved in the implementation and the challenges encountered on the way. Finally, the chapter provides insights into the value that such a project generates for different stakeholders, as well as the lessons learned in the implementation phase.

Keywords National Library · Artificial intelligence · AI · Value creation · Royal Danish Library · Metadata generation · Google Vision AI · Co-production · Digital transformation

1 Introduction

The Royal Danish Library (RDL) [1] is an institution under the Danish Ministry of Culture. The library provides services and communication of knowledge and preserves the Danish cultural heritage. The services include collecting and returning materials to public libraries, digitising material from the extensive collection, guided tours, Danish books on demand and services to professionals. The Royal Danish Library (RDL) was founded in 1648 by King Frederik III in Denmark. In 1697 the Legal Deposit Act was introduced, establishing that all printers in the country must submit copies of the writings and books they print to the Royal Danish Library. This act still applies today in an updated version.

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Since its establishment, the Royal Danish Library has undergone several organisational changes and mergers with other libraries, including the merger with the State and University Library of Denmark in 2017. Today, the Royal Danish Library is the [national library of Denmark](#); the [university library](#) of the University of Copenhagen, Roskilde University, Århus University and the IT University in Copenhagen; and the loan centre for all the Danish public libraries. The core tasks of the Royal Danish Library are digital material management, physical material management, library service, cultural information and research [1].

According to RDL's Web site, RDL has four focus areas:

- As a university library, the Royal Danish Library provides services that support research and education at Aarhus University, the IT University of Copenhagen, the University of Copenhagen and Roskilde University.
- As a national library, the Royal Danish Library collects, preserves and provides access to cultural heritage via texts, images and audio in both physical and digital forms.
- As a loan centre for the Danish public libraries, the Royal Danish Library provides services that supplement the public libraries' service offerings to citizens.
- As a research institution, the Royal Danish Library increases knowledge and awareness of the Danish cultural heritage [1].

RDL has about 650 employees and about 250 students. About 80 are employed in the division called digital transformation, which in turn comprises 5 different departments. About 60 employees in the digital transformation division deal with classical IT development and maintenance. Twenty employees comprise the communication department of the entire library (Head of Data, Interview 1, January 2024).

1.1 AI Applications in RDL

According to a section leader (Interview 7, March 2024), there are three main application areas in which AI is used in RDL:

1. Data for internal and research use (Data Lab)
2. AI used on collections
3. KB Labs experiment [2]

Within these three areas, RDL is experimenting with different AI projects, and different AI solutions are applied to the context of these projects. It is mostly machine learning embedded in handwritten text recognition (HRT) technology, optical character recognition (OCR) technology, and, more recently, Generative AI. However, most of these technologies are still at the experimental level and have not been taken into full production mode yet. In addition, AI technologies have been applied in the context of specific experimental projects. Recently, RDL has been trying to centralise all the AI-related activities and get an overview of what is going on concerning AI in the RDL.

1. The data labs are labs that provide collection data to researchers and students at the universities. For example, it can be data scientists who teach Python or R that ask for access to collection data. In addition, there are researchers, especially in the digital humanities areas, who use their RDL's collections to train and develop Large Language Models to be applied in research projects.
2. RDL has been experimenting with and applying AI in different special collections and has developed a few main projects. The specific technologies used in these experimental projects are Machine Learning, Google Vision AI Platform, and Transkribus. Google Vision is a technology for recognising things in images and is mainly an Optical Character Recognition (OCR) technology. The most relevant projects are (a) the digitalisation of the Elfelt Negative Collection, where Transkribus, a handwritten recognition program originated by an EU project, had been used to read the handwritten text on the postcards [3]. (b) The application of Google Vision technology to recognise images and text in a special collection of topographical postcards. The postcards have an image on the front side, and the back side has a small text to the recipient. Usually, they are sent by mail. (c) The application of Machine Learning Technology for the preservation of material [4].
3. The KB lab experiments [2] were born from an innovation week, where “all the developers had one week where they worked on a project, and then at some point, they had developed a lot of small projects that were put on the website” (Section leader, Interview 7, March 2024). This is a concept that RDL ran for 3–4 years. Presently, the project has been set on pause due to other priorities, mostly dictated by the Ministry. The AI technology used in these experiments is mostly Machine Learning, for example as in “Fake News Portlet”, “Word2vec” and “SoundSearch”.

This chapter investigates how the Royal Danish Library developed and implemented AI to make a special collection of topographical postcards available to the wider public. The chapter first introduces the postcard project, including needs for developing and implementing the project and the internal and external actors involved. Then the chapter provides insights into the value (co-) created with the project, the challenges faced, and the lessons learned. Finally, the chapter provides some concluding remarks.

