

- Master Thesis Report -

WILL DUTCH LIBRARY COLLECTIONS FLOAT?

An Evaluation of Implementing a Floating Library Collection
Concept within the Dutch Public Library Sector using a Systems
Engineering Approach into Improving the Transport of Interlibrary
Loan using Discrete Event Simulation Modeling

Nick van der Noordaa

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Delft University of Technology

**FACULTY TECHNOLOGY,
POLICY AND MANAGEMENT**
Systems Engineering Department

<i>Visit</i>	Jaffalaan 5 2628BX Delft The Netherlands
<i>Mail</i>	P/O Box 5015 NL-2600GA Delft The Netherlands
<i>Phone</i>	+31 (0)15-2788380
<i>Fax</i>	+31 (0)15-2783429
<i>Web</i>	www.sk.tbm.tudelft.nl

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Master Thesis Report

Author	Nicholas van der Noordaa BSc Student registration number: 1198491
Degree	Master of Science
Graduation Date	July 6 2011
University	Delft University of Technology
Faculty	Technology, Policy & Management
Program	Transport, Infrastructure and Logistics
Department	Systems Engineering
Company	Kwink Groep B.V.

Graduation Committee

Professor	Systems Engineering	Prof.dr.ir A. Verbraeck
First Supervisor	Systems Engineering	Dr. M. Seck
Second Supervisor	Marine and Transport Technology	Dr. R. R. Negenborn
External Supervisor 1	Kwink Groep B.V.	ir B. van Mil
External Supervisor 2	Kwink Groep B.V.	Bertiene Dunning MSc

PREFACE

During the past eight months I performed my master thesis project at the consultancy firm Kwink Groep B.V. in the Hague. This thesis is the final project of my master Transport, Infrastructure and Logistics at Delft University of Technology, Faculty of Technology, Policy and Management.

This project has been performed based on a assignment I have designed together with Kwink Groep B.V. and Ronald Spanier who is managing the Pilot Distributie project commissioned by the Stichting Bibliotheek.nl. This assignment was set up based on complementing the Pilot Distributie with additional research into improving the transportation of interlibrary loan in the Netherlands. The project has resulted in preliminary results of the effects of implementing a floating collection concept within the public library sector. Several library organisations within the sector are exploring the concept and the results from this project could be valuable in assessing the possibilities of implementing a floating collection.

Making this thesis valuable for the Delft University of Technology and valuable for both Kwink Groep B.V. and the Dutch library sector would not have been possible without supervision and great support. I would like to thank all the consultants and trainees at Kwink Groep B.V. that helped me and above all my supervisors Bill van Mill and Bertiene Dunning. I would also like to thank Ronald Spanier from the Servicecentrum Flevolandse Bibliotheken, also on behalf of Kwink Groep B.V., for the opportunity to perform this project. Without his help, valuable input and the joyful contact moments, the project would not have been successful. Thanks to Ronald I had the chance to meet several important people in the library sector who have been very helpful for me in understanding the sector and its situation regarding interlibrary loan. A special thanks to all the interviewees and their time.

Both my supervisors from TU Delft, Mamadou Seck and Rudy Negenborn, also deserve a grand thank you; they helped me, challenged me, kept me on the right path and reassured me at times when I needed it the most. I would also like to thank Alexander Verbraeck for his important advice at the crucial moments during the project and for again being my professor during the conclusion of yet another degree at this faculty.

I personally would like to thank both my parents for their moral support during my extensive student career, for not giving up on me and finally their valuable input as external readers during this project.

And of course, thanks to all those other people that supported me, listened to me and believed in me during the course of my studies, with special thanks to Floor!

Nick van der Noordaa
Amsterdam, June 2011

EXECUTIVE SUMMARY

One of the provincial organizations that will have to deal with less funding in the coming years are the Provincial Service Organizations (PSO). PSOs are the regional facilitators that facilitate Dutch public libraries within a province. Amongst other activities they facilitate the libraries with ICT services and transportation of library materials between the libraries within a provincial service area. Due to recent budget cuts, these PSOs will have to find means to reduce costs and operate more efficient. The focus in this project is on reducing costs of the transportation of library materials between public libraries. This service provided to the end-user is called interlibrary loan (ILL). The launch of the national library catalogue (NBC) is expected to increase the use of this service and therefore the demand for transportation. Due to this increase, several provincial transportation service providers (PSOs) are foreseeing severe problems with their capacity. The consequences of this issue have an effect on the library sector itself and finally have an effect on the end-user of the library. The limited capacity of the transportation services lead to longer turnaround times of library materials and therefore longer waiting times for the end-users. The relevance of a good transportation network between libraries is of social importance. The public library sector is a publicly funded sector and finding ways in where the public funds can be used more efficient is a great opportunity as is a better library service towards the end-users.

This project focuses on reorganizing the distribution of interlibrary loan (ILL) to reduce costs in the future. A relatively new and innovative concept within the library sectors throughout the world is implementing and maintaining so called floating collections. With floating collections, the library materials that are lent out do not return to the owning library but remain at the location of its former request. The biggest advantage of implementing this concept is the immediate reduction of return movements of the library materials. In theory this reduction can reach a 50% reduction of transportation movements. Potential negative side effects are; emptying out the smaller libraries and capacity problems in the bigger libraries due to the increase of floating materials in their libraries; ownership issues due to libraries purchasing the materials, but once floating, "lose" their material to the floating collection. Focus within this project is on the logistics of implementing a floating collection within the library sector in the Netherlands. The objective of this project is to evaluate the potential of implementing a floating collection concept in the Dutch public library sector, considering an expected growth in demand for interlibrary loan, limited budget for the transportation services of the PSOs and considering the needs and requirements of all involved stakeholders. The research question that is answered in this project is:

Does implementing a floating collection in the public library sector in the Netherlands improve the transportation service of interlibrary loan considering the expected growth in demand and limited budget for the interlibrary loan service in the future?

The focus is to limit the costs due the budget cuts enforced in the public library sector. However, with solving the perceived issues by the stakeholders and to keep the stakeholder satisfied, extra capacity is needed to implement the floating collection in the coming three years. It can be concluded from analysis that with no

implementation of the floating collection concept, the capacity of the current system is absolutely not sufficient which is proved by simulation. When deciding not to implement such a system, other measures must be taken to limit the increase in demand. In terms of growth in demand, the implementation of a floating collection does handle the increase of transportation needed without the necessity of increasing the capacity and therefore investing in resources. However, limiting the issues and keeping the stakeholders satisfied means that extra capacity is needed to overcome the increase in demand in order to ensure the waiting times of the end-users remain on the same level as in the current situation.

The configuration of the library sector in the Netherlands is the main reason why the research question is hard to answer. There are several reasons to call the library sector in the Netherlands unsuitable for implementation of the floating collection; this sector involves many stakeholders with the same goals and ambitions towards the end-user but with different ideas on how to reach these goals and the history of the library sector in the Netherlands shows local origination of libraries that have grown to large provincial organizations. The goal for the future is one national organization and one library collection (the *Collectie Nederland*). However, the library sector has only recently started organizing institutions on a national level. That why it is too early to implement a floating collection on this level due to the immaturity of the national library sector. Now is a good moment to test the floating collection concept on a lower level. After successful testing and the successful implementation of the NBC, the floating concept can be implemented on a national level.

To obtain more detailed information and increase the quality of the knowledge of the library sector relevant to the implementation of a floating collection, a research team should be set up. This research team should research the following using the *Collaborative Business Engineering* approach; include all involved stakeholders in the project actively and upgrade the model with increasing the number of libraries and PSOs with the new information obtained; the model should play a central role and include clear and transparent communication about this model. Include validation of the input variables using information from the field.

Successful implementation of the floating collection concept within other library organizations in other nations should be investigated. Focusing on lessons learned, the advantages and cutbacks from methods used should give high quality insight in the process steps of implementing a floating collection concept in the field. Also, the possibilities of lessons learned from other sectors in developing redistribution plans should be investigated. The algorithms used in the private sector could be adapted in the library sector by redefining the algorithms to fit this case. These models are sophisticated and have high potential in optimizing the redistribution based on a number of constraints, for example, minimizing costs. The following steps should lead to a successful implementation of a floating collection: First test the floating collection with a complete simulation model of a provincial service area. Second, test the floating collection in practice on a provincial level. And finally, implement the floating collection in practice on a national level.

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1 INTRODUCTION

The first chapter of this thesis report includes an introduction on the library sector, the problem it is facing with interlibrary loan and the scope of the project, leading to the research questions. Based on these questions, a project approach is described and argued. The chapter finishes with the general outline of the project.

During the past year, several provincial governments and municipalities in the Netherlands have announced the implementation of mild to severe budget cuts in their organizations. This directly comes from the national government, whose national policy is to empower severe budget cuts in all sections of the national, regional and local governments. The provincial governments have announced that all the provinces combined will be cut 400 million Euros from their budgets. 290 million will be reduced from their budget in the year 2011. These cuts are often bigger than the budget cuts the provinces endure from the national government (1). This stresses the fact that less money is available in the coming years for several provincial organizations.

The Provincial Service Organizations (PSO) are one of the provincial organizations that will have to deal with less funding in the coming years. Every province in the Netherlands has its own PSO. PSOs are the regional facilitators that assist Dutch public libraries in their businesses within provincial boundaries. The activities of the PSOs consist of facilitating public libraries within their service area with digital services, ICT services, innovation and project development, and transportation of library materials between libraries and similar organizations. Due to recent budget cuts all PSOs have to find means to reduce costs and operate more efficient (2).

One of the most important services the PSOs provide to the libraries in their province is the transportation of library materials. All the libraries in the region depend on this service to transport their materials to other libraries that request the materials and to return the materials to the owner of the materials. Every library has a different collection and because of this transportation service it is possible for end-users to request materials that are not available at their own library. With the use of an ICT system maintained by the PSO, the end-user can order, for example a book, directly from a library that has the book available and the PSO transports the materials from the requested library to the local library of the end-user. When the end-user returns the book, the PSO returns it to the owning library. Next to transporting library materials between libraries, the PSO transports exchange collections to schools and care institutions (3).

This service of transporting library materials between libraries is called Interlibrary loan (ILL). Currently in the Netherlands there are two types of ILL, OBL (Onderling bibliotheekair leenverkeer) and IBL (Interbibliotheekair leenverkeer). The ILL between libraries within the same province is called OBL. The ILL between libraries of different PSO service areas is called IBL (4).

The budget cuts in the library sector will shape the future organization of the PSOs. The impact is expected to be significant (2). Due to the budget cuts from the

municipalities, several smaller libraries are expected to close their doors (5). Local libraries are expected to operate with less budget in the future and therefore possess less buying power, meaning that libraries will buy less new materials than before and the collections will not expand (2). Due to these developments, the transportation volumes of ILL materials are expected to rise in the coming years because end-users will choose to borrow materials from other libraries more often than currently.

On a national level, innovation in the library sector is taking shape. The Stichting Bibliotheek.nl (BNL) is a foundation that contributes to expanding and maintaining the national digital library. They work for the joint public libraries in the Netherlands. One of the main objectives of the BNL is to implement and operate the National Library Catalogue (NBC). The NBC is a national online catalogue that should have been launched at the end of 2010¹ (6). End-users can order materials using this online catalogue and pick up these materials at their local library, even if their local library does not have the material in their collection. The material is then ordered from a library somewhere in the Netherlands that does have the material available and the material is delivered to the local library by the local PSO. The launch of this national catalogue is expected to increase the use of the transport service of the PSOs (7).

The logistics of transporting library materials crossing the provincial borders (IBL) is not yet organized on a national scale. When a material is requested from a library in a different province, the library does not send the material with the transport service of the PSO. The library sends the material in an envelope to the requesting library using the national mail service from PostNL. This way of transporting the materials on a national scale is very costly and needs to be reduced in the future. The Stichting Bibliotheek.nl has started a pilot project with the goal to improve the distribution of IBL and save costs (8). This pilot project uses the PSO transport service in every provincial service area as a hub and use TNT Innight that distributes the ILL materials between the hubs every night. This pilot project aims to reduce the costs of transporting materials over the provincial borders (8).

Currently, every PSO has its own transport service. There are many differences between these services among PSOs, but there are also many similarities. Every PSO operates their service within the boundaries of the province and they operate from the capital of this province². Depending on the size of the province and the number of libraries within the province, the PSO operates several routes within the province. On these routes, the libraries are served by the PSO in between two to five times per week. Dependent on the different service levels (days per week serviced by the PSO), most of the libraries have to pay a yearly fee. The routes are operated by a so called loop system. The PSO calls on the main library of a Library Organization (LO), and then call on the different library locations of this LO to distribute the ILL materials between the branches. A LO consists of more library locations and a head office. The loop closes by calling on head office of the LO. After calling several LOs and their locations, a route is completed and the service returns to the PSO headquarters (9). In Figure 1-1: Example of a route within a provincial service area operated by a PSO an example is given of a route of the PSO transport service.

¹ At the moment the launch date is unclear due to a lot of issues remaining in the implementation process (64)

² Except for the provinces North and South Holland. The PSO ProBiblio operates within both provinces

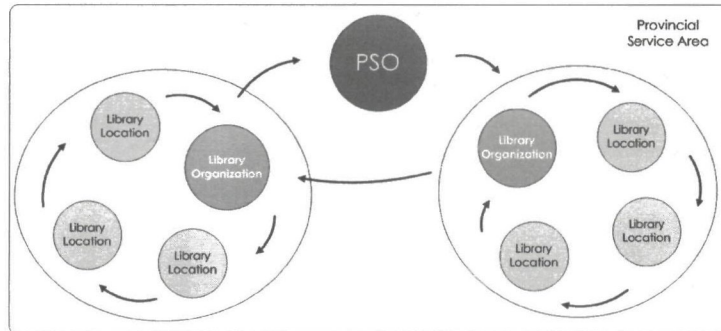


FIGURE 1-1: EXAMPLE OF A ROUTE WITHIN A PROVINCIAL SERVICE AREA OPERATED BY A PSO

Several transportation services of PSOs are foreseeing problems with their capacity (9). In the past year the transport volumes have risen to a level where the PSO is having trouble distributing the ILL materials in an efficient manner. With the expected increase of transport volume, this becomes a larger issue. Especially because of the budget cuts, the funding will not increase in the coming years in order to be able to invest in new resources and capacity (10). The current routes that are driven by the service are historically developed and are static. They do not change when the demand for ILL changes due to the service level they have to provide to the libraries. Small changes in the routes do occur, but these are based on the demand of their customers, the library organizations and not to make the routes more efficient.

The consequences of these issues have effect on the whole library sector and finally have effect on the end-user. The inefficient use of resources leads to longer turnaround times of library materials being lent out and therefore waiting times for the end-users become longer. The relevance of a good distribution network between libraries is of social importance. The public library sectors is an important part of the culture of the Netherlands. To ensure the continuity of the library sector, a significant amount of public funds is invested in this sector. To find a way in where the public funding can be spend in a more efficient way is a great opportunity as is a better library service towards the end-users.

1.2 RESEARCH SCOPE

This project focuses on the distribution networks of the eleven PSOs combined. "The Pilot Distributie" project organizes a service between the transportation service hubs, and this project focuses on the distribution of materials within the provincial service areas. As described above, the library sector has less funding available to invest in a new distribution system and therefore this project aims to research the provincial distribution network considering an increase in volume while maintaining similar resources.

This project is executed is commissioned by the national collaboration of the PSOs, the Stichting PSO Nederland (SPN). The SPN is determined to work together with the

local PSOs to support the public libraries in this form of collaboration. The SPN aims to shape future innovation in the library sector and the development of their services and products (11). The public library sector is in a situation of change due to the recent innovative projects that have been implemented in the sector and the most important development is the digitalization of information. The focus of this project is on the national distribution network that is jointly operated by the members of the SPN, the PSOs.

This project focuses on reorganizing the distribution of ILL in order to save costs in the future. A relatively new and innovative concept within the library sectors throughout the world is implementing and maintaining so called floating collections. The basic concept of a floating collection is that several organizations maintaining a collection of materials share their collections among each other in a network. The members can lend materials from this collective collection and after returning the materials, the materials enter the collection of the requesting library. The materials within this collective collection "float" among the physical locations, repeatedly being requested and transported from organization to organization. The collective collection of materials are a "floating collection" (12). In Figure 1-2 the difference between the original organization and the floating collection is presented graphically.

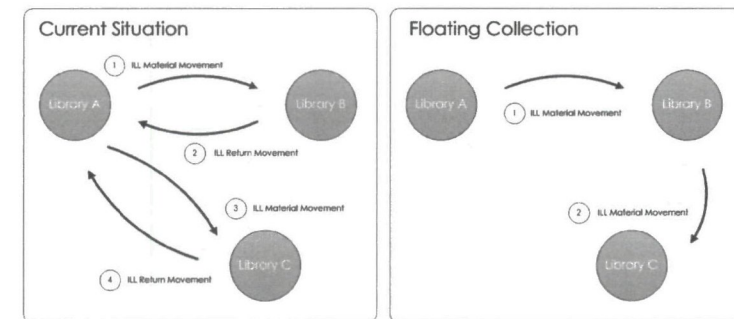


FIGURE 1-2: DIFFERENCE IN TRANSPORT MOVEMENTS BETWEEN THE CURRENT SITUATION AND AFTER IMPLEMENTING A FLOATING COLLECTION

The biggest advantage of implementing a floating collection concept is the immediate reduction of transportation movements that return the library materials to the location of origin. In theory this concept can reach a 50% reduction of transportation. Possible negative side effects that are expected; smaller libraries empty out and the bigger libraries have no capacity to support the increase of floating materials in their libraries. Issues are also expected due to the ownership of the materials. Libraries purchase materials but once floating "lose" their material to the floating collection (12).

The logistics of transporting the materials are the highest costs of ILL and due to the budget cuts in the future this is the area of interest to research. The question is if saving costs on transporting ILL is possible by implementing a floating collection

concept. This project discusses the organizational aspects and consequences of implementing a floating collection but focuses on the effects on costs and service to the end-user.

1.3 RESEARCH QUESTIONS

The objective of this project is to evaluate the potential of implementing a floating collection concept in the Dutch public library sector, considering an expected growth in demand for interlibrary loan, limited budget for the transportation services of the PSO's and considering the needs and requirements of all stakeholders involved. This project has setup a research question and sub questions in order to reach this goal.

The research question that is answered in this project is as follows:

- o *Does implementing a floating collection in the public library sector in the Netherlands improve the transportation service of interlibrary loan considering the expected growth in demand and limited budget for the interlibrary loan service in the future?*

The following sub research questions enable answering the main research question.

1. How is the current system of distribution of ILL materials between libraries in the Netherlands organized and who are the relevant stakeholders involved?
 - a. What is the scope of the system?
 - b. Who are the involved stakeholders and what are their goals and interests in the distribution of ILL materials between the libraries?
 - c. How is the distribution of interlibrary loan within the Netherlands organized by the PSO's?
 - d. What are the system requirements of implementing a floating collection system?
2. How can the floating collection be implemented to meet the requirements of the involved stakeholders and future growth of ILL in the library sector?
 - a. What is the future situation of the interlibrary loan, considering future trends within the library sector?
 - b. What is the floating collection concept and what are the benefits and cutbacks of implementing a floating collection within the Library Sector in the Netherlands?
 - c. What possible solutions to the identified issues can be designed to minimize the negative impact of implementation of a floating collection?
3. What is the impact on the key performance indicators of the system when implementing the floating collection using a simulation model of the interlibrary loan system?
 - a. What design of a model can represent the ILL system in the Netherlands?
 - b. What information and data are necessary to design an ILL model?

- c. Is the ILL model valid to be an effective representation of the ILL system in the Netherlands?

4. What conclusions can be made from the results from the simulation of the current situation, the future situation, the implementation of the floating collection and the implementation of the designed solutions to minimize the negative effects of the floating collection?
5. What are the next steps in implementing the floating collection in the library sector in the Netherlands from an organizational point of view?

Next to the abovementioned questions focusing on evaluation of implementing a floating collection in the Netherlands, the next questions focus on the applicability of the tools used and research performed during this project:

1. Can the floating collection concept be implemented in other sectors than the library sector?
2. Can the model designed in this project be applied in other fields?
3. What can be learned from the results from this project that can be used in other sectors?
4. What is learned from the use of the research approach within this project?

2.3 RESEARCH APPROACH

The research approach of the project is elaborated on in this section. First the methodology behind the chosen research method is argued and second, the research approach is detailed based on the sub questions stated in the former chapter.

Considering the complexity of the distribution system described in the former chapters, there are many organizations interrelated with ILL in the Netherlands with contradictory interests. The dynamic environment of the library sector within the Netherlands, with on the one hand the innovations in the sector and the other the budget cuts that limit certain opportunities, a "complete and holistic system approach" is needed. In order to find solutions in the library sector, one must make sure that all the components of the system, e.g. the logistics, library organizations and people within the sector, work together in order to provide that the system works efficiently. The methodology that fits these arguments is a systems engineering approach (13).

Thinking in systems promotes a holistic view to problems (14). One definition states:

"The systems engineering method recognizes each system is an integrated whole even though composed of diverse, specialized structures and sub-functions. It further recognizes that any system has a number of objectives and that the balance between them may differ widely from system to system. The methods seek to optimize the overall system functions according to the weighted objectives and to achieve maximum compatibility of its parts." (15).

System development often requires contribution from diverse technical disciplines (16). As also the case with finding solutions within the described system in this project, several disciplines are assessed to find a suitable solution to the problem faced by the collaboration of the PSOs. Using systems engineering has been partly the domain of the technical community. Except in the last years more and more nontechnical practitioners are using systems thinking as a guideline into solving issues within leading projects. Terry Bahill (17) states that "systems' thinking is a discipline for seeing wholes". It is a framework for seeing interrelationships rather than static snapshots. He also states that "systems thinking forces people to gather all possible processes and interrelationships into an organized structure."

Within the field of systems engineering there are several approaches a project can use in order to use an outline to reach the goals identified in the introduction. There is a systems engineering approach that claims that it extracts all similarities between the different approaches within the systems engineering field. The person behind this approach is Terry Bahill and he developed the SIMILAR approach together with Bruce Gissing (17).

Bahill and Gissing incorporate two systems engineering methodologies into the SIMILAR approach; the Requirements Discovery Process and the Systems Designs Process. Both of these approaches fit this project for the following reasons:

- Due to the complexity of the many stakeholders involved, discovering the requirements of the future system is difficult and of significant importance.
- Due to an implementation of the floating collection concept significant changes to the current system are needed. This needs a design approach into designing the new systems that is evaluated at the end of the project.

The main focus of this approach is the constant feedback to the needs and expectations of the relevant stakeholders in the system. After every step in the SIMILAR process, the needs and expectations are evaluated on the proceeding of the project in order to stay in line with the involved stakeholders. This methodology fits with the need of collaboration with many different stakeholders within the ILL organization within the library sector in the Netherlands.

The process steps as described by Bahill are depicted in Figure 1-3.

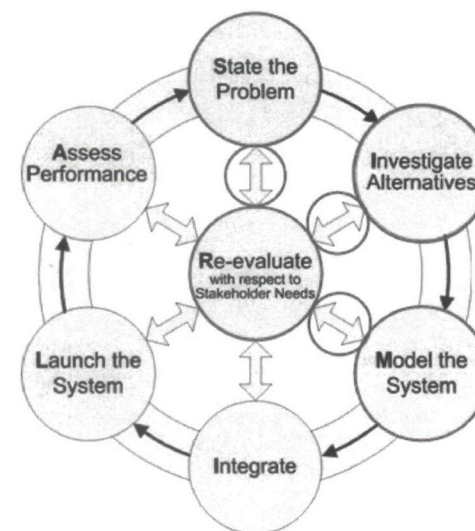


FIGURE 1-3: THE SIMILAR APPROACH (17)

These seven steps can be summarized with the acronym SIMILAR: State, Investigate, Model, Integrate, Launch, Assess, and Reevaluate. This project adapts four stages (lined in blue) from the SIMILAR approach: State the Problem, Investigate Alternatives, Model the System and Re-evaluate. The reason for selecting only half of the process steps is because Bahill and Gissing developed the method for complete field projects including implementation and integration of the designed system (17). In this project a preliminary study into the implementation of a floating collection concept is performed which disallows the use of the last three steps in the SIMILAR process. The selected process steps are elaborated in more detail within the next paragraph.

1.5 RESEARCH PLAN

In the following, the research plan of the project is described, which is an adaptation of the systems engineering approach, SIMILAR, described in the former paragraph. An important part of the project is the analysis of the current situation. Due to the complexity of the library sector and the many autonomous stakeholders involved in ILL, the analysis of the current situation has a large role in understanding the system and identifying the needs and requirements from the stakeholders and the system in order to successfully implement a floating collection in the library sector in the Netherlands. The chapter that describes the floating collection describes the changes needed within the concept and the possibilities of adapting the distribution concept of the ILL.

In the following paragraphs the steps of the project are described more in detail:

1.5 STATE THE PROBLEM (INTERPRET LOGIC) SYSTEM ANALYSIS

Bahill states that the problem statement starts with a description of the top-level function that the system must perform or the deficiency that must be ameliorated. This problem statement must include all of the requirements that the system must satisfy and inputs should come from all involved stakeholders (17). Following Bahill's step, the current top level system of ILL in the Netherlands is analyzed. This is done to gain more insight and knowledge about the library sector and the distribution network that organizes the ILL. The first step in this SIMILAR step is to define the scope of the system. In the scope, the boundaries of the system are identified as are the involved stakeholders.

The second step is to perform a thorough stakeholder analysis on all the relevant stakeholders that are part of organizing the ILL in the Netherlands. The goal is to gain insight in the interests, goals, influence and power of the stakeholders involved. The needs and expectations of the stakeholders involved are analyzed. To gain this information several interviews with relevant stakeholders are held. The analysis results in an overview of the network of stakeholders involved and identify critical stakeholders in the system that are crucial to the system and have the power to adapt the system to solve the issues described in this chapter. All these actors are described in detail.

The interviews contribute to the gathering of information regarding the organization of the distribution network. In the next step the current distribution is analyzed. First focusing on the definition of ILL. The current ILL concept will be analyzed second based on information gathered from several sources, including the interviews held and internet resources. Third, attention is on the current organization of the logistics and the service level offered to the end-users. The analysis on the current concept identifies the systems' capabilities and analyze the logistical operations of the current situation.

All the above mentioned steps within this phase are incorporated in the system diagram of the current system which present the architecture of the system. The base of the system diagram is a conceptual model. In this conceptual model the system factors are identified as are the relationship between these factors. Factors that influence the system from outside the system are identified and the means of the problem owner to influence and change the factors of the system are determined. The output of this phase forms a system diagram which gives an overview of the complete ILL in the Netherlands.

In the concluding paragraph the stakeholder needs and system requirements are stated. These needs and requirements are the basis for the evaluation of the future situation and the implementation of the floating collection. These needs and requirements determine the chosen key performance indicators during the evaluation of the modeling phase.

1.6 EVALUATE ALTERNATIVES (SIMULATIONS) EVALUATION PHASE

In this chapter the future situation of the ILL in the library sector in the Netherlands is investigated in detail. There are several external factors identified in the former steps that shape the future of ILL. In this paragraph a future situation is sketched to set a yardstick for the floating collection concept during the evaluation phase. The next step is to analyze the floating collection concept in more detail. In this paragraph information from a questionnaire is used to assess the possibilities and cutbacks from implementation of a floating collection. A SWOT Analysis puts the concept in perspective of a possible implementation. The most significant issues that can be investigated within the scope of this project are identified.

Based on the perceived issues of the stakeholders identified, solutions are designed to minimize these issues after implementation. While designing the solutions, a closer look into other sectors that are or have faced similar problems in their field are taken. From these lessons learned, solutions are designed for the perceived issues and these solutions are investigated using system modeling in the following chapter.

1.7 ANALYZE THE SYSTEM (SIMULATIONS) EVALUATION PHASE

Bahill states that in the business environment, models and simulations are run to analyze the process and find the as is and, through analysis, determine the to be (17). In order to find the as is and determine the to be, models of the alternatives to optimize the distribution of ILL within the Netherlands are designed in this chapter. A model is "a simplified description, especially a mathematical one, of a system or process, to assist calculations and predictions" according to the Oxford Dictionary (18). In this project three simplified models are designed that are the base of the evaluation of the three situations that are assessed on their performance. The current and future situation as well as the implemented floating collection concept are evaluated on their performance by using discrete event simulation modeling. Using discrete event simulation modeling enables a detailed comparison between the current and future situation with the implementation of a floating collection.

The following arguments lead to the conclusion that discrete event simulation modeling fit the goals of the project (19):

- Library materials are discrete entities that flow through the system one by one. The materials flow through the system through processes and resources. This enables discrete analyses.
- The identification of queues is possible with discrete simulation. This enables locating bottlenecks in the distribution process, waiting times of the end-user and delays in delivery.
- Simulation can handle various stochastic variables in the system and evaluate the system in time with varying the variables. There are many stochastic variables within this system.
- Dynamic modeling is possible with simulation. In this project dynamics are needed due to the increase of transport flow over time.

In this project a simplified model of a set of libraries is used that is similar to reality and inspired by reality. This method is called exploratory modeling and analysis. Exploratory modeling and analysis can be used to explore the influence of

uncertainties and to test the effectiveness and robustness of designs given all these uncertainties (20). The use of this method is ideal in this project because of the uncertainties of implementing such a design in the Dutch library sector. This project evaluates the effects on a smaller scale and extrapolate the results to a larger scale in order to find a more clear direction of a design with fewer uncertainties in the future.

The set of libraries in the exploratory model contain similar characteristics as libraries in the real world have and the number of materials flowing through the system are determined through data analysis. Due to the unpredictability of the outcome (of the implementation of a floating collection concept), this exploratory model shows the preliminary results of implementation in the Netherlands.

The first step is conceptualization of the system. During the conceptualization phase, models are made that identify the objects, the processes and the decisions made by the models. The output of the conceptualization is a set of key performance indicators on which the performance of the models are evaluated. During the specification phase, data is collected through various sources; through interviews with the stakeholders involved, internet sources and the library of the Technical University of Delft. During this phase any assumptions made in designing this model are clarified and argued. The next phases included the set-up of the evaluation and the verification and validation of the model.

1.5.4 MODEL THE SYSTEM: EVALUATION OF THE SIMULATION RESULTS

In this phase all the results from the simulation runs are assessed. An overview of the effects on the key performance indicators is provided. To conclude, the results are evaluated on the system requirements.

1.5.5 RE-EVALUATE: CONCLUSIONS AND RECOMMENDATIONS

Bahill states that the Re-evaluation step is arguably the most important of these steps. Re-evaluation should be a continual process with many parallel loops and it means observing the output and using this information to modify the system input, and or the product, and or the process (17). During the course of the project and after every step an evaluation takes place in order to observe the output of that step in respect to the needs and requirements of the stakeholders.

In the final phase the conclusions and recommendations are presented. The research questions stated in the introduction of this project are answered and next steps are identified for implementing a floating collection in the library sector.

1.6 OUTLINE OF PROJECT

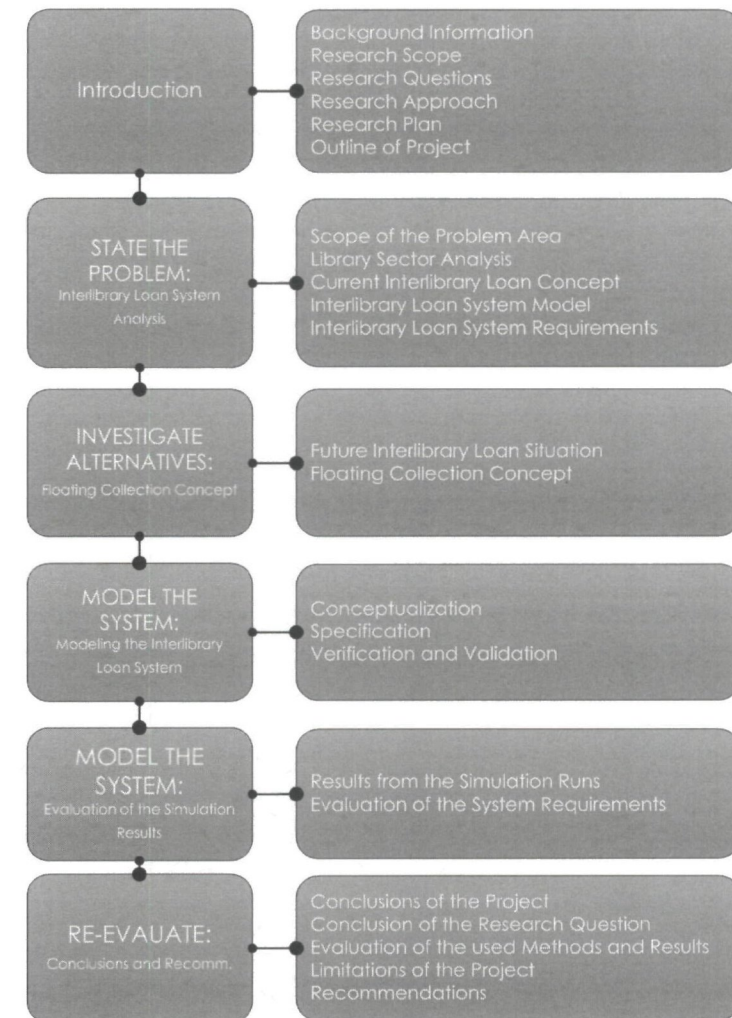


FIGURE 1-4: OUTLINE OF THE PROJECT

2 INTERLIBRARY LOAN SYSTEM ANALYSIS

In this phase of the project the current interlibrary loan (ILL) within the Netherlands is analyzed. The following steps analyze the system to get a complete overview and understanding of how the ILL is organized and which stakeholders are involved in the processes. First the scope of the system is determined. Next, the network of stakeholders within this scope is analyzed. After that, the critical actors in the system are identified, and the logistical concept of ILL is assessed. All the above mentioned analyses form the input of the system diagram which enables the identification of the architecture of the system and the requirements of the system.

The first step of a problem statement is to determine the boundaries and the scope as to what part of the system is and what elements are out of the control of the relevant involved stakeholders concerning the issues stated in the introduction of the project. First, the physical boundaries of the system are set and second the relevant stakeholders are identified.

This project will focus on both the OBL (ILL within provincial service area) and the IBL (ILL in between provincial service areas) transportation flows in the library sector within the provincial services areas in the Netherlands. Every element that is directly and indirectly involved in the organization and execution of the transport of ILL materials is included in the scope of this project. The focus is on the logistics and the logistical operations that facilitate the movement of ILL materials.

The implementation of the NBC in the library sector is taken into account. Effects from this implementation are assessed and evaluated throughout the project. Also the provincial catalogues that have the same purpose as the NBC, but contained within the provincial service areas are within the scope of this project. Data from these provincial catalogues are used as input for the project.

Table 2-1 includes all the relevant stakeholders that are included in the stakeholder network analysis:

Library Organizations	Governmental Organizations	Private Organizations	Non organized interest groups
National Stichting PSO Nederland (SPN) Vereniging Openbare Bibliotheken (VOB) Stichting Bibliotheek.nl (BNL) Sectorinstituut Openbare Bibliotheken (SIOB) Centrale Discotheek Rotterdam (CDR) UKB (KB+UB's)	Municipalities (containing a LO) Provincial Governments Ministry of Onderwijs, Cultuur en Wetenschap (OCW)	Third Party Logistic companies (3PLs) Nederlandse Bibliotheekdienst (NBD Biblio) Centraal Boekhuis (CB)	End-user
Local Provincial Service Organizations (PSO) Plus Libraries (CG Library) Library Organizations (LO) Library Locations (LL)			

TABLE 2-1: INVOLVED STAKEHOLDERS WITHIN THE SCOPE OF THIS PROJECT

In the system scope relevant stakeholders were identified that are relevant to this project. In this step of the problem statement, these stakeholders are analyzed more into depth. Several steps are part of this analysis and first, the problem owner of the project is assessed, the Stichting PSO Nederland. The second step is to analyze the network of stakeholders. The stakeholder analysis obtains insight in the goals, interests and positions of the stakeholders regarding the issues stated in the introduction of this project.

The goal of this paragraph is to gain insight in the goals and means of the SPN in which the SPN can influence the system and determine a good implementation of a floating collection. There are links to be identified between the goals of the SPN organization and the means of the SPN to reach these goals. In order to analyze these aspects, a goal mean diagram is designed. The goal mean tree diagram of the SPN and the explanatory description of the diagram can be viewed in Appendix A: Goal Mean Diagram of the S.

The individual PSOs are part of the collaboration SPN and are focused on their own service area and transportation service. However, the SPN is focused on sharing the knowledge between the PSOs. The task of the SPN is to communicate the benefits of knowledge and skill sharing to the individual PSOs. Otherwise the PSO will not see the gain and will not collaborate in the way the SPN would like to see it. In the diagram in Appendix A is shown that the services of importance in this project are both the ICT services and the logistical services. The correlation is clear; the ICT system houses the digital cataloging of the materials and the order system so the end-user can order materials from other libraries. When looking at a national level, the ICT system should be compatible with all provincial service areas. At this moment the ICT system of provinces differ.

The task of a single PSO is to collaborate with library organizations within its area, the "client" of this PSO. If new policy is set on national level, it is the task of the individual PSO to communicate the changes to the library level. If they do not do this in a correct way, the library organizations might not cooperate in the way they would want it. Focusing on implementing a floating collection, the tasks of most importance are the tasks to collaborate with the library organizations. Collaboration is significant for the successful implementation of the floating collection concept and it is identified as one of the clear goals and tasks of the SPN. In order to understand the needs and requirements of the stakeholders involved with implementing a floating collection in the library sector, a stakeholder analysis is performed in the following paragraph.

The Stichting PSO Nederland operates in a network of stakeholders in the library sector. Many of the stakeholders in this network are directly involved with the distribution of library materials and several stakeholders are indirectly involved. The SPN therefore must rely on a selection of stakeholders in the network to achieve their goals in optimizing the distribution of materials between libraries. It is important for the

SPN to be aware of the network of stakeholders and their goals and interests in the current and future situation of the distribution. The stakeholders that are of importance to the SPN are stakeholders that are directly involved with the distribution, for example, the PSO in the provincial service area that is affected by the possible solutions and outcome of this project. It also includes stakeholders that possess means that have the power to help optimize the transportation of library materials.

In order to create this awareness for the SPN, a stakeholder network analysis is performed (21). This analysis leads to a qualitative better understanding of the network of actors involved in the distribution of library materials between libraries. The analysis maps the relationships between the different stakeholders and this provides insight in the opportunities and threats for the approach of the future situation and leads to a more legitimate analysis of the network. The network analysis recognizes the position of the involved stakeholders and that leads to a better collaboration between the stakeholders in the attempt to solve the issues of the future.

To perform the stakeholder network analysis, several steps need to be made. After identifying all the involved stakeholders, the stakeholders are mapped in a formal chart wherein the formal relationships between the stakeholders are identified as are the formal tasks, competencies and current laws and regulations. The interests, goals and problem perceptions of all the involved stakeholders are identified next as are the interdependencies of the stakeholders. These are identified by the resources available by the stakeholders and their subjective involvement in the situation. After performing all the steps necessary the implications of the findings are identified. To obtain the necessary information needed to perform the detailed analyses two techniques are used. To start, a desk study is performed to analyze initial information available. After the desk study several interviews are performed to analyze the stakeholders more in depth. In the following paragraphs the steps and conclusions of the stakeholder analysis are discussed.

2.2.2.1 DEFINITION OF THE ORGANIZATIONAL STRUCTURE OF THE STAKEHOLDER NETWORK

The first step in the stakeholder analysis is identifying the formal relationships between the involved stakeholders by using a formal chart. All the stakeholders in the network are connected with each other and the formal map is presented in Appendix B: Formal Chart of the Stakeholder Network.

All the library organizations have similar goals to the issues faced with the implementation of a floating collection concept. All the organizations have goals to assist the library sector to be successful and support the organizations that need guidance to achieve the continuation of the library sector as a part of cultivation of the Netherlands. The sector organizations on a national scale are young: the SPN, the Sector Instituut Openbare Bibliotheken (SIOB) and Bibliotheek.nl (BNL) are set up in the beginning of 2010 in context of the library innovation. The projects initiated by these national sector organizations might not have the full support of the local organizations due to their national agenda. The library sector is historically a regional and autonomous organized being and is starting to be organized from a national perspective. The national organizations must take into account the local and regional

needs of the library organizations in order to successfully organize projects on a national scale.

2.2.2.2 PERCEPTIONS OF PROBLEM BY THE STAKEHOLDERS WITHIN THE NETWORK

After determining the formal characteristics of the involved stakeholders within the network, the informal characteristics are explained in this paragraph. The informal characteristics are determined by identifying the interests and goals of the stakeholders within the problem area. The interests of the stakeholders are concerns they might have with the current situation and these interests indicate the direction the relevant stakeholders might have towards the future situation. Next to the interests, the stakeholders have concretizations of their interests, their goals they want to achieve considering the distribution of ILL materials between libraries in the Netherlands. Their goals can also be described as the desired situation of the stakeholders. The gap between the current situation and the desired circumstances can be determined to identify the underlying reasons for the goals of the corresponding stakeholder. The problem perceptions analysis can be viewed in Appendix C: Interests, Goals and Problem Perceptions of the Stakeholder.

There are many stakeholders involved in the system and they all have the same goal; to make sure that the end-user receives its material fast, against low costs and to give the end-user an endless availability of materials. But the different stakeholders have different roles in enabling these goals and this can work conflicting. The stakeholders in the network can be categorized in different levels; national and regional networks. The stakeholders of a national level are more concerned with the policy in the library sector and less with the actual service. The regional stakeholders focus more on their own clients. When policy is made from the higher levels, its effect on the lower levels can be different than anticipated at first.

Governmental bodies are set as out-of-scope, but have influence through several bodies and have to guarantee cultural policy in the Netherlands.

2.2.2.3 INTERDEPENDENCIES OF THE STAKEHOLDERS WITHIN THE NETWORK

The informal relationships are identified and so are the problem perceptions including the interest and goals of the involved stakeholders in the problem. The next analysis is more in depth within the interrelationship with the problem owner. In this analysis the dependency of the various stakeholders on SPN is assessed. The dependences are determined by three means; the importance of the stakeholders' resources to the SPN, the involvement of the various stakeholders in ILL and the degree to which stakeholders match with each other. To determine the above, the dependency of the resources of the stakeholder are identified and the degree of substitutability of that stakeholder. Once these are identified the criticality of a stakeholder is determined. This shows if the stakeholder is critical to the success of possible solutions that are designed in the project. The most critical stakeholders identified are the SPN, the PSOs, all the library organizations and the governmental organizations involved with cultural policy. The interdependencies can be viewed in

Appendix D: Interdependencies of the Stakeholders within the Network. The output of the analysis is used in the next paragraph.

All the important information on all the involved stakeholders in the distribution of materials between libraries in the Netherlands is identified. The last step is to categorize the stakeholders in their power and involvement in ILL and to determine which stakeholders must be taken into account in planning future alternatives within ILL. To do this a power versus interest grid is made. This grid consists of two dimensions: the interest of the stakeholder in the problem and the power the stakeholders have within the scope of the project. These two dimensions are put on the axes of the grid and result in identifying four categories of stakeholders:

- **Players**
Players have both a high interest in the problem and have enough power to influence the outcome of the project; these players must be taken into account
- **Subjects**
These stakeholders have a high stake in the problem, but when it comes to influencing the outcome they have little decision power for major influence.
- **Context setters**
The setters of context in ILL are stakeholders that have the political power to make changes and influence other stakeholders but have less interest than the players within ILL
- **Crowd**
The stakeholders that form the crowd have less power and less interest than the rest and are not taken into account further

The grid shown in Table 2-2 helps to highlight possible coalitions to be encouraged or discouraged and the grid provides information on how to convince certain stakeholders to change their views within the problem to help achieve possible solutions in the future.

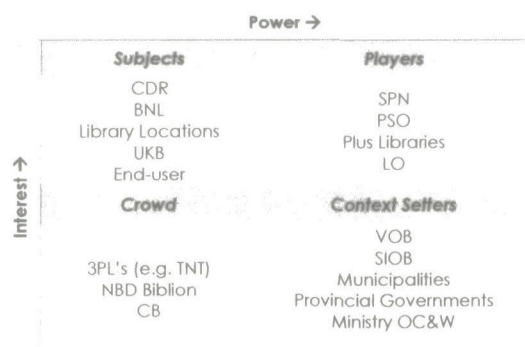


TABLE 2-2: POWER INTEREST GRID INVOLVED STAKEHOLDERS

The players in implementing the floating collection are the stakeholders that are directly involved with ILL, the SPN, the PSOs and the LOs including the Plus Libraries. These stakeholders possess the collections of library materials that float among each other and it is of significant importance that the needs and requirements of these players are met to ensure the success of such a change within these organizations.

The stakeholders directly involved with the players are the stakeholders that need to cooperate in order to make this incremental change effective. Requirements from this corner are needed to be considered and discussed, but if stakeholders in this category stand in the way of success they could easily not participate and the plan does not fail. The crowd is only of interest whenever the project needs the stakeholders categorized in this corner. The context setters are background stakeholders and in the case of the library sector important national organizations that deliver the funds. These context setters state the boundaries in where the project can be executed.