2 Description of the Project

The Postcard project comprises the digitalisation of the collection of topographical postcards at RDL. The collection of topographical postcards includes about 350,000 postcards from the period 1887 to the 1990s from all parts of Denmark. It is part of a larger collection of prints and photographs at RDL, which has over 18 million physical images. The collection of prints and photographs is divided into three main parts:

1. The portrait collection with portraits of Danish men and women
2. The topographical collection with pictures of places
3. The chronological collection with pictures of events

In addition, there are several special collections such as the collection of Danish cartoon art, an album collection and collections donated by photographers, publishers, theatres and other companies [5].

The topographical postcard collection has been built partly through donations from private individuals and partly through compulsory delivery from Danish printers. Railway and local historians often use the collection.

The Postcard project started in 2018, and its main idea was to generate keywords and metadata about the topographical collection of postcards to be able to make them available online to the wider public. The project was initiated by a senior researcher at one of the “Special Collections” of the RDL. Presently, it is on the way to being put into production as a service for the users of the RDL library. The project objectives are mainly cost-effective digitisation and cost-effective generation of metadata. Through the project, however, RDL aims to get experience with and an overview of the opportunities and barriers of automated generation of metadata through the use of commercial AI services or machine learning services such as Google Vision [6] for use in later projects.

2.1 Need(s) Behind the Implementation

The main drivers behind the implementation of the project were the new strategy for broader dissemination of the Royal Danish Library’s collections. Such drivers include dissemination to wider target groups; increased accessibility to library collections; the user demands; and the need to generate as many metadata as possible to make it easy for users to retrieve the library material. In addition, the project is addressing indirect and observed needs of the library users to have online access to all the library collections as well as to be able to easily find out what there is in these collections and what possibilities they offer.

Thus, the project aligns with the general RDL’s mission of making RDL’s collection easily accessible, retrievable and searchable by the public. In fact, the postcard project was initiated to generate better metadata for library users as well as to make it easy to access, use and search the RDL’s collections. As a department manager says:

As I said before, the user demand, we have a reading room downstairs here where we bring down the physical material for the users who come here. But that’s not how people use material any longer. They go online and if it’s not online, they find something else. Fewer and fewer people come here to use the material in the reading room. So, we can sense that, we can feel that, and we need to react to that. Of course, it’s also our task. (Department manager, interview 14, March 2024)

2.2 Actors Involved

The project was started by a senior researcher in the special collection of historical cards and photographs at the RDL. He already had experience with dissemination of topographical material from the aerial photography project “Denmark seen from the air” [1].

The main groups of employees directly involved were the curators, who are historians or experts in the field, the employees at the digitisation department that had to put the postcard into digital format, and a big number of student assistants. There were a number of co-production phases and activities in which different stakeholders were involved. Here, the co-production activities are summarised in Table 1 by following Mergel et al.’s [7] phases of the co-production process.

2.3 Organisational Level

The project received support from the RDL in various ways. The head of the division where the postcard project was anchored directly supported the project. The top management of the RDL indirectly supported the project by providing a general policy of experimentation with AI in the library that functions as an institutional framework for “playing with AI” at RDL. As a senior researcher says:

I think our AI policy is actually a good first step because that gives some institutional framework, but it also needs to be facilitated. I think the idea of doing this sandbox for the AI is actually a good idea, but also—yeah, we’ll probably do it anyway. (Senior researcher, interview 14, March 2024)

Table 1 Co-production activities in the postcard project at the Royal Danish Library

Co-commissioning	<i>Prospective co-production phase</i>	The project was started by a curator (senior researcher) in the special collection of historical postcards, but he got support from the head of the division and library management
Co-design	<i>Concurrent co-production phases</i>	The project was envisioned by the curators but co-designed with employees from the digitalisation department that specialised in preservation of material
Co-implementation		The project was co-implemented by the digitalisation department, the curators and Google Vision
Co-delivery		The service is co-delivered by RDL, Google Vision and Users
Co-assessment	<i>Retrospective co-production phase</i>	Curators, Google Vision, users

2.4 *External Actors*

The project involved two main external actors: Google Vision Cloud Service and the government attorney. In fact, RDL had made an agreement with Google Vision Cloud Service to send them the digitalised version of the postcards to Google Vision, and Google Vision returns metadata in the form of tags, OCR and Handwritten Text Recognition (HCR) to the library. This service was provided by Google Vision upon a fee paid by RDL. In addition, RDL is also collaborating with the government attorney to find out possibilities to work with collection data in relation to General Data Protection Regulation (GDPR) and copyright issues.

2.5 *Challenges*

In the implementation of the postcard project, RDL has encountered a number of challenges. The most important challenges were related to copyrights and GDPR issues in using external commercial service providers such as Google Vision to generate metadata on the library postcard collection. In fact, there is a need for a data agreement between the library institution and the service provider if the service provider has to handle copyrighted data. This is illustrated by the following quotes:

Well, very much copyright and GDPR I think. (Vice director for Digital Transformation, Interview 4, March 2024)

At the same time, there was also this whole complete question about GDPR and all that regulation. ... We did some handheld experiments with some data, which we were confident didn't hold any sensitive information, but we couldn't go through that for the 380,000 postcards. So, we had to limit it. (Senior Researcher, Interview 5, March 2024)

Another important technological challenge was related to the accuracy and quality of the metadata generated by Google Vision. Google Vision not only generated descriptive keywords of the postcards' content but also generated a lot of redundant descriptive keywords, which generated "noise" in understanding the metadata (Senior Researcher, Interview 5, March 2024). Another technological challenge was data bias. This was important as there was a clear American bias in the metadata generated by Google Vision. For example, Danish places displayed in some postcards were interpreted as located in the USA by Google Vision.

The cost of generating sufficient metadata for postcards also represented a challenge. In fact, while it is not expensive to create digital files of cultural heritage material, it is instead very expensive to generate metadata. Two final challenges are the lack of time for library employees to experiment with this type of AI and the accuracy and quality of the metadata provided to the library users.

3 Results

3.1 Organisational Level

The application of Google Vision AI technology in the postcard project has generated a number of important organisational values for RDL. These can be summarised as follows: production of more metadata about the topographical postcard collections; unlocking some of the data which are locked in the handwritten statements on the postcards; better and more precise library search services allowing the public to find whatever they search for precisely; the potential for doing large-scale OCR or handwriting text recognition; freeing resources for other tasks or potentially also translating some of the material making it easier to search in the collections; increasing cost-efficiency by using AI instead of student assistants to generate metadata about the collections (Department manager, interview 14, march 2024); and increasing the potential for the library to understand the data they have in their own collections because the vast part of the collections are still unknown to the library due to the fact that it takes many years of manpower to go through the collections (Research Librarian, Interview 14, March 2024).

3.2 Lessons Learned

The respondents highlighted several lessons they had learned from the postcard projects at an organisational level. One of the main lessons learned in the initiation and co-production of the postcard project is that it is best to start on a small scale and then scale it up to a more considerable quantity of data. Another important lesson is that it is important to make sure to jump on the AI wagon *if, when and how* it is the right thing to do for each specific library. Finally, one other lesson concerns the ethical, sustainability and data bias issues related to using AI, as using AI can be very costly, and we should be aware of copyrights and GDPR issues as well as we should be well aware of how to use AI and for what.

3.3 Value Created and Co-created

According to the respondents, there are different public values that using Google Vision AI in the postcard project has generated or has the potential to generate for society. The first is the important cultural value of making available to the general public both existing collections and new services for library search. In fact, even though the RDL has many student assistants, it would have been impossible to make

the postcard collection available to the general public without Google Vision technology, as it would have taken about 80 years of work for a person to generate the metadata generated by Google Vision. That would have not been possible for the library. Another public value is the increase in user satisfaction with the library services, as users are very happy about getting access to old photographs and thus acquiring knowledge about how places looked from a historical perspective. As stated by a Senior Researcher:

That's a very surplus value that somebody has kept all this data, and we have scanned it and made it available for free. I think we need to do more of that. In order to do that, we need to use AI. (Senior Researcher, Interview 5, March 2024)

The democratic value of increasing access to cultural heritage and making everybody access it from close or far away is another significant public value. In fact, presently, the postcard collection and most of the national collection of heritage materials are located in central Copenhagen. This implies that it is more difficult to access these collections for users located outside the Copenhagen area than for those located in the area.

Yes, it's a democratisation but it's also a way to make the collections in use, which we have not thought about. (Senior Researcher, Interview 5, March 2024)

The above quote also points out another type of value: the value of using the collections in different ways and for different purposes if there are no copyright restrictions, the metadata are better, and the access is made easier. This implies a broader application and use of the collection data by other stakeholders than the general public. For example, at present, municipalities, regions and private consultants are using the postcard collection for pollution assessment:

So, I think by putting this digital data online, it's also creating a possibility for reusing almost in a lot of different ways, which you potentially can't even think of. (Senior Researcher, Interview 5, March 2024)

3.4 New Skills

The study points out the need for new skills if AI adoption succeeds in national libraries. Important skills are data science and computer science. As a team leader in the digitalisation department states:

If we are making AI or making new models or training models, we need the computer science skills or data science skills. (Team Leader, Interview 6, February 2024)

In addition, it is important that the employees working with the library collections (e.g. the curators) have some computational skills and vice versa the computational experts have an understanding of the library collection. As a research librarian states:

So, you need a lot of computational skills. Still, you need to understand the content. That's why I have emphasised many times that neither the organisation nor the individual employee

can be divided into in-groups like digital and non-digital. We all have to have the skill—some of the skills; we cannot be expert in both parts but the content people need some computational skills at least, and the computational experts need to understand a bit of the concept.... That is crossover skills. (Research Librarian, Interview 13, March 2024)

4 Conclusions

This chapter has provided an overview of the Royal Danish Library and has investigated RDL's AI initiatives. The findings show that the Royal Danish Library has started experimenting with AI in several ways and has initiated several initiatives, including the data labs that provide collection data to researchers and students at the universities; application of AI on special collections; and the KB lab experiments [2], which are the results of an innovation week, during which all the developers could work on an idea that had.

The chapter provides insights on an important project that has almost been put into production, the postcard project. This project started in 2018 with the main idea of generating keywords and metadata about the topographical collection of postcards in order to make them available online to the wider public.

There were several needs behind the project, including changing user demands, but it generally aligned with the RDL's mission of making the collection easily accessible, retrievable and searchable by the general public. The postcard project was initiated to generate better metadata for the library users as well as to make it easy to access, use and search the RDL's collections. A few actors were involved, including the project initiator, the curators in the postcard collection department, Google Vision and the government attorney to sort out copyright and GDPR issues.

The implementation of the postcard project presented a lot of challenges in applying AI to a library collection. These challenges included copyrights, GDPR issues, metadata quality and data bias.

The project has created organisational and public value. At the organisational level, the project has, for example, increased cost-efficiency by using AI instead of student assistants to generate metadata about the collections as well as providing the opportunity for the library to understand better the data they have in their own collections because the vast part of the collections are still unexplored as it takes many years of manpower to go through the collections. Examples of public value include the cultural value of making available to the general public both existing collections and new search services as well as the democratic value of increasing access to cultural heritage and making it equally possible to access it to users located in any part of Denmark.

Finally, RDL pointed out the need for a convergence of skills for those dealing with this kind of project in the future: the collection specialists need computational skills, and the IT employees need knowledge of the collection.

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Appendix

See Tables 2 and 3.

Table 2 Overview of the postcard project at the Royal Danish Library

Case and project name			
Royal Danish Library/The digitalisation of postcards collection project			
Country	Number of employees	Type of AI solution	Year and maturity level
Denmark	650	OCR/HRT recognition/Google Vision	Started in 2028/On the way to production
Project description			
Digitalisation of approx. 350,000 topographical postcards from the period 1887 to the 1990s from all parts of Denmark			
Need(s) behind implementation	Actors involved	Challenges	
The new strategy for wider dissemination of the Royal Danish Library's collections—both in relation to target groups and accessibility; the user demands; need to generate as many metadata as possible	Curators in Special Collections, library management, digitalisation department, Google Vision	Copyright, GDPR, technological challenges, data bias, quality of the generated metadata, lack of time to experiment with technologies, accuracy of metadata provided to library users, high cost associated with generating sufficient metadata	
Results			
Organisational level	Value created and co-created	Lesson learned	
The value of AI at organisational level includes production of more metadata unlocking of data locked in handwriting text; better and increased precision of search services; potential for large-scale OCR or handwriting text recognition; freeing resources for other tasks; increasing cost-efficiency in generating metadata; better possibility to understand own collection data because	The cultural value of making existing collections available to the public; democratic value of increasing access to cultural heritage; the value of providing new search services and cleaner metadata to the public; potential of using data collection in new ways and different stakeholder groups than the wider public	(1) Start in small scale and later scale it up to a bigger quantity of data; (2) make sure to jump on the AI wagon if and how it is the right thing to do; employee's competences, e.g. employee in library collections need computation skills and vice versa computational experts need an understanding of the collections; awareness of the ethical, sustainability and bias issues in using AI	

Table 3 Overview of the interviews

Interview number	Position	Interview date	Interview length
1	Head of Data	12-01-2024	45 min
2	Head of Data	17-01-2024	1 h and 15 min
3	Head of Data	24-01-2024	45 min
4	Vice Director for Digital Transformation	08-03-2024	1 h
5	Senior Researcher	27-02-2024	1.5 h
6	Team Leader	28-02-2024	1 h
7	Section Leader	08-03-2024	1 h + 15 min
8	Conservator/Senior Researcher	06-03-2024	1 h
9	Head of Section	15-03-2024	1.5 h
10	Head of Department	14-03-2024	1.5 h
11	Centre Director	04-04-2024	1 h
12	Head of Department	Spring 2023	1 h
13	Research Librarian	18-03-2024	45 min
14	Department Manager + Senior Researcher + Research Librarian	18-03-2024	1 h

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