In this paragraph conclusions are presented on the performed stakeholder network analysis and the needs and requirements of the stakeholders concerning ILL are stated. These needs and requirements form a significant part of the remaining phases of the project. The SIMILAR approach (see 1.4) states that after every phase in the project, the needs and requirements of the stakeholders need to be assessed. Stakeholder needs in implementing a floating collection concept:

- **Customer satisfaction.** The biggest need of all stakeholders is to ultimately serve the end-user with the best service the library sector can provide, the following needs are derived from this need.
- **Innovation.** To hold on the end-users, there is a need for innovation within the sector. The last years and organizational changes within the sector have shown that innovation in the sector has a significant positive effect.
- **Availability.** The availability of library materials is of essence. The goal of ILL and the implementation of the NBC are to increase the accessibility of library materials to the public. A high availability of materials is a significant need of all the stakeholders involved in ILL.

There are three main stakeholder requirements for implementing the floating collection concept:

- **Customer service.** The requirements focus mainly on serving the end-user with the best service the stakeholders can provide. Among this is to make sure that the costs of implementing a floating collection are to the minimum.
- **Waiting time.** The waiting time for end-users that need to wait for materials to arrive at the location they have chosen must not increase after implementation of the floating collection.
- **No negative effects.** Many stakeholders involved in ILL are skeptical about the floating collection concept. Some stakeholders predict certain negative effects after implementation to take place. The minimization of these negative effects is an important requirement for the implementation of a floating collection concept. The expected negative effects are discussed in 3.2.

2.3 CURRENT INTERLIBRARY LOAN CONCEPT

In this paragraph the current concept of the interlibrary loan system in the Netherlands is analyzed. This is done by elaborating on the definition, characteristics and behavior of interlibrary loan. The next step is in depth on how the transportation services are organized and the service level. This is done by explaining the logistic organization and the service level provided to the end-user.

2.3.1 DEFINITION OF INTERLIBRARY LOAN

The definition of interlibrary loan is:

"ILL is a service whereby a user of one library can borrow books or receive photocopies of documents that are owned by another library." (22)

The user makes a request with their local library, which, acting as an intermediary, identifies owners of the desired item, places the request, receives the item, makes it available to the user, and arranges for its return. Although books and journal articles are the most frequently requested items, the Centrale Discotheek Rotterdam (CDR) lends audio recordings, video recordings, maps, sheet music, and microforms of all kinds. In many cases, nominal fees accompany interlibrary loan services reaching up to a couple of Euros per request.

Like stated in the introduction, there are two categories of interlibrary loan systems operating in the Netherlands:

- **OBL (Onderling Bibliotheek Leenverkeer)**
This service contains the lending of materials between libraries within the provincial service area of a PSO. This is supported by an ICT system within this service area and the transportation service of the PSO.
- **IBL (Interbibliotheek Leenverkeer).**
This service is a nationwide service which goes beyond the borders of the provincial service areas. There is still no ICT catalogue system running to support this service but there will be one in the near future. This national catalogue (the NBC) will support the IBL (and the OBL) in the future. The transportation system currently used is the mail service of PostNL. However, like stated in the introduction, the Pilot Distributie has started using the service of TNT Innight to transport IBL materials between PSOs using the PSO headquarters as transportation hubs and the PSO transportation services to deliver the materials to the library organizations within the provincial service area.

ILL materials can in theory be every piece of material available in the collection of libraries today (23). In the current situation libraries have to select parts of their own collection to be available for either OBL or IBL use or for both. There are also cases that a part of the collection of a library is only available for viewing from a distance using the internet and not available for lending (23). Like said before, in theory an ILL material can be every material in a library available for lending. But the question that is significant for this research is, can one categorize ILL materials within the Netherlands? A possible categorization of ILL materials could enable the distribution

of ILL to be more efficient. Realizing categorization could create more insight in what kind of materials are lent between libraries and with categorization, a more focused logistical operation could be possible. With categorization, ILL materials could be stored and distributed centrally instead of amongst the other materials. Finding logistical solutions to the distribution issue could be easier.

To answer the question of categorization is possible it is necessary to find out why materials are lent out to other libraries. This is explained by: the requesting library do not have the material in its collection and there is another library that has the material in stock. The true question is why certain libraries do not have certain materials in their own collection. There is a true difference in type of collections in the libraries in the Netherlands. There are certain educational levels identified of the materials in library collections, as presented in Table 2-3.

Royal Library	WO level
University Libraries	WO level
Plus Libraries	HBO level
Library Organizations - Library Locations	Secondary school level

TABLE 2-3: CATEGORIZATION OF LIBRARIES IN THE NETHERLANDS

It can be assumed that the position of the libraries within the list stated above is the educational level in which the highest educational level are supplied by the Royal Library and the lowest educational level are supplied by the library locations. It is also safe to assume that the largest libraries, which have the most materials in their collections and the rarest materials within their collections, are also on the top of the list. Concluded from these assumptions, it is safe to say that the lowest libraries are the libraries that request OBL and IBL materials from the higher libraries and therefore the higher ranked libraries are the supplying libraries (7). The next question is to what kind of materials do the higher libraries have that the lower libraries do not have in their collections.

Very popular titles like adult fiction can be ruled out. It is very likely that even the smaller libraries have these books within their collections. Some libraries even exclude the popular titles (or a selection) from OBL and/or IBL to supply their own end-users first, given a certain time period (23). Other libraries say that it is not because of the popularity of the material that defines it to be lent out to other libraries, but more the rarity of the material (23). It is likely that a book that focuses on a frog that only lives in the northern part of the Netherlands will be available in the library of Sneek, but will not be a part of the collection in the Royal Library in The Hague. There might be a person in The Hague that is interested in this frog and will request the book via the IBL system. Other libraries say that the nature of ILL materials are scientific for the same reasons that the extra materials owned by the higher libraries are of more scientific nature and will be requested by the lower libraries (23). The most interesting distinction that stakeholders within the sector make between normal materials and ILL materials

is by using the Long Tail Theory (7). In the next paragraph the Long Tail theory is explained and then the application within the library sector is tested.

The Long Tail Theory refers to the statistical property that a larger share of population rests within the tail of a probability distribution than observed under a 'normal' distribution. A long tail distortion arises with the inclusion of some unusually high (or low) values which increase (decrease) the mean, skewing the distribution to the right. This can be seen in Figure 2-1 (24).

The term Long Tail has gained popularity in recent times as describing the retailing strategy of selling a large number of unique items in relatively small quantities, usually in addition to selling fewer popular items in large quantities. The Long Tail was popularized by Chris Anderson in an October 2004 Wired magazine article, in which he mentioned Amazon.com and Netflix as examples of businesses applying this strategy (25). The Long Tail distribution is illustrated in the Figure 2-1.

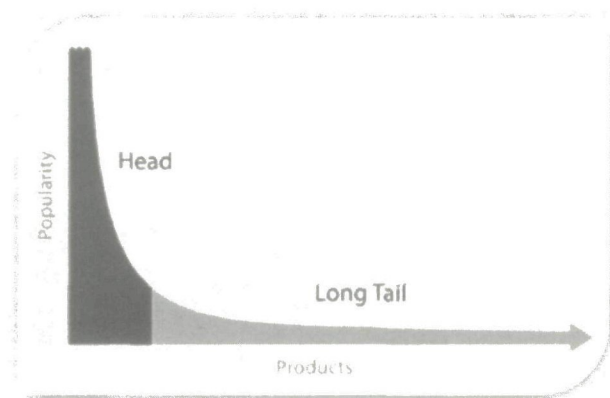


FIGURE 2-1: THE LONG TAIL THEORY FROM ANDERSON

If the long tail theory is applied on ILL in the library sector, one might assume that the more popular materials or the more available materials are in the 'head' of the long tail distribution and the unpopular or rare materials are in the 'tail' of the long tail distribution. Immediately the question is raised if one can define ILL materials as materials that appear in the long tail of the distribution.

The theory states that in the tail of the distribution an endless amount of products, for example ILL materials, are stored that are not lent very often. Within theory about the long tail theory applied to the library sector, the Online Computer Library Center (OCLC) states that 10% of the library collection represents 90% of the usage by the end-user (26). This is very comparable to the theory stated by Anderson that states that 80% of the products recite in the tail while 80% of the popularity recites in the

head of the distribution (25). The OCLC finally performed a study in requested ILL materials in 2005 and found out that actually 75% of the ILL requests were of materials that recite in the head of the distribution instead of in the tail (26).

This last research done by the OCLC disproves the theory that categorization of ILL materials is possible using Andersons theory of the Long Tail distribution. To conclude this sidestep within this project, it is not possible to categorize the materials that flow as ILL and this makes the implementation of a floating collection more challenging.

The concept of ILL is investigated in the former section and in the next step the organizational aspects of ILL is analyzed. In the current distribution concept, the materials that enter the ILL system are owned by the library organizations. Like sated above, the LOs themselves decide whether a material is entered into the ILL system. The origin of an ILL material is the location of the owning LO and the materials are distributed from this location and returned back. It is notable that the origin of the materials is not digitally registered in the current situation but will be after the introduction of the NBC.

When an ILL material leaves its origin due to a request, it is transported to the requesting location. The requesting location is held responsible for the return of the material. This return movement is therefore initiated by the requesting location when, for example, the end-user of the requesting location has finished reading the book (7).

The means of transportation are different with both the OBL and the IBL. With OBL requests, the materials are sent with the transportation service of the PSO using the standard crates delivered by the PSO. The LOs that are signed with the transportation service pay the PSO a yearly fee to be part of one of the routes of the transportation service. This fee is of a public nature which results in a fairly low rate if you compare the fee to private logistic company's fees. Being part of the transportation service of the PSO brings several side benefits for the libraries like lending out other materials between library locations, for example beamers against no extra costs (10).

The Pilot Distributie has started a different classification of IBL distribution. Before the Pilot, the IBL materials were send using envelopes and the regular mail delivery service from PostNL. Now they have started to use the TNT Innight service to transport the IBL materials from PSO to PSO, using the PSO headquarters as transportation hubs in every provincial service area. Instead of sending the IBL materials with the regular PostNL postal service using envelopes, it is now send with the PSO transportation service. At the PSO headquarters, the IBL and OBL materials are split and the IBL materials are put in special TNT Innight boxes to be picked up by TNT Innight at night. TNT Innight sorts the IBL materials at night and deliver the IBL materials the next day to the PSO in the provincial area of the requesting library location. The return movement is done in the same way. Due to the recent start of the Pilot, it is not clear as to what the prices will be per IBL material to transport the materials using this service. In Appendix E: The Setup of the Pilot Distributie the goal of the project, prices and service of the Pilot can be viewed.

Next of focus is the number of logistical hubs currently operating, the number of service points in the system (read: library locations), transportation between hubs and between hubs and service locations, sorting activities and routing of the transportation. This can be seen in Table 2-4.

The number of hubs and their locations	There are 11 central hubs, one per provincial service area. The PSO headquarters are the hubs within a provincial service area.
The number of library organizations and their library locations	There are 171 library organizations and 1031 library location in the Netherlands (27)
Transportation between hubs	The transportation between the hub locations is outsourced to a 3PL: TNT Innight
Transportation between hub and service points	The transportation between the hub locations and the library locations is organized by the transportation services of the individual PSO organizations
Sorting activities	<p><i>Sorting in the transportation vehicle</i> In the current situation the transportation service employees of the PSOs sort the ILL materials in the truck. This means less capacity in the vehicle due to space necessity for the sorting activities. Advantage is that less sorting is needed at the hub and that materials that have a destination within the current route can be delivered within the same day.</p> <p><i>Sorting at the hub</i> In the current situation several PSOs have sorting activities at their hub location. Sorting is done in order to prepare the routes of the next day.</p>
Routing possibilities	<p>One loop per day servicing an amount of service points that can be serviced in a day</p> <p>One loop with smaller inner loops connecting the Library Organizations with their incorporated library locations within an inner loop. This routing principle must include sorting activities within the truck to be feasible.</p>

TABLE 2-4: CURRENT LOGISTICAL OPERATIONS OF ILL

The number of locations as to where the end-user can pick up and return its materials is stated above. The means to order material and accessibility is elaborated on next. Library end-users need to visit the library which they have a membership to loan materials they desire. Within their library they can take material directly from the shelves of the library but they can also login to a local computer to log in to the provincial catalogue to check if the material they requested is available at another library when the library does not possess a copy. Within the same internet environment, the end-user can request this material and the end-user receives an

email at the moment he can pick up his requested materials. Picking up the materials must be done at the library he requested the materials. Returning the materials takes place at the same library.

2.3.4 SWOT ANALYSIS OF THE CURRENT INTERLIBRARY LOAN CONCEPT

It is concluded that categorization of ILL materials is not possible with the current research done on ILL. In theory every material within the collections of the libraries in the Netherlands can be an ILL material. However, certain educational level differences exist which can cause problems with the implementation of a floating concept. This is because the collections of local libraries have no demand for materials with a high educational level. These libraries do not desire a certain percent of their collection to be of a high educational level without demand for these materials. A SWOT analysis is presented on the current organization of ILL in the Netherlands in Table 2-5.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Due to the retail formula of the Dutch libraries it is a strength that the users are forced to visit the library to pick up and return their requested ILL materials (App. G) • The visits have social benefits: people can use the library as a meeting point (App. G) 	<ul style="list-style-type: none"> • The local transportation services are the bottlenecks of the current situation (national focus) due to their limited service levels towards the smaller library locations (9) • These limited service levels cannot guarantee certain delivery times to the end-user (10) • Opening hours of the library. Working people cannot visit the libraries to pickup or return materials (App. G) • Distance to the libraries is in some cases too far for the user to travel (App. G)
Opportunities	Threats
<ul style="list-style-type: none"> • Development of libraries as cultural centers by forcing the members to visit the libraries (App. G) • Funding for culture is continuous, but need for spending this funding is necessary (7) 	<ul style="list-style-type: none"> • The current capacities of the transportation service of the PSOs are low (9) • The transportation flow of the future is expected to increase (7) • A decrease of number of libraries (App. G) • Continue to lose members at the same rate if no changes are made (App. G) • Budget cuts ensures that small libraries will need to close their doors towards the end-users. (App. G)

TABLE 2-5: SWOT ANALYSIS OF THE CURRENT ORGANISATION OF ILL IN THE NETHERLANDS

2.4 INTERLIBRARY LOAN SYSTEM MODEL

The next step is combining all the previous steps and designing a system diagram in which the complete ILL system is illustrated. The final step towards the completed system diagram is the design of a causal relationship diagram. Within this diagram the individual elements of the ILL system are set in relation to each other. The final system diagram is used to identify the external factors that influence the future of the ILL in

the Netherlands and that identify the system requirements. This is presented in the concluding paragraph.

In this paragraph the causal relationship diagram is used to gain more insight in the relationships between the different elements within the system. The relationships between the elements are bidirectional which creates reactions within the system whenever one of the elements changes. In the diagram several loops are identified which identify critical relationships within ILL (28). These loops and their effects are described in this paragraph. The causal relationship diagram and a more detailed description are presented in Appendix F: The Causal Relationship Diagram.

The largest loop in the system has the service level of the transportation service as the center. Whenever the service level of the library organizations in the provincial service area is changed, the complete system is affected. The most important effect within this loop is the delivery time of the ILL materials. These can only be determined by altering the service level of the LOs. If the delivery time is decreased, the delivery time affects the end-users which will then, as a result, use the ILL system more, which in the end will result in more volume of ILL materials being transported through the system. This then will decrease the service level.

An important factor that is identified is the popularity of the new NBC. It is notable that the popularity is mainly influenced by outside factors, meaning, that the SPN does not have full control of the popularity. When the popularity increases significantly, the results are severe on the need for transportation and the necessity for capacity.

The goal of this paragraph is to define the system and its borders to identify what is part of the system and what factors do not belong within the system but are part of the environment of the system. Another goal of the system diagram is to define the structure and relationships within the system and to define the output of the system and identify the criteria of the problem owner. These criteria form the basis for the search for possible solutions. The knowledge gained from the system diagram can be used to define possible solutions and identify relevant environmental factors that influence the system but cannot be influenced by the SPN.

The system diagram consists of the following components:

- *System and boundaries of the system*
The identified system that fits in the boundaries set by the problem and the problem owner is formed by the use of a causal relationship diagram. This diagram is elaborated in the former paragraph. This diagram forms the basic component of the system diagram. From this diagram all the other components are identified and emphasized in the system diagram.
- *Instrument factors*
From the causal relationship diagram the control elements are identified which the problem owner directly has the power to influence the system with. These factors are placed on the top side of the system diagram
- *Environmental factors*
The elements that are not part of the system and cannot be influenced by the problem owner are environmental factors. The relevant factors that influence the system are identified in the causal relationship diagram and are illustrated in the system diagram on the left hand side of the diagram.
- *System criteria*
The most important outcome of this analysis is the identification of the system criteria. These criteria will be the basis of the search for possible solutions to achieve the objectives set by the SPN in the context of the distribution of materials between the libraries in the Netherlands. The system criteria are placed on the right hand side of the diagram.

The most important factors identified:

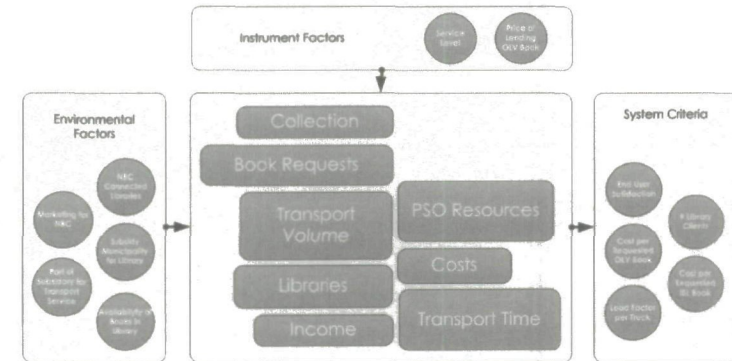


FIGURE 2-2: SYSTEM DIAGRAM OF THE ILL SYSTEM

2.5 INTERLIBRARY LOAN SYSTEM REQUIREMENTS

In the last paragraph, the concluding remarks are made of the system analysis. In this paragraph the system requirements are presented that are derived from the stakeholder requirements and the system analysis. After processing the needs and requirements of the involved stakeholders, the system requirements can be set using the system analysis and model from 2.4. There are three categories of system requirements identified:

1. Costs

- The costs per shipment of OBL/IBL (ILL) may not increase while implementing the floating collection concept
- The costs of resources used to transport the ILL materials may not increase while implementing floating collection

2. Service

- The waiting times for the end-user may not increase due to the implementation of a floating collection

3. Capacity

- The capacity of the transport service cannot increase in the coming years
- The capacity of the Library shelves must be met
- The number of scientific materials within the local library collections must be limited

The system requirements identified in this section are used as input in the next chapter and for the setting of the key performance indicators for the simulation model.

3 FLOATING COLLECTION CONCEPT

In the former chapter the system of ILL in the Netherlands is analyzed. From this analysis the system requirements are identified. In the following section the implementation of the floating concept in the Netherlands is discussed. This is done in three steps. First the future situation of the system is discussed. This is done based on the environmental factors identified in the system diagram in the former chapter. The second step is to discuss the floating collection concept.

3.1 FUTURE INFORMATION SITUATION

In the introduction of this project the cause of the expected problems of the future are stated. Due to both the increasing use of the OBL and IBL system in the Netherlands and the implementation of the NBC in the near future, the transportation demand for ILL will drastically increase in the coming years and limited budget will be available for the transportation service to handle this increase. To determine how much the demand will increase, this paragraph first assesses the environmental factors from the system analysis to identify the causes of the increase in demand and second, a source is used to determine the growth rate of demand per year.

In the former chapter the following relevant environmental factors are identified:

- External factors related to the implementation of the NBC:
 - Popularity of the NBC among the end-users
 - The number of libraries connected to the NBC
 - Share of library materials in local collections open to the NBC
- Funding from governmental bodies to react to the expected growth of demand

It is expected that the demand for ILL materials will increase. The main reason for this expectation is the steady increase of the use of OBL (ILL within a provincial service area) in the past years (9). In the past years the library organizations have increased the accessibility of the materials within the province. In some provincial service areas it is free of charge for an end-user to request an item within the borders of the provincial service area. This measure has increased the demand significantly (29). The next reason why the demand will increase in the coming years is the introduction of the NBC (National library catalogue). This national catalogue will increase the accessibility to a higher degree than is seen in the current situation (6).

The rise in demand is dependent on the popularity of the NBC. The increase of demand is an effect that is needed to give the end-users a higher accessibility is an important question. The rise in demand is also dependent on the number of libraries that are connected to the NBC and the selection of their local collection to enter in the NBC. The actual growth in demand in the future is hard to predict, but is expected to be significant. To determine a good estimation on the future demand, the growth of the last years are assessed.

In the monthly digest of the Stichting Bibliotheek.nl (BNL) the figures of the yearly growth are given and these figures are presented in Table 3-1.

Year	Requests	Requests honored	Not honored requests	% honored	In process
2008	92627	69840	21623	77%	1164
2009	154885	111662	41243	73%	1980
2010	236241	173998	59824	75%	2419

TABLE 3-1: FIGURES ON THE GROWTH OF REQUESTS IN THE ONLINE TOOL AANVRAGEN (29)

It is shown in the Table that the growth of requests ("Aanvragen") increased with 67% in 2009 and 53% in 2010. These growth rates are very high. However, during the interview with Ronald Spanier, the expert on ILL from BNL, mentioned these rates to be put in perspective (7). The figures in this Table are from the tool "Aanvragen". This tool is not nationally adapted by all provincial service areas. The increase in percentages is including the newly connected libraries to the tool Aanvragen. The absolute total numbers per year cannot be compared. Mr. Spanier mentioned that a part of this growth is due to the increase of the demand for ILL. He estimates a growth of 30% per year in the last 3 years (7).

During the same interview Ronald Spanier is asked if he could estimate the future growth of the total ILL demand in the next three years. After checking with the right people in his organization, the estimate growth for the coming years is presented in Table 3-2

year	growth/year
2010	30%
2011	35%
2012	45%
2013	55%

TABLE 3-2: GROWTH ESTIMATION FOR THE ILL IN THE COMING YEARS

These figures are high and will cause severe issues with the current capacity of the transportation services of the PSOs. These growth figures in demand are used in the simulation model.

3.2 FLOATING COLLECTION CONCEPT

The next step is to analyze the floating collection concept in more detail. In this paragraph former experiences with implementation of a floating collection concept are assessed and information from a questionnaire are used to assess the possibilities and cutbacks from implementation of a floating collection. A SWOT Analysis is presented to put the concept in perspective for possible implementation. The most significant issues that can be investigated within the scope of this project are identified and possible solutions to these issues are presented.

3.2.1 CONCEPT OF FLOATING LIBRARY COLLECTIONS

The concept of floating library collection is similar to the current situation as is described in section 2.3. There is only one crucial part changed. The basis of the concept is to eliminate the return movement of ILL materials and store the ILL materials at the location where it is last requested and returned. When a material is requested after it is stored at the last location, it is directly transported to the location of the new request. In theory, this eliminates up to 50% of transportation movements because the material, in theory, never has to return to the location of origin. This has major consequences to the organization of ownership and responsibility of the material. There are some measures that need to be taken in order to implement this concept successfully.

The first question that is raised is whether who is going to pay for the organization of a floating collection. In the current situation libraries have their own materials in their own library collection. Issues can be raised that libraries do not want their materials in the possession of other libraries where they cannot have an eye on their possessions or the knowledge of the whereabouts of their owned materials. Like stated before in paragraph 2.3, the locations of the ILL materials are not tracked at the current moment. The requesting party is responsible for the return movement. With no automated location determination, the materials can get lost or libraries can decide to keep the materials (23).

One can decide to shift the ownership of the floating ILL materials to a central organization, but the question then is which organization and is this organization are willing to pay for the preservation of a floating collection. Next, the natural mixing of the collections is of particular interest. One can view the change of collection in time as a positive effect to the collection of a library location, but it also poses many threats. For example, the movements of ILL materials could dominantly go in one direction instead of bidirectional and create both empty bookshelves in one library and lack of space in another. Other libraries state that they would not want rare ILL materials on their shelves that are of no interest of the majority of the end-users (23).

It is mentioned before that innovation is part of a new strategy in the library sector in the last years (30). On several areas within the sector innovation is implemented to create awareness that the library sector is new and innovative in its operations and services. The concept of floating collections is a very innovative and an unconservative way of organizing collections of library organizations. It is very rare in the world and the cases where a floating collection is implemented are limited. The idea of the concept is new and this is the main reason for the number of implemented concepts being scarce. One of the successful implementations of a floating collection is at the Sarasota Country Libraries in Sarasota, Florida.

The Sarasota Country Libraries have eight libraries in the Sarasota County and had capacity problems with their ILL transport service. The demand was rising after the moment they had introduced an ICT Collection system and made it accessible for the public. The board of the Sarasota Country Libraries decided to implement the floating collection concept in 2007. On their website they promoted the floating collection concept and made a presentation available with their implementation

process. The most important facts from their implementation process are presented here in Table 3-3 (12).

Main reasons for floating	<ul style="list-style-type: none"> Capacity issues of the ILL transport service The desire for one collection instead of eight separate collections
Preparation process	<ol style="list-style-type: none"> 1. Setup of a project implementation team 2. Setup of ICT systems that were needed to support the floating collection 3. Testing of the ICT system 4. Training of Staff in the new processes
Results	<p>Collection:</p> <ul style="list-style-type: none"> April 2008: 20% Floating June 2008: 45% Floating August 2008: 70% Floating October 2008: 90% Floating <p>Transportation:</p> <ul style="list-style-type: none"> September 2007: 2100 crates transported April 2008: 1700 crates transported June 2008: 1300 crates transported
Issues	<ul style="list-style-type: none"> Disappointing adaption by the library staff Budgetary problems Unbalance of the shelves Regular clients were angry with empty shelves of their library
Positive feedback	<ul style="list-style-type: none"> More efficient More variety in collection Staff liked the challenge and change in organization
Lessons learned:	<ul style="list-style-type: none"> To create a rebalance/repositioning plan To better communicate Standardize even more

TABLE 3-3: RESULTS SARASOTA FLOATING COLLECTION

There are significant differences between the case described above and the case of the Netherlands and within a provincial service area. The area of implementation at the Sarasota Libraries is significantly smaller than a regular provincial service area in the Netherlands. Another major difference is the ownership of the collection. The Sarasota Libraries possess the complete collection. In a provincial service area there are many owners of collections (the library organizations) within the area. This can create major issues after implementing a floating collection in the Netherlands.

During the course of this project a questionnaire, presented in Appendix G: Questionnaire, is handed out to several library organizations involved in ILL within the

Netherlands. The questions include valuable information about the floating collection concept. From this questionnaire the SWOT Analysis of the implementation of the Floating Collection, presented in Table 3-4 is derived.

Strengths	Weaknesses
<p>Logistical strengths:</p> <ul style="list-style-type: none"> No direct return movements in the system. Major effects on logistical cost. These effects could up to 50% reduction in movements and could reduce transportation costs. Potential faster delivery due to the decrease in average distance <p>Collection strengths:</p> <ul style="list-style-type: none"> A natural changing variation in the collections of the libraries due to the natural rotation of materials <p>Organizational strengths:</p> <ul style="list-style-type: none"> Cheap organizational adaptations 	<p>Organizational weaknesses:</p> <ul style="list-style-type: none"> No central administration of the ILL materials available at this moment. The responsibilities are of requesting and receiving library Seems not to fit with the retail formula of the libraries today Major issues are expected with ownership. Library organizations purchase their own collections and implementing a floating collection means that their purchases leave their library without knowing when the materials return and who is responsible <p>Collection weaknesses:</p> <ul style="list-style-type: none"> Scientific characteristics of ILL today can give strange collections and unbalanced collections in time
Opportunities	Threats
<p>Organizational opportunities:</p> <ul style="list-style-type: none"> The implementation of a floating collection is consistent with the innovations within the library sector being implemented at the moment. <p>Logistical opportunities:</p> <ul style="list-style-type: none"> The reduction in transportation movements can increase the current capacity without increasing the costs for resources. The increase of capacity has the potential to overcome the increase of demand in the near future 	<p>Collection threats:</p> <ul style="list-style-type: none"> Libraries can decrease the procurement of rare and unpopular materials, they can easily obtain rare items through the ILL floating collection Possible capacity problems due to an expected unbalance between the size of original collections and the number of materials in libraries

TABLE 3-4: SWOT ANALYSIS FOR IMPLEMENTATION OF FLOATING COLLECTION CONCEPT IN THE NETHERLANDS (APPENDIX G: QUESTIONNAIRE)

The weaknesses and threats identified through the questionnaire and deducted from interviews are further analyzed in the next paragraph. One of the goals of this project is to attempt to minimize the possible issues that can occur after implementation of the floating collection. By further analysis of these issues, possible solutions to these issues can be designed to attempt to minimize them.

The most relevant issues from the SWOT analysis presented in the former paragraph are analyzed in this paragraph. The following issues are of significant importance to the involved stakeholders:

- An unwanted mixture of library materials within a library due to the floating of all materials
 - Mixture of owner of materials
 - Mixture of type content of materials
- Shelf capacity problems due to the unnatural unbalance of materials amongst libraries
 - An overcapacity at libraries that have more requesting members than materials requested by other libraries
 - An under capacity at libraries that have less requesting members than materials requested by other libraries
- Knowledge problems about the whereabouts and moment of return of library materials

Mixture of material

After implementing a floating collection concept in the library sector in the Netherlands, a shift of library materials is very likely to occur. Library materials do not return to their original location immediately and thus a mixture of library materials in the current collections occurs. As stated in the SWOT analysis in the former paragraph, this phenomenon has both positive and negative effects. Focusing on the negative effects; the libraries participating in the floating collection concept could perceive the mixture in their collection as unwanted by the organization of that library and especially unwanted or undesired by the end-user population of that library. There are two types of mixtures identified in this study, a mixture of heritage of the materials (*mixture of ownership*) and a mixture of content of the materials. Although these two types are correlated, content of the materials is often related to the location of the library (e.g. a smaller library in the country side will have special books about the area) (23).

Research done on the desires of a library, regarding the mixture of content of the materials, shows that the majority of the collection should be owned by the library itself. Retracting this information means that a library collection should have more than 50% of their collection formed by their own materials (7). Numbers on the desired content for the collection is still to be discussed. One can argue that the desired content is dependent on the desires from their members, but it is the members that are *demanding the material in the first place*. If there is a shift in content, it is because of the members themselves.

Shelf capacity

Another issue that is expected after implementation, and has occurred at the Sarasota Libraries in Florida, is the unbalance in number of materials at the libraries after a certain period. This unbalance can be created due to more users requesting

materials in one library than are requested at this library by other libraries. This causes this library to have an overcapacity in a certain period making other libraries having an undercapacity of materials (23).

Research has shown that libraries can house 10% more materials than the number of materials in their own collection (7). If the number of materials exceeds the 10% on average, then there is no space left to display the materials on available shelves within the libraries. Research showed that libraries do not desire an under capacity in fear of losing satisfaction of their members. Libraries could handle a discharge of materials of up to 20% in a certain time period, but not more (7).

Knowledge problems

Feedback on the questionnaire showed that issues are expected to the tracking and tracing of the library materials and issues relevant to the return date of their materials. In theory there is no return date within a floating collection, but to keep stakeholders satisfied, the organization might find it a good initiative to implement a return date to make sure stakeholders see their possessions return within a certain time period.

Issues surrounding tracking and tracing are not to be expected due to the tracking and tracing being available within the NBC (31).

3.2.3 POSSIBLE SOLUTIONS FOR THE PERCEIVED ISSUES

In the former paragraph issues that can occur after implementing a floating collection are identified. In this paragraph solutions are designed to minimize these issues. To find solutions the first step is learning from other sectors that have similar situations and similar problems. What solutions are being implemented in these cases and can these solutions be designed in such a way that it could minimize the issues that might occur after implementation of the floating collection concept?

There are two sectors identified that have similar situations and similar issues:

- The distribution of empty maritime containers
- The repositioning of rental cars within a service area

In the next sections a closer look is taken into both cases and an assessment is made on what can be learned from these cases in order to design solutions for the issues in the library sector.

Empty maritime containers

The maritime container sector has similar problems as the library sector could have after implementation of a floating collection. Next to transporting maritime containers containing goods for demanding customers, container shippers need to manage their fleet of containers while considering the empty container flows. Due to natural unbalance in supply and demand throughout the world, there is an unbalance in the storage of empty containers within seaports. These empty containers need to be transported to locations with demand for empties. This so-called "repositioning" is a major part in the container fleet management of container shippers (32).

The fleet management relies on mathematical algorithms to solve and optimize the repositioning problems of the distribution of empty containers. In this sector,

algorithms were designed in the 1970s and nowadays are highly improved. The algorithms today depend on the forecast made on the demand and supply flows of containers worldwide, the costs of transporting and storage of empties and the capacity available for transportation of empties. The optimization of the repositioning plan is cost driven. As transporting empties does not add value to the shipper, the costs must be absolutely minimum (33) (34).

Implementing a rebalance plan within the floating collection concept could be a good solution to solving the issues discussed above. But adapting an algorithm directly from a container shipping company could be problematic. There are many differences between the sectors. The models involving empty containers rely on advanced forecasting models which do not exist in the library sector. Forecasting is primarily done with historical data and the transportation services of the PSOs nowadays do not have this data available for forecasting (10). This could be possible in a couple of years. The container sector is cost driven, which is also sought after in this project, however, the container industry is a sector that is also profit driven. The library sector is not profit driven, but service based and therefore the algorithms used in the container sectors would need significant adaptations. The container shippers also handle one big "collection" (read: fleet) of containers. In the case of the libraries, there are many "fleets" and like said earlier, issues are expected from mixing the "fleets".

Car rental service

The car rental sector also possesses similar distribution concepts to the library sector. Within car rental companies the user often can choose to rent a car for a round trip, in where the user returns the car at the location it has picked up the car earlier, or he can choose to rent the car for a single trip and drop the car at another location than where he picked up the vehicle. This second option makes it necessary for car rental companies to manage their fleet in similar ways as the container shippers. Due to the stochastic nature of the single trips, an unbalanced fleet of cars occurs throughout the companies' locations. To balance the fleet, car rental companies have repositioning strategies and these are also based on algorithms (35).

As the case with the container shippers, the algorithms used by car rental companies are highly sophisticated and depend even more on forecasting models. Car rental fleet planners must forecast demand beforehand to be able to supply the demand on every location. The same as with containers, the car rental company is a cost driven market with a main focus on generating high profit (35).

When designing a rebalance or repositioning plan for the floating collection of the libraries in the Netherlands, the same issues as with the car rental service case are present. Car rental companies operate one collection and all the locations are managed by one headquarter who manage the fleet planning. When the floating collection is implemented and matured enough to generate good statistical historic data to provide data for advanced forecasting models, the algorithms used by car rental companies could be very useful for the library sector.

3.2.4 EVALUATION

Looking at both cases, designing a rebalance or repositioning plan seems a good solution to all the issues that are expected by implementing a floating collection in the Netherlands. When designing a rebalance plan a lot can be learned from both cases. However, at this stage of time, the algorithms used by the both the container shipping companies and car rental companies are far too sophisticated and have different goals than the library sector to adapt these algorithms at this level.

When modeling the system in the coming chapters a rebalancing plan must be designed that satisfies all the requirements of the stakeholders involved in the system. Based on this paragraph, a rebalance plan has the potential to solve the issues described in the former paragraphs. When designing a plan that periodically redistributes library materials to locations where, for example, there is a shortage of materials, the issues might be prevented. While rebalancing library materials, more transportation is needed to perform the rebalance. The extra movements necessary to reposition the materials decrease the potential advantage gained by implementing a floating collection concept, but the question is, by how much.

4 MODELING OF THE INTERLIBRARY LOAN SYSTEM

In this chapter the current system and the implementation of the floating collection is modeled. Based on the discrete event modeling techniques the current situation is conceptualized in several graphical models. This is done to gain insight into the processes of the PSO transportation service and the communication between these processes. From these conceptual models the key performance indicators are determined to evaluate the implementation of the floating collection concept. After the conceptualization, the details of the simulation models are assessed by specifying the data needed and clarifying the assumptions that need to be made in order to create a model that represents reality. The following steps are to verify the correctness of the models and validate the model using an expert within the library sector to check if the model behaves correctly.

4.1 CONCEPTUALIZATION

Within this paragraph the conceptualization phases is elaborated on. The more detailed descriptions into the conceptualization models are presented in Appendix H-J. In this paragraph a summary is presented and the identified key performance indicators are mentioned.

4.1.1 DESCRIPTION OF THE CONCEPTUALIZATION STEPS

The first modeling technique used in the conceptualization phase is object modeling. In this analysis all the relevant objects in the system, derived from the causal relationship diagram from paragraph 2.4.1, are assessed by using object modeling in the Unified Modeling Language. This is done to gain insight in the objects and their characteristics as well their relationship between other objects. Using UML enables a clear and static view of the ILL system and that identifies a complete view of the structure of the modeled ILL system at a specific time (36). The object model focuses on a particular set of object instances and attributes, and the links between the instances. A correlated set of sub models provides insight into how an arbitrary view of a system is expected to evolve over time (37). The identified objects and their relationships are complex within the ILL system. There are objects with overlapping characteristics and objects belonging to several classes which make a clear overview of the objects difficult. To enable the object model to be less complex several objects are added to the object model. This technique has enabled the project to gain a clear insight in the architectural blueprint of the ILL system including the stakeholders, their activities and their business processes. The object model of the ILL objects and detailed description can be viewed in Appendix H: Object Modeling.

The next step of the conceptualization phase is to place the objects from the object model in sequence. Followed by designing a process-oriented description of all the processes operated by the transport service of a PSO. The technique used in this step is IDEF0-diagrams (38). This technique gives insight in the process steps, the information and resources needed per process step and the necessary input to create the relevant output object. The models show that the system has three decomposition levels. A third decomposition was needed in order to gain enough insight in the processes to be able to conceptualize the ILL system. The individual tasks of resources are identified in the third decomposition and the allocation of the information is

identified. The complexity of the processes and its functions are simplified and put in sequence using this technique which enables easier modeling in the next paragraphs. The IDEF0-diagrams of the ILL processes and a more detailed description on the use of the IDEF0 diagrams can be viewed in Appendix I: Process Oriented Modeling.

In order to understand the individual decisions that need to be made by the relevant employees of the transport service of the PSO, a flow chart model is made as the following step. In this analysis a flow chart model is used to visualize the decisions of the directly involved stakeholders within the processes of transporting library materials (39). Within the processes identified in the process oriented models in Appendix I, the identified organizational units are the user, the library and the PSO. The flow within the flow chart starts with the order of an ILL material and flows through the system until the material is back at the library of origin. The most information is gained on the side of the PSO. This model enabled a clearer overview of processes and the decisions needed by the relevant entities in the system. Using a flow chart model enables the conceptualization to be more comprehensive. Tasks identified in the process oriented modeling in appendix I are set in sequence of decision and flow using the flow chart modeling. This creates an insight in the responsibilities of the stakeholders involved directly with the transportation of ILL materials. Particular bottlenecks and flaws in the flow of the system were not identified. The flow chart model and detailed description of the use of the model can be viewed in Appendix J: Flow Chart Modeling

4.1.2 IDENTIFICATION OF THE KEY PERFORMANCE INDICATORS

The ILL system is conceptualized so that a simulation model can be specified and built. The goal of simulating the ILL system is to assess the possible alternatives against the current situation and rate the performance of the alternatives. In order to rate the performance, the performance must be measured by selecting key performance indicators (KPI). Accordingly, choosing the right KPIs is reliant upon having a good understanding of what is important to the organization. Because of the need to develop a good understanding of what is important, performance indicator selection is often closely associated with the use of various techniques to assess the present state of the business, and its key activities (40). The key activities identified within this project are the system requirements identified in paragraph 2.5.

The KPIs enable the assessment of the system's performance by simulating the models in the next chapter. The KPIs identified use the same categories as the identified system requirements, namely costs, service and capacity.

Costs

KPI	unit	calculation
The number of materials collected by the PSO	# library materials	Counting the number of library materials that enter the PSO headquarters
The number of materials distributed by the PSO	# library materials	Counting the number of library materials that exit the PSO headquarters
The average cycle time of a library material	# days	Calculating the interval in days that a library material returns to its original location

TABLE 4-1: COST KPIS

The system requirements stated in 2.5.2 state that the costs of shipping a single library material should not increase after implementation of the floating collection concept, and the costs of resources should not increase after implementation. After the conceptualization of the system of ILL the KPIS stated in Table 4-1 are identified. The costs of shipping library materials and the use of resources are measured using the number of transported materials in the system. After determining the number of transported materials of the different simulation models, one can compare the differences between the numbers of transported materials and justify the differences in costs of shipment and resources. The average cycle time of the library materials is the time it takes in an interval to return to the library of origin. This KPI is an important cost estimate for the library organizations because a materials out of the collection does not generate income. When returned, the materials are accessible for end-users to be lent. After implementing a floating collection, the cycle time increases. The amount of increase is an important KPI for the implementation and the communication towards the stakeholders.

The cost KPIS are important performance measures to answer the research question because the KPIS determine in part the success of this project. The research question raises the question if the implementation of a floating collection improves the transportation of ILL considering budget limitations. Measuring the costs using cost KPIS partly answers this question.

Service

KPI	unit	calculation
The average waiting time of an end-user	days	Calculating the amount of days the end-user needs to wait after the end-user made an order until the end-user can pick up the library material.

TABLE 4-2: SERVICE KPIS

The system requirements state that the waiting times of the end-user for receiving the ordered materials may not increase after implementation of the floating collection concept. The KPI that measures the waiting time is stated above. Calculation of the waiting time using the simulation method in the next chapter is not complicated. The time it takes for an end-user to receive its order is measured and assessed in paragraph 5.1.

The waiting times of the end-user are of importance in answering the research question because the research question asks if the implementation of a floating collection improves the transportation of ILL considering the expected growth in demand. A growth in demand without a growth in capacity increases the waiting times of the end-users. Measuring the waiting times shows when the growth in demand of the ILL can be handled by the transportation service after implementation of the floating collection concept.

Capacity

KPI	unit	calculation
Mixture of library materials within a library collection	% of own library materials within the collection	This is calculated by determining the origin of the library materials within the collection
Library shelf capacity	%	The number of library materials in current collection divided by the original number of materials within the collection

TABLE 4-3: CAPACITY KPIS

The system requirements state that three terms of capacity should be met. First the capacity of the transport service cannot increase in the coming years due to budget constraints. The capacity of the transport system is not a KPI in this system because it is an input variable. Within the model the capacity remains the same. Second, the mixture of library materials must be contained. Library organizations need a large portion of their collection, more than 50%, to be their own. Third, the capacity of the library shelves must be met. This means that the increase in number of materials in a certain library may not increase with more than 10% because of limited shelf space. The decrease in number of materials in libraries may not decrease more than 10% of their original capacity.

The importance of the capacity KPIS regarding the project are because of the stakeholders needs and position in the system. As identified in the library sector analysis (2.2), the negative effects that might occur after implementation of a floating collection need to be minimized. Measuring these KPIS identify the negative effects of implementation and rate the performance of possible solutions to these negative effects.

4.2 SPECIFICATION

In this paragraph the details of the simulation model are determined. All the necessary steps to specify the simulation model that have been performed are described more in detail in Appendix K, Appendix L and Appendix M. In this paragraph a summary is provided to gain insight in the steps made to specify the model.

The first step in the specification phase is to build the simulation model. The simulation model is built in Rockwell Automation's Arena (41). This is a software tool to enable the simulation of discrete event simulation modeling. Using Arena, the models from the conceptualization phase are translated into a simulation model that can be run in a certain time period to assess the processes and objects of the system and measure the performance of the system. In designing the Arena model the Handboek Arena is used (42). A more detailed description of the setup of the simulation model in Arena is presented in Appendix K: Setup of the Discrete Simulation Model.

A small representation of the exploratory network of library is shown in Figure 4-1:



FIGURE 4-1: SETUP OF THE SIMULATION MODEL BUILD IN ARENA

In Figure 4-1 the setup of the exploratory model built in Arena is presented. In this small representation of a provincial service area and the libraries operating in this area the choice is made to use a set of four libraries of different sizes in this model. All the relevant categories of libraries in the Netherlands are represented in the model.

- PSO
- Plus Library (Library B)
- Library Organization (Library A)
- Library Locations (Libraries X and Y)

Each library has a different size of collection available for ILL and a different amount of members requesting ILL materials. In this model the PSO collects and distributes the IBL and ILL from all the libraries.

The next step is to collect the relevant data needed as input for the simulation model. The data is collected by performing interviews with relevant stakeholders and various internet sources. The nature of the public library sector in the Netherlands enables public data sharing so all the relevant data are available without barriers. The data used in the simulation model can be viewed in Appendix L.

The final step is the setup of the simulation runs. In this step the length of the simulation run is set; the length of the simulation run is one year. The main reason for choosing one year is the availability of the data collected. The data collected is in periods of calendar years which makes the data easier for comparison reasons when the model is run for one year. More details on the simulation run setup can be viewed in Appendix M: Simulation Run Setup

During the former steps in specifying the simulation model, various assumptions have been made. These assumptions are very important to clarify. Every model is a near representation of reality and simplified to create a more clear understanding of the situation. The assumptions made in this chapter limited the model in its performance in representing the real situation. All the assumptions made in during the design and specification can be viewed in Appendix N: Assumptions.

4.3 VERIFICATION AND VALIDATION

During the verification phase it is checked if the model is coded correctly and if the model is translated correctly from the conceptualization phase to the specification phase. During the specification the input variables are determined and the calculation rules of the output variable determined. In this paragraph it is checked if the translation is performed correctly. This is done by both a dynamic verification and static verification (43).

First the dynamic verification is performed. Dynamic verification is performed during the execution of software, and it dynamically checks its behavior. It is commonly known as the test phase (43). It is important if the model logic is coded correctly. At this point a trace of commands is made in one simulation run. After several tests and adjustments, the model seems to be coded correctly. Next to the code, the model is walked through thoroughly and checked for structural errors. Second, the model has been checked if the output variables are calculated correctly. This is called the static verification. Static verification is the process of checking that the software meets the requirements by doing a physical inspection of it (43). The model is checked how much entities are created, how much entities end up in queues and how much entities leave the system. In the last model this is all acceptable.

The final step in completing the design of the simulation model is to validate the model. Validation means that the model is correctly representing reality. The validation phase knows two steps. The first phase is the face validation by a library expert and the second phase is the structural validation of the simulation model.

The face validation phase is conducted with an expert within the library sector and a manager of a PSO transportation service (7). Face validity is the validity of a test at face value. In other words, a test can be said to have face validity if it "looks like" it is going to measure what it is supposed to measure. In simulation, the first goal of the simulation analyst is to construct a model that appears reasonable on its face to model users and others who are knowledgeable about the real system being simulated (19). During the expert meeting, all the inputs, processes and outputs of the model were discussed. Also, the behavior after changing several input variables is discussed and after several adaptations to the model, the model was face validated.

The next validation step lets the model undergo several structural tests to check if the model behaves as expected to the changes in input parameters. This is necessary because it needs to undergo experiments in a later stage in the project. With these tests, some input variables are changed into extreme values and checked how the model responds to these changes (44). Three tests have been done and the results of the tests can be viewed in Appendix O: Validation and the summary is given below.

- *Capacity of a shipment*

In this test the capacity of a shipment is lowered to a minimum. Instead of allowing 45 materials (3 crates) per library per pickup day, the variable is changed to 15 materials (1 crate). As can be seen in the appendix, the model behaves like expected. The majority of the library materials are not collected by the PSO and do end up in long queues. This delays the wait for materials for the end-user dramatically. This is as expected because the capacity at the current situation is just sufficient to transport the materials.

- *Percentage of users requesting materials*

In this test the distribution of the requests over the libraries is changed. In the current situation the library users from library A request materials with the distribution of 70% to library X and 30% from library Y. This distribution is reversed. The expected effect occurs. Library Y receives too many orders and with the current service level cannot provide this service. Also the library collection is too small to handle the requests resulting in the emptying of the collection. This can be seen in Appendix O.

- *The speed of the collection and distribution of library materials*

In this test the speed of collection and distribution of the PSO transport service is varied. The current speed in the model is half a day to reach the PSO and half a day to reach the destination location. In Appendix O the results are presented and the effects of the waiting times are as expected. When dropping the time to 0 days, the waiting times of the end-users decreases and when the speed is changed to 3 days, the waiting times increase.

5 EVALUATION OF THE SIMULATION RESULTS

In the former chapter a simulation model has been designed to evaluate the floating collection concept by implementing this concept in the model of the current situation. The simulation model has been designed and validated by sources within the library sector. In this chapter the simulation models are run for the period of one year and the results are presented in the first paragraph. After assessing the results, the results are evaluated on the key performance indicators identified in the former chapter.

5.1 RESULTS FROM THE SIMULATION RUNS

The key performance indicators identified in paragraph 4.1.4 are measured using the simulation models designed in the former chapter. The KPIs are as followed:

- The number of library materials transported by the PSO
 - The number of materials collected by the PSO
 - The number of materials distributed by the PSO
- Average cycle time of library materials
- Average waiting times for the end-users
- The composition of the library collections
 - Mixture of library materials within a library collection
 - Library shelf capacity

In the following sections the results on the KPIs are presented using tables and graphs, and the results are discussed. First the current situation is presented followed by the future situation of the ILL in the next three years and finally followed by the results from the implemented floating collection. The final results from the adaptations made to the models regarding the redistribution plan are set up to minimize the negative effects of implementing the floating collection.

5.1.1 CURRENT SITUATION

The simulation results for the current situation are presented below for all the KPIs:

Materials transported by PSO

	materials	crates
Materials Collected	5817	1939
Materials Distributed	5701	1900
Total	11518	3839

TABLE 5-1: CURRENT SITUATION; MATERIALS TRANSPORTED

As shown in Table 5-1, in the current system 11.518 materials are being transported by the PSO. The difference in the numbers of collected materials and distributed materials are the materials still handled by the PSO at the moment that the simulation run has been stopped. Note that the number of transported materials is done with the capacity of 3 crates per library and that a crate can handle 15 materials.

Average cycle time of library materials

	days
Average cycle time of a library material	18.0

TABLE 5-2: CURRENT SITUATION; CYCLE TIME

The average cycle time, the time it takes for a library material to be back at the library of origin is 18 days. This number is more dependent on the time it takes the user to use the material than the transportation service operated by the PSO. The time the user uses the material is determined by a triangular distribution of minimum 3 days, on average 7 days and a maximum of 18 days. If the average waiting time (see below) is subtracted twice (two trips) from 18 days, 10 days remain as the time it takes for a user to return the material effectively. This is unexpected. One would expect 7 days to be the average time it takes the user to use the materials. It takes the material 3 days longer than average to return to the library. Due to the different service levels (Plus Library 5 days / LibA 3 days / LibX 2 days / LibY 1 day) of the libraries, the materials take longer, on average, to return to the owning library. This accounts for the extra cycle time of the library materials.

Average waiting times end-user

	days
Average waiting times of the end-user	3.8

TABLE 5-3: CURRENT SITUATION; WAITING TIMES

The average waiting time of an end-user is 3.8 days. This number is validated in the previous chapter using the experts' opinion and is the overall average in the current situation. Note that due to the different service levels of the libraries the waiting times are dependent on the service level (the number of times per week the PSO serves the library) provided by the PSO. Also note that in the simulations weekends are excluded from the simulation time. The days used in this chapter are weekdays.

The composition of the library collections

The composition of the library collection in the current situation is static. Every library possesses its own materials which is presented in Table 5-4.

Materials	Collections			
	Plus	LO	LL X	LL Y
Plus	100%	0%	0%	0%
LO	0%	100%	0%	0%
LL X	0%	0%	100%	0%
LL Y	0%	0%	0%	100%

TABLE 5-4: CURRENT SITUATION; COMPOSITIONS OF COLLECTIONS

These values are expected because all the used ILL materials returned by the end-user return to the library of the owner by the transportation service of the PSO. These presented results of the current situation are the yardstick with which the next models (the future situation and the floating collection) are compared.

3.1.2 FUTURE SITUATION

In the future situation the simulation models are being adapted to fit the predicted future scenarios. As discussed in paragraph 3.1, the demand for ILL increases dramatically. The following increase presented in Table 5-5 is predicted by Mr. Spanier (7):

Year	Growth in demand/year
2011	35%
2012	45%
2013	55%

TABLE 5-5: GROWTH IN DEMAND FOR ILL

These growth rates have been adapted in the demand of the model and the following results are from the simulation runs indicating the values for the KPIs in the future situation.

Materials transported by PSO

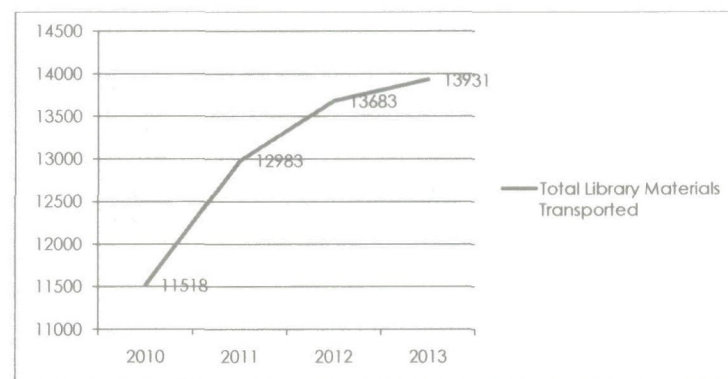


FIGURE 5-1: FUTURE SITUATION; MATERIALS TRANSPORTED

The graph in Figure 5-1 indicates the growth in materials being transported by the PSO transport service. The expected growth rates of the transported materials are similar to the growth rates as in Table 5-5, but this does not occur. The reason for the decline in growth of the transported library materials is the stationary capacity of the trucks of the PSO transportation service. The capacity reaches its maximum after 2010 and simply cannot handle the extra demand in ILL. The remaining library materials remain within the queues at the library waiting to be picked up the next time the PSO services the

library. These queues increase exponentially through time. It is arguable that the results presented in Figure 5-1 are representing the real future situation. Whenever the waiting times of ILL grow exponentially, the users use the ILL system less, creating a drop in demand. This elasticity of demand is not modeled in these simulations and the results above stipulate the reaction of the system to the exponentially increase of the demand for ILL.

Another reason for the decline in growth of materials transported is the raise of number of materials waiting in the queues. Due to the exponentially growth of number of materials in queues, the number of materials within the library collection drop to zero, which disallows users requesting orders to order and these users and requests exit the system without the orders being honored.

Average cycle time of library materials

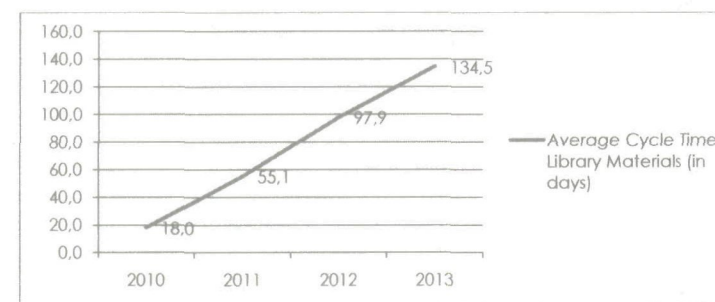


FIGURE 5-2: FUTURE SITUATION; CYCLE TIME

The average cycle time of a library material increases through the years. As said before, the cycle time is dependent on the time it takes the users to use the materials, but in the case of growing demand, the waiting times within the queues for the PSO transport service take over as the main driver for the cycle time and the cycle time grows up to 134.5 days in the year 2013. When subtracting the average waiting times of the users in 2013 (see below) (52.8 days) and the average usage time of a library material (14 days) from the cycle time, 68 days is left what represents the average waiting time within both the queues at the library, at the collection for pickup and at the collection for return. It takes the PSO so long to pick up a library material at a library because of the limited capacity available (see above). All these figures are again arguable because of the drastic increase in waiting times it is questionable if the end-users will still use the system and if the demand will still increase with the same rate as used in this project.

Average waiting times end-user

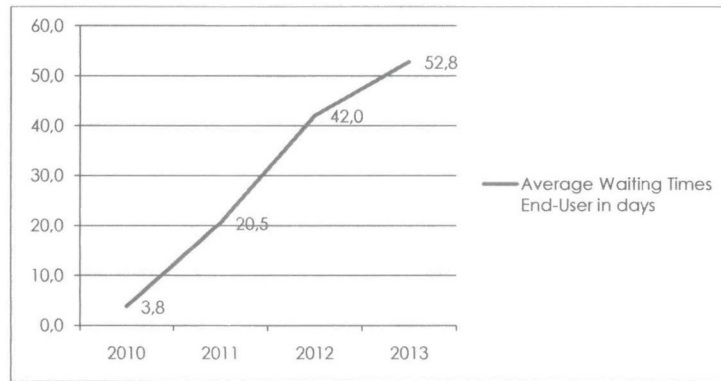


FIGURE 5-3: FUTURE SITUATION: WAITING TIMES

As expected from the former results shown above, the waiting times rise to the extreme in the coming years due to the increase in demand for ILL. The average waiting times increase up to 10 weeks. It is an understatement that these waiting times are unacceptable for the end-users. It is argued before whether the end-users will wait this long for their materials. As a result of the increasing waiting times, the demand drops after several months. This indirect effect, the elasticity of the demand, is not modeled in this project in order to objectively compare the future situation with implementing the floating collection concept.

When evaluating the results of the future situation without the option to implement a floating collection concept, one can argue the severity of the future situation of ILL. When the growth rates are to increase as expected by the expert, the library sector involved with ILL has a serious problem. With the current capacity, the increase in demand can never be handled by the PSOs and with no funds available for increase in capacity, the sector should find serious solutions to decrease the increase in demand for the future.

The composition of the library collections

The composition of the library collections of the libraries in the future situation remain the same as in the current situation.

5.1.3 IMPLEMENTING THE FLOATING COLLECTION

At this point the simulation model used in the last two paragraphs is adapted more thorough. Adaptations are made in order to simulate the situation in which library materials are returned and not transported back to the origin library. The materials enter the library collection of the user who last used the library material. The results from the simulations through the coming three years are presented in the section below.

Materials transported by PSO

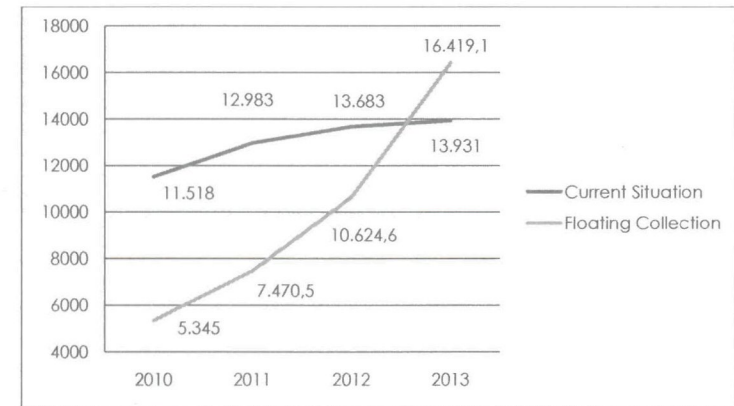


FIGURE 5-4: FLOATING COLLECTION: MATERIALS TRANSPORTED

In Figure 5-4, the number of transported materials through the years is presented for the future situation and after the implementation of the floating collection concept. It is clear that due to the implementation of the floating collection in the year 2010, the number of materials transported decrease with 50%. Due to the materials not returning to their origin, a major decrease in movements is realized. This effect has an effect on the capacity of the transport service. The capacity of the transportation service double in respect to the demand for transport after implementing the floating collection concept. The figure in year 2010 drops more than 50%. This is caused by the minor adaptations to the model. Because within the exploratory model, due to its size, the materials requested by the end-users are sometimes located at their own library which disables the need for transportation. This minor change in the model is justifiable because after implementing a floating collection, the user will first use the ILL system before checking the shelf of the library for this material (7). Even while considering this effect, the transportation drops near 50%, which is expected.

This effect in year 2010 was expected, but the results in the next years are more interesting. The question was if the implementation of the floating collection can intercept the demand for ILL with the same capacity. Due to the abovementioned increase in capacity of the transport service, the increase in demand for ILL in the future can be handled by the PSO (when looking at the stable waiting times of the end-users below). The increase in transportation follows the same growth as the growth of demand. This means no increase in waiting times for the users and no unnecessary waiting times of materials to be handled by the PSO. The results in 2013 of the floating collection compared to the future situation are unexpected at first, but considering the unwanted modeling effects caused by the exponentially increase of queues in the future situation, the model of the floating collection can handle the increase of demand, whereas the model of the future situation cannot. This causes the number of transported materials to increase in the year 2013 compared to the

future situation. This makes the two models non-comparable in the future years (2011-2013). However, positive results for the implementation of a floating collection can be derived.

Average cycle time of library materials

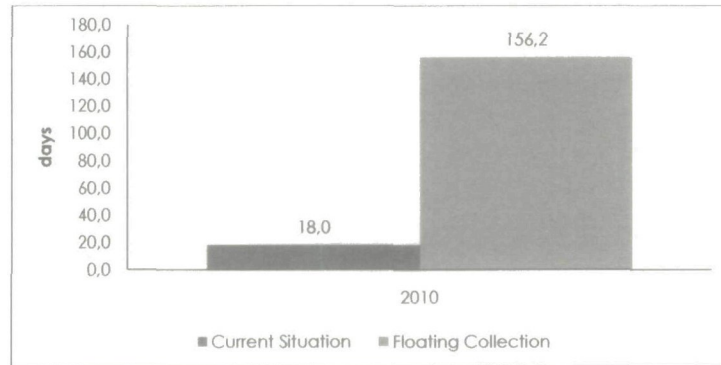


FIGURE 5-5: FLOATING COLLECTION; CYCLE TIME

The graph stating the cycle time shows that the cycle times of library materials increase more than 8 times. This is expected due to the fact that the materials do not return to the origin directly. Interesting to know is that, on average, the library materials do return to their origin, and within 32 weeks in the case of this small exploratory model. However, one can argue these results when looking at reality. The simulation model is a small network of libraries, and increasing the number of libraries within the network will increase the cycle time of the materials.

Average waiting times end-user

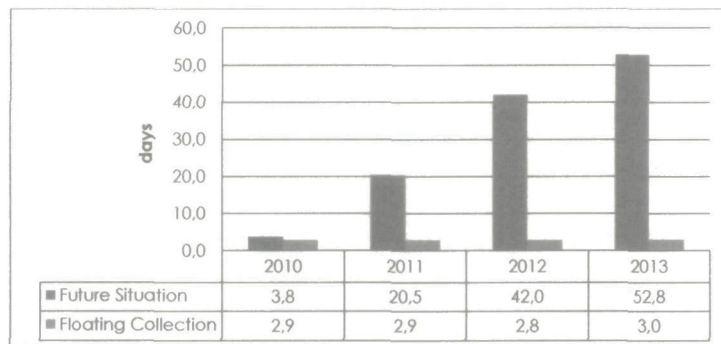


FIGURE 5-6: FLOATING COLLECTION; WAITING TIMES

Following the expectation of the increase of number of materials transported, the waiting times of the end-users do not increase significantly in the coming years with the implementation of the floating collection.

These results are very clear in identifying a positive result for the implementation of floating collection in the situation of the Dutch library sector. However, the negative effects expected by the stakeholders need to be investigated. The following KPIs on the composition of the library collections try to give a clear indication on the results of the negative effects after implementing the floating collection concept.

Composition of Collections in the year 2013

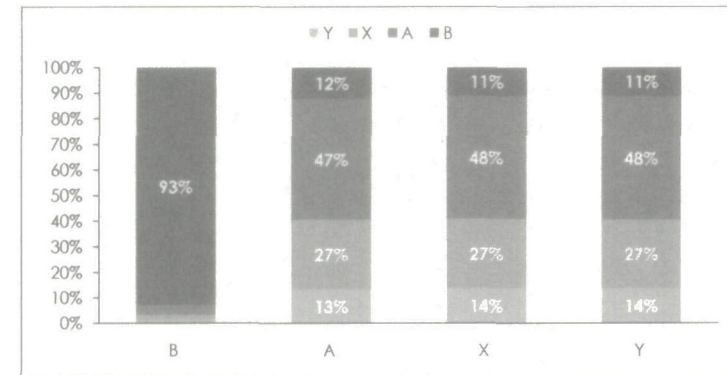


FIGURE 5-7: FLOATING COLLECTION; COMPOSITION OF THE COLLECTIONS

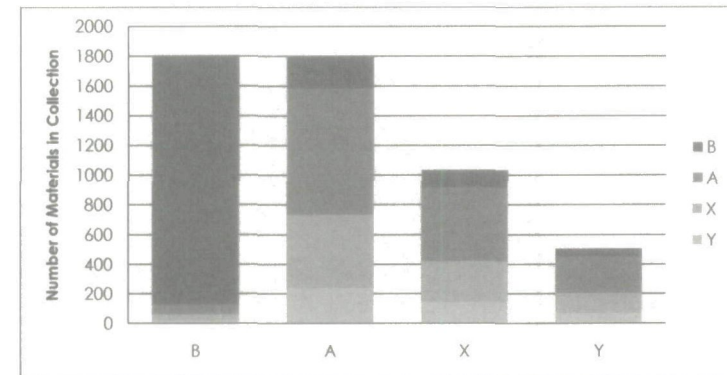


FIGURE 5-8: FLOATING COLLECTION; COMPOSITION OF THE COLLECTIONS

The first discussed issue after implementation of the floating collection in the former chapter is the mixture of library materials in the library collections. As illustrated in the

Figure 5-7, the library collections are mixed. The Plus library (LibB) has a less mixed library collection than the others. This was expected because the materials available for ILL of the Plus library within this system are of scientific level. The demand for the scientific materials is lower than for the regular materials (for a more detailed description on the demand patterns and assumptions see Appendix L and Appendix N) and therefore the materials from the plus library are not spread out over the other libraries. One can see a clear distribution in the mixture of materials within the collections. This is as expected due to the distribution of the demand depending on the size of the library collections. The assumption is that the materials within this exploratory model are without categorization of any sort. Recalling paragraph 2.3.2, categorization of ILL was not possible. Other categorizations (e.g. origin) are left out of this model. Within this model the smallest library collection (library location Y) loses most of its materials. When reflecting on the real situation, this might not happen. Small libraries have special collections which might not be of interest in the larger libraries. Assuming equal categories of materials, this does occur.

As discussed in paragraph 3.2.2, when libraries lose more than 50% of their own collection it is unacceptable for the library organizations. In the Figure 5-7 it is clear that this phenomenon occurs for three out of four libraries. As discussed in paragraph 3.2.3, a redistribution plan needs to be designed in order to minimize this unwanted effect. In paragraph 5.1.4, the redistribution plan is designed and adapted in the model to generate results and determine whether this plan still favors the floating collection as a suitable alternative to the issues stated in this report.

The next issue expected by the involved stakeholders is the unbalance in number of materials within the library collections. In the Figure 5-8 is shown that this issue does not occur within this simulation model when compared to the initial values of the library collection stated in Appendix L. As is shown in Figure 5-8, the libraries have the similar amount of materials in the processes and no significant unbalance is identified. After analysis it became clear that the assumptions made in the former chapter are the reason for the perfect balance in the library collections. To recall the data collection paragraph, 4.2.2, the number of requests per requesting library is proportional to the size of the library collection. In the interview with Mr. Spanier he clearly stated that one can assume this distribution of requests (7). One can argue if this is the case in the real world. It is however difficult to simulate random values in this part of the simulation model. Test runs have been performed where the distribution is subjected to random distribution functions. However, due to the necessary replications, an average towards the stated distribution occurs. Unless the proportional distribution of requests and size of library collection differs, the balance in library collections remains in balance.

In combination with the issue of mixed library collections and the stakeholder requirements to decrease the cycle time of materials once floating, a redistribution plan is designed and implemented in the floating collection simulation model. The design and the results are presented in the following paragraph.

5.1.4 ADAPTING THE FLOATING COLLECTION CONCEPT

In this paragraph the issues occurring during implementation of the floating collection, as discussed in the former chapter, are attempted to be minimized. This is done by adapting the floating collection simulation model with a redistribution plan. Several options are available for a redistribution plan to be designed, and these options are discussed first.

The first subject that needs to be determined is the number of materials that need to be redistributed to the rightful libraries. By determining these numbers, a closer look is taken into the composition as simulated in the former paragraph. By determining a wanted composition and subtracting the current composition from this desired situation, one gets the percentages of the collection that need to be redistributed and the locations where to redistribute the library materials. In the following tables the desired situation is presented as is the subtraction from the current situation. This all resulting in the redistribution plan.

Materials	Collections			
	Plus	LO	LL X	LL Y
Plus	70%	10%	10%	10%
LO	10%	70%	10%	10%
LL X	10%	10%	70%	10%
LL Y	10%	10%	10%	70%

TABLE 5-6: DESIRED COMPOSITION OF COLLECTIONS AFTER REDISTRIBUTION

After the interview with Mr. Spanier, it became clear that the libraries would not accept losing more than 50% of their collection while participating with the floating collection (7). To create a safety margin for the redistributions, 20% is added to the initial stakeholder requirement, creating a need for 70% of the own collection to be part of the collection after redistribution. Following from this desired situation the following redistribution plan is made by subtracting the desired composition from the current composition. In Tables 5-7 till 5-9 the calculation can be followed.

Materials	Collections			
	Plus	LO	LL X	LL Y
Plus	93%	12%	11%	11%
LO	4%	47%	48%	48%
LL X	2%	27%	27%	27%
LL Y	1%	13%	14%	14%

TABLE 5-7: CURRENT COMPOSITION LIBRARY COLLECTIONS

Materials	Collections			
	Plus	LO	LL X	LL Y
Plus	100%	10%	10%	10%
LO	0%	50%	40%	55%
LL X	0%	35%	30%	35%
LL Y	0%	15%	20%	10%

TABLE 5-8: ROUNDED INTEGERS OF THE CURRENT COMPOSITION LIBRARY COLECTIONS

Materials	Collections			
	Plus	LO	LL X	LL Y
Plus	-30%	0%	0%	0%
LO	10%	20%	-30%	-45%
LL X	10%	-15%	40%	-15%
LL Y	10%	-5%	-10%	60%

TABLE 5-9: SUBTRACTED REDISTRIBUTION FLOWS

As is presented in the tables above, the percentages of the collections at any given time during the simulation are extracted from the collection and divided amongst the negative percentages and the collections accompanying these percentages. The collection of the Plus Library is extracted from the redistribution plan because it is predicted that the stakeholder requirements are met (minimum of 50% of own materials within collection) and the number of materials from the Plus library will not drop below 50%.

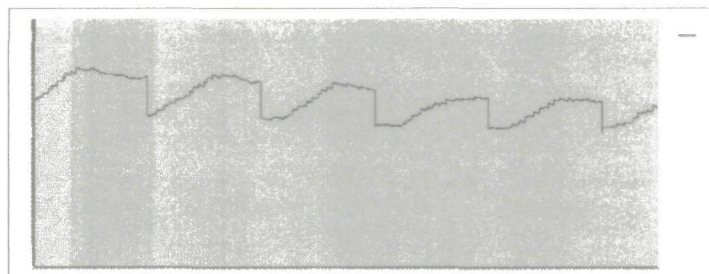


FIGURE 5-9: AN EXAMPLE OF THE REDISTRIBUTION PLAN IMPLEMENTED ON LIBRARY A WITHIN ARENA

In Figure 5-9 the course of the number of materials in the library organization (library A) is shown including the redistribution plan. In the Figure is shown that every 2 months the selected materials are excluded from the library collection and placed in queue to be redistributed. It is also shown that the library collection is supplemented with library materials in the course the 2 months after.

The second subject to be determined is the frequency of the redistribution. After testing with the simulation model, the desired period of redistribution is two months. First, the balancing of the frequency was dependent on the number of transportation movements occurring with the redistribution. If the frequency is high, the number of transportation movements in one year increase and the capacity might not be enough to transport all the materials, as seen in the future situation. Second, if the frequency is too low, the own materials within the local library collections drop below the 50%, and this situation is unacceptable.

From running the tests it became clear that with the current capacity of shipments, the waiting times for the end-users reached a level which was unacceptable for the end-users and making the floating collection not feasible to be implemented. The waiting times of the end-users with the redistribution plan occurring every two months and the maximum capacity of 3 crates per library presented the following:

		Float without RP	Float with RP
Plus B	OBL	1,80 days	7,20 days
LO A	OBL	2,00 days	6,27 days
	IBL	2,55 days	3,27 days
LL X	OBL	2,55 days	16,96 days
	IBL	2,91 days	16,62 days
LL Y	OBL	3,77 days	29,57 days
	IBL	4,19 days	28,30 days
AVG		3,0 days	16,80 days

TABLE 5-10: WAITING TIMES END-USERS WITH REDISTRIBUTION PLAN

The reason why the increase of waiting times occurs is because the redistributed materials are queued in the same crates as the regular ILL materials. This is because in reality this would occur in the same manner. However, the two flows, regular and redistribution, could be separated and the regular ILL could receive priority above the redistributed materials. In this simulation model this is not the case. Researching the possibilities for separating both the flows could be interesting.

To find solutions to solve the issues of the increased and unacceptable waiting times, two options in this simulation model are available: increasing the capacity per library (number of crates handled per call) or increasing the service level (number of calls per week) of the libraries. Both these options are undesirable according to the stakeholder needs and requirements (see 2.2.3). However below, these options are assessed to evaluate the designed redistribution plan.

After testing with the simulation model, the increase of 33% in capacity of the crates per library showed a significant drop in waiting times in order to implement the redistribution plan. The increase entails one extra crate to be handled per library. After testing with the service levels it showed that increasing the service levels of the library organization to five times a week and both the library locations to three times a week (instead of one and two times a week) showed equal positive results.

The choice is made to handle one crate more per library instead of increasing the service levels. This is made because increasing the service levels has a higher impact on the number of resources needed for the transportation service of the PSO. After calculation, increasing the service level needs four crates per week more than increasing the number of crates handled per library. Also looking at the routes operated by the PSOs, increasing the number of crates per library is more efficient than adding locations to the existing routes.

To conclude, a redistribution plan is designed with the following characteristics:

- Frequency: 2 months
- PSO Capacity increase: 1 crate per library

The results of the simulation runs including the redistribution plan are depicted in the following section.

Materials transported by PSO

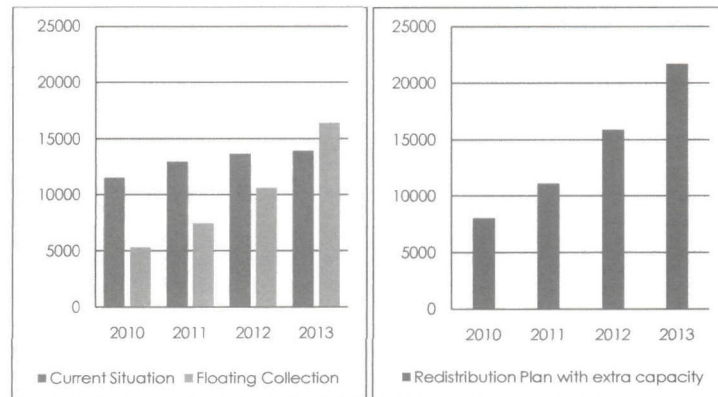


FIGURE 5-10: FLOATING COLLECTION COMPARED WITH REDISTRIBUTION PLAN; MATERIALS TRANSPORTED

The comparison of the results from 2010 and 2011 show that the number of transported materials with a floating collection including the distribution plan is higher than without the redistribution plan. This is as expected due to the increase in transportation because of the extra transport movements generated by the redistribution. It is also showed that the number of transported materials is less than the current situation, which indicates that an improvement in number of transported materials is created and extra capacity is generated compared to the current situation.

The results in years 2012 and 2013 of the number of transported materials are un-comparable due to the extra capacity implemented within the model including the redistribution plan. The extra capacity is used in these years which disenables the comparison between the results. However it is positive that the extra capacity is used

Will Dutch Libraries Float? Evaluation of the Simulation Results

in the years 2012 and 2013. This shows that with the growth in demand, the extra capacity is needed.

Average cycle time of library materials

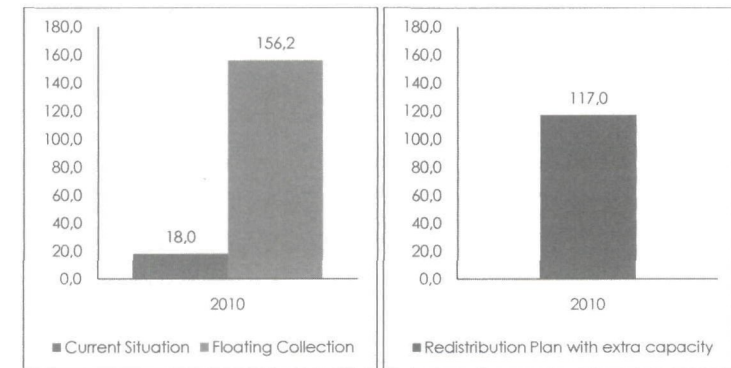


FIGURE 5-11: REDISTRIBUTION PLAN; CYCLE TIME

Looking at the results of the cycle times of the materials including the redistribution plan, the cycle times decrease. However, the decrease in cycle time (of 25%) is not significant compared to the floating collection without redistribution plan.

Average waiting times end-user

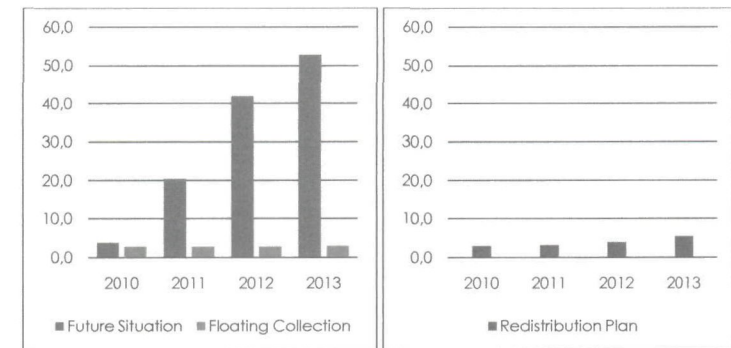


FIGURE 5-12: REDISTRIBUTION PLAN; WAITING TIMES

The average waiting times show promising results. However the waiting times do increase due to the increase in traffic within the model. On the one hand, one can argue if the increase in transportation moves is significant or even troubling for the end-users. On the other hand, the need for capacity increase might discourage

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the stakeholders to consider the option. This because increase in capacity does not even lower the waiting times for the endusers.

These results are very positive for the implementation of the floating collection concept. Including a redistribution plan with a frequency of 2 months, the future demand of ILL can be transported by the PSO with only a small increase in capacity per library. The use of a redistribution plan attempts to minimize the negative effects for the involved stakeholders. If these effects are indeed minimized is shown in the next section.

Composition of Collections

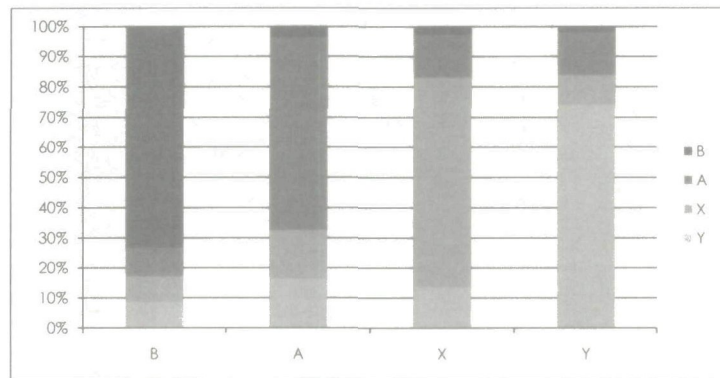


FIGURE 5-13: REDISTRIBUTION PLAN; COMPOSITION OF COLLECTIONS

As seen in Figure 5-13, the redistribution plan meets the requirements from the stakeholders. On average the requirements are met. It is shown from the animations used in the simulation modeling that, for example, the collection of LL Y drops to 47% a couple of days before the redistribution. This must be taken into account when communicating to the stakeholders, but might not be significant as the average is significantly above the 50% (74%).

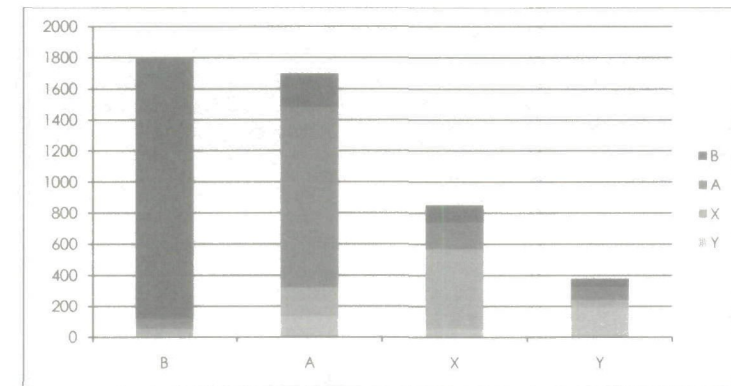


FIGURE 5-14: REDISTRIBUTION PLAN; COMPOSITION OF COLLECTIONS

As seen from Figure 5-14, the balance of the collection remains. This is as expected due to the proportion between the requests and the size of the libraries.

5.2 EVALUATION OF THE SYSTEM REQUIREMENTS

In this paragraph the results from the former paragraph are evaluated against the stakeholder requirements and the system requirements based on the results of the KPIs presented. This evaluation is done in the three identified categories: costs, service and capacity.

5.2.1 COSTS

Deriving the direct costs of implementing the floating collection is complicated within this project. The simulation model models the KPI: number of transport movements per material. The number of movements could be translated into currency, however, the historical data does not provide this information, and neither is this model capable of calculating the costs in a significant fashion. The evaluation on costs are assessed based on the percentage difference between the alternatives.

The main cost drivers of the transportation service of the PSO are the necessary resources like trucks and truck drivers. Within the simulation model of the current situation a clear picture is shown of an exploratory situation in which the capacity is nearly sufficient. This is also the case within the real world. Any changes to this system cause the capacity to be more than enough or absolutely not sufficient. To know this, one must look at the average waiting times of the end-user. When the waiting times increase, this is due to the limited capacity available.

While designing the redistribution plan, a choice is made to increase the capacity. This is not conform the stakeholders' needs or requirements, but is tested to show the results. Not increasing the capacity shows that with a redistribution plan, the floating collection concept is not a feasible concept for implementation in the case of the example model. Increasing the capacity leads to additional investments, but the

question is how much. This is not an easy question to answer. The capacity is increased by 33%. But this does not mean that when owned 3 trucks, the PSO should invest in 1 extra truck. There are numerous factors influencing the need for an extra truck.

The conclusion here is that when after implementing the floating collection concept including the redistribution plan, the PSO must manage the capacity closely. The results show that in year 2012, the extra capacity is needed; so immediate necessity for extra capacity is not required. This gives the transport service of the PSO some room to grow into the expected increase of demand.

5.2.2 SERVICE

Evaluating the service towards the end-user is done based on the average waiting times. This is the time an end-user needs to wait before it can pick-up its material from the library. Assessing the results gives a positive feedback for the waiting times after implementing the floating collection. Even after implementing the redistribution plan into the floating collection concept confirms that the waiting times are not significantly larger than accepted.

The waiting times do increase after implementing the redistribution plan, but not to an unacceptable level. Whether to know if the former statement is true, it is necessary to communicate the waiting times to the stakeholders.

5.2.3 CAPACITY

The category of capacity deals with three subjects:

- The capacity of the transport service
- The capacity of the library shelves
- The configuration of library materials within the library collection

The capacity of the transport service is discussed in paragraph 5.2.1.

The capacity of library shelves proved to be of no concern within this project. Due to the proportional distribution of the requests from the requesting libraries and the size of the library collections, the capacities of the shelves within the libraries in the model remained intact. There were no libraries under-shelved and no libraries with an under capacity. However, in the real world, this is most likely not to occur. The real world is not as perfect as the model in this project. As seen in Sarasota, the unbalance between libraries participating in a floating collection does occur and implementing a redistribution plan should solve this issue. The redistribution plan in this project does not rebalance the libraries, but minor changes in the model enable this when needed.

The configuration of the library collections generated issues like expected in the former chapter. With the implementation of the redistribution plan, the issues are resolved.

6 CONCLUSIONS AND RECOMMENDATIONS

In this chapter the project is concluded. First the sub research questions stated in the introduction are answered. The next step is to evaluate the project and answer the main research question of this project. The limitations of this project are discussed next and the last step is to present recommendations to the Stichting PSO Nederland for further steps into implementing a floating collection in the library sector in the Netherlands.

1. How is the current system of distribution of materials between libraries in the Netherlands organized and who are the relevant stakeholders involved?

To answer this question several aspects of this question were answered first. First the problem owner, the Stichting PSO Nederland, was investigated and after that the library sector and its stakeholders were analyzed, using desk research, interviews etc. Outcome of this analysis is a set of stakeholder needs and requirements in where the demands of the stakeholders in the process of implementing a floating collection were determined:

The following stakeholder needs have been determined:

- A need for innovation within the sector to meet the requirements of the end-users.
- The availability of library materials is of essence to increase the service for the end-user.

Stakeholder requirements for implementing the floating collection concept are to make sure that the costs of implementing a floating collection are to the minimum; to make sure that the waiting time for end-users not increase after implementation of the floating collection; and to ensure the minimization of negative effects after implementation of the floating collection concept.

Concluding from the stakeholder analysis one can argue that the network of stakeholders is very large with many individual stakeholders with different agendas. The reason for this is the historical development of the sector. Implementing a floating collection on a national scale considering the complexity of many stakeholders implicates the difficulty in realizing the possible implementation. The national organizations in the sector must not underestimate the need for collaboration on the lower level of the sector in order to achieve innovative national agendas such as implementing a floating collection concept.

Second, the organization of interlibrary loan (ILL) was analyzed more into depth to create insight in the business of transporting library materials within the network of libraries. The possibility to categorize the ILL materials in respect to the total collection is investigated with no success by using the long tail theory of Anderson (see 2.3.2). The current organization is analyzed including the logistics of the transport service and the level of service provided towards the end-user. The outcome of this phase is a SWOT analysis of the current organization which is shown in paragraph 2.3.4. The strengths and opportunities of the current situation are the retail formula of the

libraries which forces the end-users to travel to the library for their materials which enables people to meet in libraries and be tempted to participate in cultural events organized by the libraries. This feature has the opportunity to create cultural centers around libraries in the cities. Negative aspects of the current situation are the opening hours and distances to the libraries. These aspects limit certain population groups' access to the libraries and their collections. Implementing the national catalogue in combination with a floating collection concept might improve the accessibility for these population groups.

Third, the system requirements are identified using the input from the former analyses and constructing a causal relationship diagram of the ILL system. This diagram creates a complete overview of the discrete element factors of the system and their direct causal relationships between each other. The diagram identified the instruments of the system that can be influenced by the Stichting PSO Nederland, the environmental factors which were the input in analyzing future trends and the criteria factors which followed into the system requirements. The system requirements are as followed:

- The costs per shipment of ILL may not increase while implementing floating collection
- The number of resources used to transport the ILL materials may not increase while implementing the floating collection concept
- The waiting times for the end-user may not increase due to the implementation of a floating collection
- The capacity of the transport service cannot increase in the coming years
- The capacity of the Library shelves must be met
- The number of scientific materials in the collections must be limited

2. In what way can the floating collection be implemented to meet the requirements of the involved stakeholders and future growth of ILL in the library sector?

The steps into answering this question are as follows. To analyze the future situation of the ILL in the Netherlands the environmental factors from the causal relationship diagram were the input for investigating the future trends. The main driver for the future is the increase in demand for ILL caused by the future introduction of the NBC. After desk research and discussions with an expert, the growth rates of the ILL demand in the coming years were predicted for 2011-2013 respectively 35%, 45% and 55%.

The second step was to analyze the floating collection concept. First this was done by handing out a questionnaire to relevant stakeholders within the library sector. The output of the questionnaire was analyzed and complemented with a case study on the successful implementation of a floating collection in Sarasota, Florida. The outcome of this chapter was summarized in a SWOT analysis and the outcome of the analysis was that the possibilities of the floating collection concept could solve the issues of limited transport capacity due to budget cuts in the future by reducing the transportation flows up to 50%. The floating collection concept is also an innovative concept which fits into the innovative business plans of the library sector. Negative

aspects of the floating collection concept are the mixture of library materials in the library collections, the possible unbalance in the number of materials within the library collections and the knowledge problems of the whereabouts of the materials by the library organizations.

The negative effects described were analyzed to design solutions to these issues expected by the stakeholders after implementation of a floating collection concept. Solutions were investigated by analyzing the empty maritime container business and the car rental business. These sectors experience similar issues as the library sector could endure after implementation of the floating collection concept. The outcome of this analysis was to design a redistribution plan within the floating collection concept in order to minimize the mixture of library materials in the library collections, the possible unbalance in the number of materials within the library collections and the knowledge problems of the library organizations expected to occur. The redistribution plan is designed and tested using the simulation models in chapter 5.

3. *What is the impact on the key performance indicators of the system when implementing the floating collection using a simulation model of the interlibrary loan system?*

The first step was to conceptualize the ILL using process, object and decision modeling. From this step, the key performance indicators were identified using the system requirements identified in research question 1. The KPIs are categorized in the same three categories as the system requirements; costs, service and capacity.

The second step was to specify and design the simulation model based on the conceptualization models. Within this step data was collected from several sources, such as desk research, a questionnaire and interviews with stakeholders. In this step the model is set up and the assumptions that needed clarification in order to design the simulation models were elaborated on. The models for all the situations (current and future situation / floating collection situation) were then verified and validated using face validation with an expert within the library sector. The simulation models were verified and validated successfully and could be used for the evaluation.

The last step was to run the simulations according to the determined set-up. The results of the simulation runs are extensively elaborated in chapter 5. Main conclusions from the results are described below:

Main conclusions on the Future situation without adaptations:

- The number of transported materials increases as the demand for ILL rises. However, the number of transported materials does not increase as much as the demand due to the limited capacity of the transportation system.
- The cycle time of library materials increases dramatically due to library materials not being transported. Requested materials cannot be transported due to the limited capacity of the transport system.
- The waiting time for end-users increase dramatically. This increase in waiting time is not desired by the stakeholders involved in the system

Main conclusions on the implementation of the floating collection concept:

- After implementation the number of materials transported decreases with 50% in the first year, as expected. Due to the demand growth in the following years, the number of materials transported increases.
- The cycle times of the library materials are six times higher than in the current situation. This is expected since the materials do not directly return to their origin.
- The waiting times for the end-users do not increase when demand rises. This means that the floating collection creates enough added capacity for the transportation system; the transport service can handle the increase in demand in the next three years.
- As expected in paragraph 3.2.2, the library collections contain a mixed amount of library materials from all libraries connected with the floating collections. The requirement that a library collection should contain more than 50% of its own materials is met for half of the libraries in this model.
- The expected unbalance in the number of library materials within the library collections as expected in paragraph 3.2.2 does not occur.

In order to decrease the negative effects of implementing the floating collection, a redistribution plan was put in place. The main conclusions from this Floating collection concept including the redistribution plan:

- The number of materials transported is higher than without the redistribution plan. The number of materials transported increase more than the current situation because of the increase in capacity needed for the redistribution plan.
- The average cycle time of the library materials is lower than without the redistribution plan, but it is unknown if these cycle times are desired by the involved stakeholders.
- The average waiting times are longer than without redistribution plan, but do not increase significantly like in the years 2012 and 2013 in the current situation. Question is again if the increase of the waiting times is acceptable when increasing the capacity of the transport service.
- The amount of own materials within the collection of a library, on average, does not drop below 50%. The stakeholder requirements are met.
- As without the redistribution plan, the balance in number of materials is in balance.

The impact on the key performance indicators are assessed in paragraph 5.2. A summary is given below:

Costs:

The evaluation on costs has been assessed based on the difference between number of transported materials within the alternatives in percentages. While designing the redistribution plan, a choice is made to increase the capacity. This is not conform the stakeholders' needs or requirements, but is tested to create preliminary results on the redistribution plan. The conclusion is that after implementing the floating collection concept including the redistribution plan, the PSO should manage the capacity

closely. The results show that in year 2012, the extra capacity is needed. So, the immediate need for extra capacity is not required. This gives the transport service of the PSO some room to grow into the expected increase of demand.

Service:

Evaluating the service towards the end-user is done based on the average waiting times. Assessing the results show a positive result for the waiting times after implementation of the floating collection. Even after implementing the redistribution plan into the floating collection concept, the waiting times are not longer than accepted.

Capacity:

The capacity of library shelves proved to be of no concern within this project. The redistribution plan in this project does not rebalance the number of materials within the local library collections, but minor changes in the model would enable this option to be available when needed. The mixture of materials within the library collections did create issues like expected. With the implementation of the redistribution plan, these issues were solved.

5.2 CONCLUSIONS AND RECOMMENDATIONS

In this paragraph an answer is given on the main research question:

- o Does implementing a floating collection in the public library sector in the Netherlands improve the transportation service of interlibrary loan considering the expected growth in demand and limited budget for the interlibrary loan service in the future?

The answer to this question is given in three parts. First, an answer is given whether the Dutch library sector is suitable for a floating collection concept. Second, an answer is given if the floating collection concept improves the distribution of interlibrary loan materials in terms of costs and third, if the floating collection can handle the expected growth of ILL in the future.

There are several reasons to call the library sector in the Netherlands unsuitable for implementation of the floating collection. This sector involves many stakeholders with the same goals and ambitions towards the end-user but with different ideas on how to reach these goals. The history of the library sector in the Netherlands tells a story of local origination of libraries that in the years have grown to large organizations on a provincial level. Library organizations tend to work together with a central organization that supports these libraries on a provincial level, the Provincial Service Organization (PSO). The focus of the future is a national organization and one national library collection (the *Collectie Nederland*). But this point is far beyond reach. The library sector has just started organizing institutions on a national level (VOB, SIOB, BNL and the SPN) and is at the start of becoming organized on this level playing field. Implementing a floating collection at this stage in the setup of a national organization might be too early. A better moment to consider implementation is after a successful introduction of the digital national library collection (NBC) and if the "Collectie Nederland" is in sight. In the meantime, the floating collection concept can be tested

in practice on a lower level. Based on the development of the provincial services managed on the provincial level, the PSOs are suitable to start testing floating collections in practice.

In terms of costs, the results from this project are limited like stated earlier (see 6.1). The focus of this project is to keep the costs at the same level due the budget cuts enforced in the public library sector. However, with solving the expected issues perceived by the stakeholders and to keep the stakeholder satisfied, extra capacity is needed to implement the floating collection in the coming three years. The capacity is increased in all years during the simulation runs, but as mentioned earlier; the capacity does not need to be increased before year 2012. One could argue that with no implementation of the floating collection concept, the capacity of the current system is absolutely not sufficient which is proved by simulation. When deciding not to implement such a system, other measures must be taken to limit the increase in demand. Other measures could be to limit the use of ILL to prevent the demand for transportation to rise to the expected levels by charging the use of ILL or to promote new and innovative digital alternatives to offer materials to end-users without the need to physically transport the requested materials.

In terms of growth in demand, the implementation of a floating collection does handle the increase of transportation needed without the necessity of increasing the capacity and therefore the need to invest in resources. However, keeping the stakeholders satisfied means that extra capacity is needed to overcome the increase in demand in order to ensure the waiting times of the end-users to remain on the same level as in the current situation.

5.3 EVALUATION OF IMPLEMENTING A FLOATING COLLECTION

Next to the abovementioned questions focusing on evaluation of implementing a floating collection in the Netherlands, the next questions are focused on the applicability of the tools and research performed during this project.

1. Can the floating collection concept be implemented in other sectors than the library sector?

During this project, research is done in two other sectors that experience similar issues to the issues perceived by the stakeholders after implementing a floating collection concept. These sectors are maritime container sector and car rental sector. These sectors have similar issues but these sectors already handle "floating collections". To answer this question, one must look at similar circumstances to the library sector in the Netherlands. The main characteristics that shape the difficulties of implementation in the Netherlands are:

1. Several individual collections, not owned by one stakeholder
If one collection existed among several locations, like seen in the other sectors discussed in this project, a lot of difficulties would not exist
2. The individual collection consists of unique items
3. The stakeholders lend materials to each other

The reason for lending out the materials in the library sector is based on good will and not for profit reasons. In the cases used in this project, the cost reduction is performed for profit maximization

4. Transportation flows between these individual collections
5. The library sector is a Publicly funded sector
This sector is not profit driven

Finding a sector with similar characteristics is complicated. One could conclude that this sector and the ILL within this sector are unique and that the solutions presented in this report are specially adapted for the library sector in the Netherlands. This makes easy application in other sectors difficult. By looking at the two examples used in this project the characteristics do not match. For both examples, the only characteristics that match are characteristic 4 and less characteristic 3. Number 3 entails that individual collections lend materials to each other, which in the two examples is not really the case. In franchises, this might happen, but probably still is managed through direct orders from headquarters.

This project can easily apply for other library sectors in other countries with similar characteristics as in the Netherlands. The results in this project should be evaluated before investigating the possibilities in these countries.

2. Can the model designed in this project be applied in other fields?

Following from the question answered above regarding implementation of a floating collection in other fields than the library sector, if such a sector would be identified, it might be possible to use the same simulation model to explore the first results of implementing a floating collection.

When looking at other library sectors, the model can be used to assess the performance of their distribution networks. In this case not only foreign library sectors could be evaluated but also smaller library organizations here in the Netherlands who might decide to implement a floating collection on a local scale. For example, a library organization with several library locations.

The model used in this project is an exploratory model which entails that its purpose is to create generic results. This makes it easier to adapt such a model to other cases like mentioned above.

3. What can be learned from the results from this project that can be used in other sectors?

The results from the simulation runs could be used in other sectors that decide to investigate the possibilities in implementing the floating collection concept. Like mentioned before, the characteristics of these other sectors need to be similar in order to validate the results from this project.

The results after implementing a floating collection without redistribution plan show how such a system could react to an implementation. Special results include the shift of materials from different owners within the local collections. It is shown that the materials shift in the same distribution as the distribution in demand. The distribution in demand is assumed similar to the distribution of collections between the locations.

This means that the smaller locations with smaller collections lose their own materials in exchange for a bigger share of materials originating from the locations with much bigger collections. The bigger locations experience the opposite effect, making this result significant for all sectors.

The results of unbalancing the number of materials within the local collections in this project were limited due to the abovementioned similarity in distribution of demand and size of local collections. In this project this distribution is assumed similar, but in the real world this is highly unlikely. After test runs, it showed that tampering with the distribution functions resulted in an unbalance in number of materials of the local collections. Significant results on the balance of number of materials can only be obtained by testing in practice. When this phenomenon does occur in practice, a redistribution plan would be sufficient to balance the collections.

4. What is learned from the use of the research approach within this project?

In the introduction of this project a choice has been made to use the systems engineering approach SIMILAR from Bahill and Gissing. Arguments were set out why the SIMILAR approach should fit within the objective of this project and why this approach would enable the answering of the research questions. The question here is what is learned from using the selection of this approach and what can be done better in future research using this approach.

The main focus of Bahill and Gissing was the continuous feedback of the project steps on the needs and requirements of stakeholders. Within this project an extensive stakeholder analysis was performed resulting in the needs and requirements. However, these needs and requirements are a capture of the moment. A more dynamic stakeholder involvement would improve the feedback during the project steps and therefore the use of SIMILAR. During this project it was difficult to involve the stakeholders directly, but for future research it is advised to do so.

The combination of the requirements discovery process and system design process by Bahill and Gissing within SIMILAR is used with success in this project. The link between the library sector analysis and system analysis resulting in the complete system requirements forming the input for the design phase of the project is conducted with ease. Using the steps designed by Bahill enabled this project to focus on these discovery processes before starting the design phase. Once the requirements were identified the design phase could be started with complete knowledge of the system.

To conclude, using a systems engineering approach within this project was needed and made this project to a success. The many stakeholders involved and the various disciplines used in this project required a holistic approach which enabled a complete overview after every step of the project. After every step, the match with the stakeholders was sought and when in line, the project could proceed. Using only four steps in the SIMILAR approach disabled the real life implementation, but as a preliminary study into implementing a floating collection concept in the public library sector in the Netherlands the SIMILAR method was very useful.

6.4 LIMITATIONS OF THE PROJECT

Some limitations have influenced the results and outcome of this project and these limitations are discussed in this paragraph. Some input and information are based on assumptions and selections of data from the field (see Appendix N). These assumptions have effect on the quality and the effectiveness of the simulation model used in this report. However, the model can be adapted and upgraded by using more data and information from the field.

There are limitations based on the number of sources used from the library sector. Several interviews were held with different stakeholders, but the network of the Dutch library sector is so complex and large that more information from more different stakeholders will improve the quality and judgment of the results presented in this report. This project was not initiated by the Stichting PSO Nederland and no budget or investment from their side was needed to complete this project. This meant that the commitment of several stakeholders during this project can be improved.

6.5 RECOMMENDATIONS FOR THE FUTURE OF INTER-LIBRARY LOAN IN THE NETHERLANDS

In this paragraph, recommendations addressing the Stichting PSO Nederland are made. The recommendations contain recommendations based on necessary further research to create more insight in relevant steps in the implementation process of the floating collection concept.

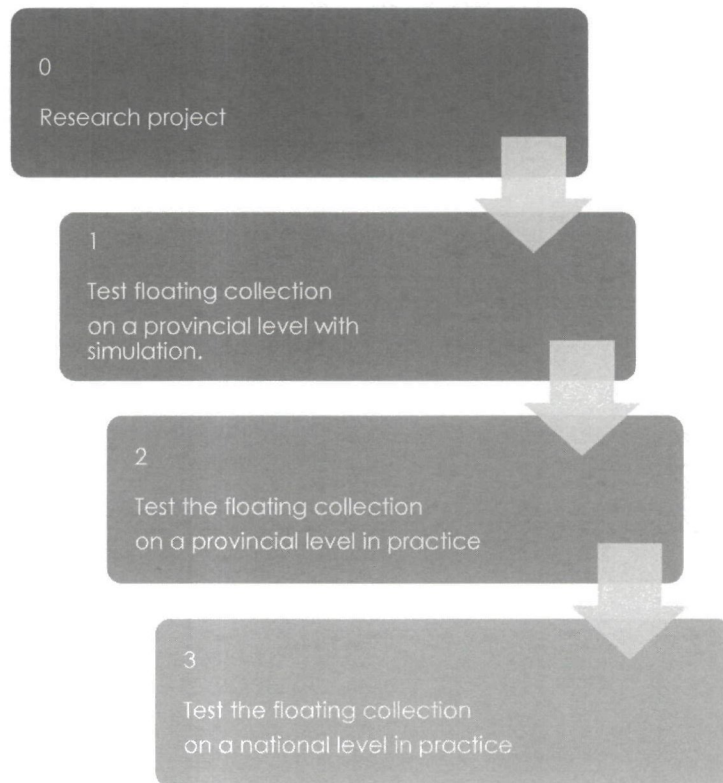
Recommendations for further research

To obtain more detailed information and increase the quality of the knowledge of the library sector relevant to the implementation of a floating collection, a research team should be setup. This research team should research the following:

- Use the Collaborative Business Engineering approach to setup the research. This approach will include all involved stakeholders in the project actively. By the use of interactive workshops, all involved stakeholders will participate in the research and the communication will be intense. Only by including the involved stakeholders actively in the process the future implementation will be a success. Members in this team should be the following stakeholders:
 - The SPN
 - All the PSOs (11x)
 - All Plus Libraries (14x)
 - A delegate from the VOB who will speak on behalf of the Library Organizations
 - A delegate from the VNG
 - A delegate from the SIOB
 - A delegate from the BNL
- With new information obtained the simulation model could be upgraded for more libraries and eventually more PSOs.

- The model should play a central role in further research. This includes clear and transparent communication about the model and the input variables should be validated using information from the field
- More successful implementations of the floating collection concept within other library organization in other nations should be investigated. Focusing on lessons learned and the advantages and cutbacks from methods used should give high quality insight in the process steps of implementing a floating collection concept in the field.
- More research in the development of a redistribution plan within the case of the Dutch library sector is needed. Focus areas of research should be dynamic redistribution. Dynamic in the sense that the moment and volume of the redistribution should be investigated in relation to the actual need for redistribution at that time in the process and the available capacity in the trucks at that given moment.
- Research into separating the redistribution flows from the regular ILL flows could improve the redistribution plan. Research is needed in using special resources for redistributing the materials next the regular transportation or giving the regular ILL materials priority over the redistribution flows.
- The possibilities of lessons learned from other sectors in developing a redistribution plan should be further investigated. From analysis in this project it became clear that the algorithms used in the private sector could be adapted in the library sector by redefining the algorithms to fit this case. These algorithms have not been adapted to this exploratory research but these models are sophisticated and have high potential in optimizing the redistribution based on a number of constraints, for example, minimizing costs.
- Alternative options not mentioned in this project to minimize the costs of ILL and to be prepared for the future growth of the demand for ILL could be investigated. Alternative options, discovered during the process of this project are distribution of ILL from one central location using a central storage and logistical operations.
- The future of the service of ILL should be investigated and assessed. Questions that need to be answered:
 - Is ILL needed in the future?
 - What time frame? 5-10 years?
 - After a successful digitalization of library materials, will there be a necessity for transporting library materials?
 - What is the potential of e-readers and printing on demand in respect to ILL?

Next steps of successful implementation



Will Dutch Libraries Float? Conclusions and Recommendations

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GLOSSARY

ILL	Interlibrary loan. This is the term that entails the lending of library materials between libraries
IBL	Interbibliothecair leenvervoer; Interlibrary loan crossing the borders of the provincial service areas
OBL	Onderling bibliothecair leenvervoer; Interlibrary loan transported within one provincial service area
NBC	Nationale Bibliotheek Catalogues; National library catalogue that will be introduced at the end of this year
Plus Libraries	Larger library organizations with additional educational tasks. The collections of the Plus Libraries are larger and contain more educational materials than library organizations. There are 14 Plus Libraries in the Netherlands and are located in the larger cities of the Netherlands
LO	Library organization (<i>Basis Bibliotheek</i>); an organization of libraries (originally within one municipality) with several library locations that owns and operates one central collection of library materials. There are approximately 171 (2009) library organizations
LL	Library location; A library that is part of a library organization. There are approximately 1031 (2009) library locations
SPN	Stichting PSO Nederland; National Collaboration of PSOs in the Netherlands
PSO	Provincial service organizations that support libraries within a provincial service area. The focus in this project is the support in ICT operations and the transportation of interlibrary loan materials within the network of libraries
BNL	Stichting Bibliotheek.nl; The national organization that is responsible for designing the digital innovation of the library sector
SIOW	Sectorinstituut openbare bibliotheken; the sector organization of the library sector. The main tasks are to implement policy from the Ministry of OCW
VOB	Vereniging van Openbare Bibliotheken; the national association of public libraries in the Netherlands. The VOB represent all the library organizations in the Netherlands
OCW	The ministry of Education, Culture and Science of the Netherlands
VNG	the association of Dutch municipalities

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APPENDICES



FIGURE 1: THE GOAL MEANS DIAGRAM OF THE STICHTING PSO NEDERLAND

A description of the diagram is given on the next page.

To combine the objectives of the problem owner, the Stichting PSO Nederland, and the means of the SPN to influence the situation, a means-end objective network is made in this appendix. The diagram in this analysis links the means of the SPN with the corresponding objectives. The means that lead to achieving an objective are identified and schematically illustrated in the diagram. The diagram is usually used for two different reasons. The first reason is to use the diagram as a tool to scope the problem area and to choose the appropriate objective level of the project. The second reason for analyzing the objectives and means of the problem owner using this tool is to be able to reason the objectives schematically in relation to the means and to create a wide range of strategies and resources that could contribute to the realization of the objectives [21]. Conclusions from means-ends objectives network:

- The higher goals in the diagram are of the collaboration of PSOs, the Stichting PSO Nederland and the means at the bottom of the scheme belong to the individual PSOs. The means are at operational level and the goals in the upper area are more strategic level.
- The goals are split in serving the libraries with services and products to support the libraries in products that benefit from scaling and in the collaboration goals that can make the body of all the PSOs stronger. The split in goals is noteworthy because the difference in goals is clear. The individual PSO is focused within their area and transportation service and the SPN is focused on sharing the knowledge between the PSOs. The task of the SPN is to communicate the benefits of knowledge and skill sharing to the individual PSOs. Otherwise the PSO does not see the gain and does not collaborate in the way the SPN desires necessary (11).
- Presented in the diagram are the services of importance in this study, the ICT service and the logistical service. The correlation is clear; the ICT system houses the digital cataloging of the materials and the order systems so that the end-user can order materials from outside their own library. When looking on a national level, this ICT system should be compatible with all the provinces. At the moment the ICT systems of several provinces differ from others. The most common ICT system that is used is the BICAT system (9).
- Several means are identified that at the moment are not used and therefore the goals are not met. There are three means that focus on forecasting transportation volume. Forecasting is not done at the moment and could increase the knowledge of the PSOs in order to improve the logistics service. It has to be noted that there are two different type of forecasting identified. The forecasting of the material that is transported within the province and on the other hand the material that comes from outside the province, the national transport from the NBD and the IBL (10).
- The task of the PSO is to collaborate with the library organizations, the "client" of the PSO. It is they who the serve and make SLAs (service level agreements) with. If new policy is set on a national level, it is the task of the individual PSO to communicate the changes to the library level. If they do not do this in a right way, the libraries might not cooperate in the way they would want it (9).

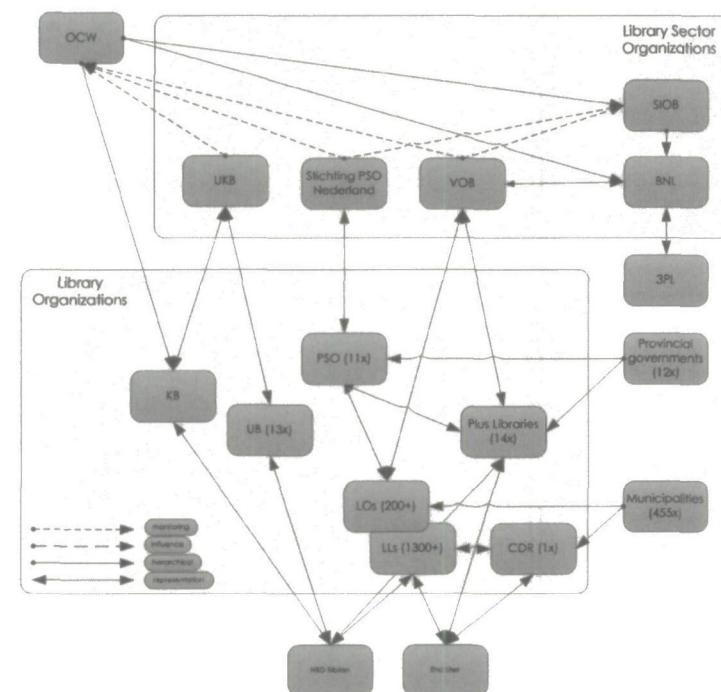


FIGURE 2: THE FORMAL CHART OF THE LIBRARY SECTOR INVOLVING INTERLIBRARY LOAN

All relationships and (inter-)connections between stakeholders have formal and informal sides. Knowledge about both sides is needed to understand the stakeholders and their environment. The formal map is a mean for orientation in that sense. Obvious to say that law and regulations have a major impact on the network of stakeholders and therefore these are identified and the impacts of the law and regulations are determined and analyzed.

Formal positions

The formal positions of the stakeholders are subdivided in three segments. First the library sector organizations are identified. These associations are advocacy organizations for their members. The important sector organizations are the problem owner, the Stichting PSO Nederland (SPO), representing all the PSOs in the Netherlands; the Vereniging van Openbare Bibliotheken (VOB), the association of all affiliated public libraries that is a member of the VOB; and the Sectorinstituut Openbare Bibliotheken (SIOB), the organization which is a policy extension of the ministry of OCW. The Stichting Bibliotheek.nl (BNL) is a sector organization that is run

individually with individual tasks but is monitored by both the VOB and the SIOB which take part in the advisory board of the BNL.

The second identified segment is the library organizations. In this segment all the different library organizations that are directly involved with libraries are classified. These include the basic libraries, the Plus libraries the PSO's and the scientific libraries.

The third segment is the external parties that have relationships with the former two segments. These include the governmental organizations, the private organizations and the end-users.

Mutual relationships

Specifying the relationships between the involved stakeholders starts with the SPN. The SPN plays a central role in the network of stakeholders that are involved with the distribution of materials between the libraries. All the PSOs in the Netherlands are member of the SPN and the SPN is a lobbyist for the PSOs towards the national government and the SIOB. The individual PSOs are the organizations that organize the transport service to all the affiliated libraries, this including the library organizations (LOs) and the Plus Libraries in their region. The individual PSOs are rewarded subsidy from the provincial governments in their region and are held accountable for certain guidelines set by the provincial governments under provincial cultural policy. The municipalities also use cultural policy to grant libraries in their region with subsidy. These grants go directly to the library organizations and the library organizations determine final destinations for subsidies among their library locations (LLs).

The ministry of OCW provides subsidy to the library sector via their sector institute, the SIOB. The ministry sets policy guidelines for the national library policy and the policy is executed by the SIOB. The SIOB also has a seat in the advisory board of the BNL is where the digital library policy is executed on a national scale. From BNL the NBC is organized and promoted as the projects that improves the national distribution of materials between libraries.

The end-users mostly visit the different libraries to lend their materials. The assumption is made that end-users go to the nearest library from their home or work location.

Law and regulations

The most important regulation that influences this project is the Bibliotheekcharter 2010-2012 [30]. In this charter the role allocation of the different organizations that are involved in the library sector innovation is set up and agreed by the important stakeholders in the network. The role allocation gives all the organizations their tasks and responsibilities within the network.

		support function to maintain, develop and promote. This would contribute to the Plus Libraries a national library and information network (48).		
Library Organization	Cheaper transportation of IBL from Plus Libraries; A good and fast OLV network of the PSO transport service	The LO offers the dynamic society free access to information, knowledge and culture for all by providing high quality library services to education, participation, meeting and cultural experience (49).	The use of PostNL to transport the IBL materials from and to the Plus Library is too costly	Lack of a cost efficient transportation network for IBL; the use of PostNL is expensive
Library Location	A fast and cheap logistical network to exchange materials with libraries	A good and complete range of materials to offer their users. This includes materials from the city, province or national	The IBL service lead times are long; The OLV lead times could be shorter	Lack of a cost efficient transportation network for IBL; the use of PostNL is expensive
Governmental Organizations				
Municipalities	Good use of municipality funds put in the libraries to achieve to (abstract) goals set by the municipalities; Interest in a good functioning of the library sector to enhance cultural development in region	Responsible for the executive work of the physical library and the local component of the national digital library, for local networks and the connection with provincial and national networks (30)	The libraries have to achieve their duties with less funding than in the past	Due to budget cuts, the municipality has pass on cuts in the grants of libraries

Provincial Governments	Good use of provincial funds put in the PSOs to achieve to (abstract) goals set by the provincial government; Interest in a good functioning of the library sector to enhance cultural development in region	Responsible for the support of the executive work of the plus library, for the provincial network, for the connection to the national network and the implementation of the national digital library (30)	The libraries have to achieve their duties with less funding than in the past	Due to budget cuts, the provincial government has pass on cuts in the grants of libraries
Ministry OC&W	Is responsible for the design of a national library network, build up by local and provincial networks, part of this is the national digital infrastructure; Interest in a good functioning of the library sector to enhance cultural development in region	Has a system responsibility for the public library sector and for giving the SIOB assignments in implementing these responsibilities (30)		
Private Organizations				
3PL's (PostNL)	In offering service to PSOs/LO to transport materials to and from libraries	To make a profit in offering services to parties that need distribution services in order to maintain continuity in business	TNT Innight is involved in the Pilot Distribution BNL	Their involvement is because of their Innight service
NBD Biblion	Have no interest in taking the national distribution of materials on their distribution of new materials	The NBD is a non-profit company that tries optimize the course of materials in the libraries by delivering materials for lending purposes to libraries (50)		

CB	Might have interest to include the distribution of Public libraries in their system	To be the biggest logistical service provider concerning materials in the Netherlands (51).		
<i>Non organized interest groups</i>				
End-user (sub-groups)	In having their material the desire for as cheap and as fast as possible available	To read materials and have the materials they desire available at their library around the corner	Having to request certain materials, one must order them at the library most of the time and have to wait up to a couple of days before their material arrives at the requested destination	The current ICT system and distribution system organized in the Netherlands

Stakeholder	Resources	Substitutability	Dependency on Stakeholder	Critical Stakeholder
<i>Library Organizations</i>				
<i>National</i>				
SPN	Joined forces; Lobby	irreplaceable	Major	Yes
VOB	Joined forces; Lobby; vote in BNL	irreplaceable	Moderate	No
BNL	Knowledge and expertise of NBC	irreplaceable	Major	No
SIQB	Extended formal powers; vote in BNL	irreplaceable	Moderate	No
CDR	Participation in distribution	irreplaceable	Major	No
UKB	Joined forces; Lobby; collection of (WSF) materials	irreplaceable	Low	No
<i>Local</i>				
PSO	Vote in SPN; collection of materials; Knowledge and expertise of distribution	irreplaceable	Major	Yes
Plus Libraries (CG Library)	Participation in distribution; collection of (WSF) materials	irreplaceable	Major	Yes
LOs	Participation in distribution; collection of materials	replaceable	Major	Yes
Library Locations	collection of materials	replaceable	High	Yes
<i>Governmental Organizations</i>				
Municipalities	Formal powers; financial	irreplaceable (within	High	Yes

Provincial Governments	resources Formal powers; financial resources	term) Irreplaceable (within term)	High	Yes
Ministry OC&W	Formal powers in SIOB; financial resources	Irreplaceable (within term)	High	No
Private Organizations				
3PL's (e.g. PostNL)	Advanced distribution networks and systems; Knowledge and expertise of distribution	replaceable	Moderate	No
NBD Biblion	Advanced distribution networks and systems; Knowledge and expertise of distribution	replaceable	Moderate	No
CB	Advanced distribution networks and systems; Knowledge and expertise of distribution	replaceable	Low	No
Non organized interest groups				
End-user (sub-groups)	Filing complaints; Lending materials; membership library	replaceable	Moderate	No

Kostenbesparing en kortere doorlooptijd

Het doel van de pilot Distributie is om de kosten van het interprovinciaal transport tussen bibliotheken te verlagen en de doorlooptijd van het landelijk transport te versnellen.

Met de pilot distributie wordt het gecombineerde gebruik getest van de provinciale distributienetwerken en nachtdistributie voor het vervoer van boeken (interbibliotheecair leenverkeer) en cd's (Centrale Discotheek Rotterdam) over provinciale grenzen heen. Per zending wordt tijdens de pilot een zeer gunstig tarief gerekend, dat in elk geval fors lager zal liggen dan de standaard portokosten voor het verzenden van een boek (€ 6,-).

Tijdens de pilot krijgen basisbibliotheken IBL-leveringen aangeboden door het provinciaal transport. Retourzendingen kunnen door basisbibliotheken gewoon weer worden meegeven met het provinciaal transport. Dat is gemakkelijk en het levert lagere kosten op. De pilot distributie wordt in opdracht van Stichting Bibliotheek.nl ontwikkeld. De pilot gaat op 7 maart 2011 van start.

Achtergrond

Plusbibliotheken versturen jaarlijks veel boeken in het kader van het Interbibliotheecair Leenverkeer (IBL) per TNT post naar basisbibliotheken. Basisbibliotheken sturen deze boeken weer retour per TNT post. De kosten die hiermee gepaard gaan zijn al jaren onderwerp van discussie. Centrale Discotheek Rotterdam is eveneens een van de leveranciers die gebruik maakt van de landelijke pilot Distributie. Leners kunnen op de gebruikelijke manier cd's lenen via de dienst Aanvragen binnen hun bibliotheekstelsel. Zodra CDR als leverancier gaat optreden kunnen leners dankzij de pilot Distributie eerder over de gevraagde cd's beschikken dan voorheen. Ook retourneren via de pilot Distributie zorgt ervoor dat de Cd's weer sneller beschikbaar zijn. Overigens is de verwachting dat met de komst van de Nationale Bibliotheekcatalogus (NBC) het gebruik van collecties over de provinciegrenzen heen zal toenemen. Goedkoop en snel interprovinciaal transport wordt daarmee noodzakelijk.

Doelstellingen

- Reduceren van de transportkosten voor interprovinciaal leenverkeer in de pilot. Na de pilot komen deze kosten nog lager te liggen. De kosten voor de CDR mogen niet hoger worden dan de huidige kosten.
- Versnellen van interprovinciaal leenverkeer (t.o.v. landelijk NBD-transport) naar 2 tot 7 dagen.
- Inzicht krijgen in volume, doorlooptijd en kosten interprovinciaal leenverkeer

Uitvoering

Tijdens de pilot bezoeken de PSO's vijf keer per week de deelnemende Plusbibliotheken en de CDR. Aan het einde van de middag zetten de PSO's de boeken en cd's die naar de andere provincies getransporteerd moeten worden klaar voor TNT Innight. TNT Innight brengt alles naar haar sorteercentrum in Nieuwegein en sorteert daar alles uit. 's Nachts wordt alles weer getransporteerd

naar de PSO's. Deze zendingen kunnen door de PSO's weer meegenomen worden in de routes van de vervoersdienst.

Heenzending aan Basis Bibliotheek

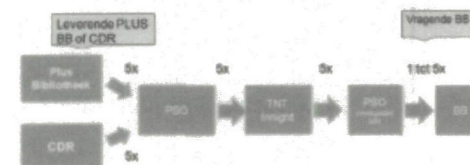


FIGURE 3: TRANSPORT FLOWS IN THE PILOT DISTRIBUTIE

De retourzending verloopt volgens in omgekeerde volgorde. De basisbibliotheek stuurt het boek retour via het regulier transport van haar eigen PSO. TNT Innight haalt het hier op en levert het af bij de PSO van de Plusbibliotheek. Deze levert het boek uiteindelijk af bij de Plusbibliotheek.

Mijlpalen

18 oktober 2010	Start nulmeting bij deelnemende Plusbibliotheken
1 november 2010	Start acceptatietest wijzigingen CBS van Plusbibliotheken
1 maart 2011	Start pilot
31 augustus 2011	Einde pilot
30 september 2011	Besluitvorming over vervolg pilot

Na het einde van de pilot zal de distributiewijze van de pilot worden gehandhaafd, totdat een besluit is genomen over het vervolg. Hiervoor worden afspraken gemaakt met de deelnemers.

Appendix 1: The Causal Relationship Diagram of the IL System in the Netherlands

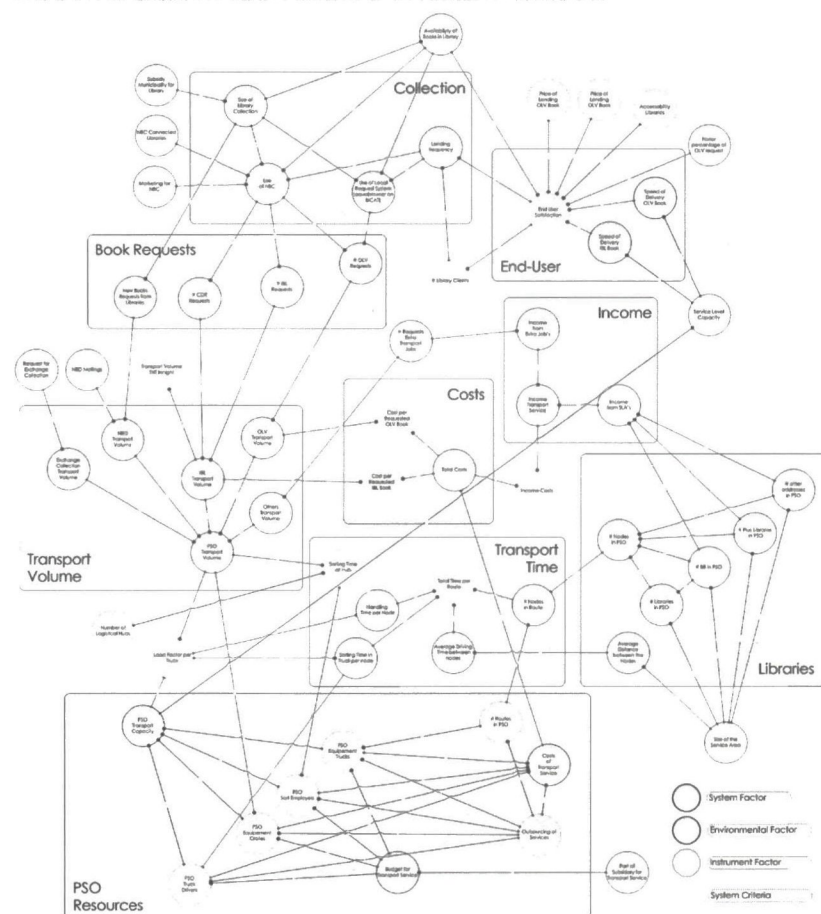


FIGURE 4: CAUSAL RELATIONSHIP DIAGRAM OF THE ILL SYSTEM IN THE NETHERLANDS

The causal relationship diagram is built up out of several elements. The system factors being the circles and the relationships between these factors being the arrows. The arrows have only one direction and stand for the causal relationship between two factors. The arrow has a negative or a positive causal relationship with an element. If one factor increases, a positive relationship increases the factor connected with a positive arrow.

Within the system of ILL, several sub systems are identified. The subsystems are enclosed by the dotted boxes. The factors are categorized: some factors have a special function in respect to the problem owner of this project, the Stichting PSO Nederland. There are environmental factors which are factors that the SPN cannot influence and are dependent on. Instrument factors are to be influenced by the SPN and can be used by the SPN to influence the system in its liking. The identified system criteria are the output factors of the system and are the factors which measure the performance of the ILL system.

Like stated in 2.4.1., there are several loops to be identified within the ILL system. Closed loops in a causal relationship diagram are of interest when modeling a system using this method because of the behavior of a loop. A loop can either have a positive effect, which means that a loop continues to increase once one factor is increased. This effect could either be wanted or unwanted. Negative loops also exist. The most important loops are discussed in 2.4.1.

The methods and techniques used in this paragraph are derived from the Road Maps to learning System Dynamics from MIT (28).

APPENDIX G: C. SPONNAER

During the course of this project a questionnaire was designed in order to gain insight in the interlibrary loan system in the Netherlands. The questionnaire is designed in Dutch and contains basic questions concerning the definition of ILL and the ILL material. Next to the basic questions, additional questions are raised focusing on future concepts within the organization of ILL. The complete list of concepts within the questionnaire is not used in the project. Within the project a clear focus is set on the floating collection concept.

The feedback of the questionnaire is used in paragraph 2.3 and 3.2. The opinions of the employees that received the questionnaire are important input in the SWOT analyses on the current ILL organization and the floating collection concept. The perceived issues that arise from implementing a floating collection within the library sector are come forth from these questionnaires.

Interbibliothecair Leenverkeer Vragenlijst - Feedback

Afstudeeronderzoek Nick van der Noordaa van de TU Delft
naar de IBL Distributie in het kader van de Pilot Distributie

Deze vragenlijst is gemaakt naar aanleiding van de geplande workshop op 9 maart 2011 in het kader van het afstudeeronderzoek van Nick van der Noordaa van de TU Delft. De geplande workshop is deel van het afstudeeronderzoek van mij dat is gestart in het kader van de Pilot Distributie van Interbibliothecair leenverkeer (IBL). De pilot is op 7 maart van start gegaan. Alle genodigden voor deze workshop ontvangen deze vragenlijst en aan allen wordt vriendelijk verzocht om het in te vullen naar eigen mening en expertise en het te retourneren. De vragen die in deze vragenlijst staan zouden tijdens de eerste workshop worden behandeld. Omdat de workshop van 9 maart niet door kon gaan, is deze vragenlijst opgesteld. De input van de betrokkenen in dit onderzoek is van groot belang voor het realiseren van realistische en significante resultaten.

- Deze vragenlijst zal:
 - dieper ingaan op het onderzoek
 - per vraag een toelichting geven over de context

INHOUD VAN DE BESTEL-ONDERZOEK

Mijn onderzoek is gestart na aanleiding van het starten van de Pilot Distributie. Ik heb samen met Ronald Spanier een opdracht opgesteld die de distributie van media binnen de provinciegrenzen zal onderzoeken. Mijn aanpak is een zogenaamde "bottom-up" benadering. Na de distributie binnen de provincie grenzen te hebben onderzocht zal ik mijn resultaten generaliseren op alle provinciale gebieden en het onderzoek op het landelijk niveau doortrekken.

Het interessante van deze tweede stap is dat er naast logistieke concepten in deze stap meer focus is op mogelijke dienstverleningconcepten op landelijk niveau. Belangrijk hierbij is het 'out-of-the-box' denken. Ik heb vanuit mijn opleiding Technische Bestuurskunde in Delft een werkwijze aangenomen waarbij samenwerking met alle betrokken partijen een cruciaal onderdeel van mijn onderzoek vormt. Omdat er veel verschillende partijen betrokken zijn bij de distributie, zowel op provinciaal als op landelijk niveau, ben ik van plan om deze partijen mee te laten denken in mijn onderzoek. Dit kan tot andere concepten leiden die anders dan de huidige zijn.

Het meest belangrijke element van mijn onderzoek is de lectrur dat door bibliotheken onderling wordt uitgewisseld, het IBL verkeer. Door het creëren van de NBC wordt verwacht dat het IBL verkeer zal toenemen. In mijn onderzoek is het van groot belang om een goede definitie te bepalen van het begrip IBL-boek. Wat is precies een IBL boek en waarom is het een IBL boek? In de workshop wilde ik een korte brainstorm organiseren waarbij een hoop ideeën over de definitie van het IBL boek boven tafel zouden komen. Ik zou graag alsnog deze input van u willen ontvangen in onderstaande tekstblok. Met deze input zou ik een betere categorisatie kunnen maken van het IBL boek.

Els Boon – Bibliotheek Drachten

Een IBL boek is een boek dat tussen bibliotheken onderling getransporteerd wordt met het doel uitgeleend te worden aan een lezer van een bibliotheek die zelf niet in het bezit is van deze titel.

In principe zijn dit alle boeken (en ook andere media) die binnen Nederland aanwezig zijn in alle bibliotheken maar er zijn (delen van) collecties die niet uitgeleend worden maar slechts ter inzage aangeboden worden. Boeken uit die collecties zullen vanzelfsprekend geen IBL boeken worden.

Willy Karel – Bibliotheek Eindhoven

IBL staat voor Interbibliothecair leenverkeer.

Een IBL boek is daarom een boek/ of ander materiaal zoals cd, Dvd, etc. wat aan ander bibliotheken buiten de eigen organisatie wordt uitgeleend.

De bibliotheek bepaalt welke materialen voor Ibl ter beschikking worden gesteld. Zo kunnen zogenaamde sprinters of titels die recenter zijn dan 3 maanden, door een bibliotheek uitgesloten worden voor IBL.

Rob Kleingeld – Mijn Eigen Bibliotheek

Een IBL-boek is een boek dat door bibliotheek X naar bibliotheek Y wordt verzonden omdat Y het niet in de eigen collectie heeft, er binnen Y wel vraag naar is, en X geen bezwaar heeft het tijdelijk af te staan. Dit houdt in dat elk boek in principe een IBL-boek is of kan worden. In principe, want in de praktijk is er wel enig onderscheid te maken.

Relaties met de hoeveelheid uitleningen per jaar of de populariteit van een boek zijn er in die zin, dat hoe meer vraag er is naar een bepaalde titel (dus hoe populairder hij is), des te groter de kans is dat die titel in elke bibliotheek aanwezig is en dus niet gauw via IBL aangevraagd hoeft te worden.

Voorbeeld: 'Komt een vrouw bij de dokter' van Kluun zal niet gauw via IBL aangevraagd hoeven worden, omdat die titel in vrijwel elke bibliotheek aanwezig zal zijn. 'Van tufsteen tot spitsboog' (over de Petrus- en Pauluskerk in Loppersum) is wel een typisch voorbeeld van een IBL-boek, omdat van zo'n titel niet verwacht mag worden dat die tot de eerste aanschafkeus van de meeste bibliotheken behoort, en er toch (incidenteel) vraag naar zal zijn.

Fred Kolman – OBA

Een IBL boek – het lijkt me beter om de term IBL titel te gebruiken – is een titel die door de ene bibliotheek (vragende bibliotheek) wordt aangevraagd bij een andere bibliotheek (leverende bibliotheek). IBL titels worden verzonden per (intern)transport of de post; in een enkel geval per mail als het een elektronische publicatie betreft.

In principe zou elke titel die in een uitleencollectie staat een IBL boek kunnen zijn. Vaak heeft het helemaal niets met populariteit te maken, maar juist met het feit dat de titel zeldzaam is (long tail).

Rene van der Have – OBD

Een Inter Bibliothecair Leenverkeer (IBL)boek is **ek** boek dat wordt uitgeleend aan een **andere bibliotheek** in plaats van aan een ingeschreven eigen lener.

Sommigen maken onderscheid tussen OBL en IBL leenverkeer. Het OBL leenverkeer is dan het leenverkeer tussen bibliotheken die behoren tot hetzelfde netwerk met meerdere vestigingen in meerdere plaatsen. Het overige leenverkeer wordt dan aangeduid als IBL verkeer.

Overigens betreft het IBL niet alleen boeken maar ook andere materiaalsoorten zoals muziekcd, muziekdvd, dvd, cd-rom, bladmuziek, games, luisterboeken, daisy-roms.

In Nederland zijn er collecties die bedoeld zijn om vanuit efficiency overwegingen andere bibliotheken te ondersteunen met literatuur. Voor een deel zijn dit collecties waar het publiek geen rechtstreekse toegang toe heeft maar wel kan aanvragen mits hij/zij lid is van een andere bibliotheek. Het gevraagde wordt niet uitgeleend aan een persoon maar aan een bibliotheek waar het gevraagde kan worden afgehaald. Deze collecties worden vaak aangeduid als samenwerkingscollectie. Afhankelijk van het collectiedoel gaat het over het algemeen om minder populaire werken maar dat verschilt per samenwerkingsverband.

Lieke de Veer – Mijn Eigen Bibliotheek

Definitie:

Een IBL boek is een boek dat via het Inter Bibliothecair Leenverkeer (IBL) geleend wordt. Het boek komt dus uit een andere bibliotheekcollectie dan die waar de lener ingeschreven staat. In Groningen spreken we alleen van Inter Bibliothecair Leenverkeer als de aanvraag buiten de eigen organisatie (lees: provincie) gehonoreerd is. Bij openbare bibliotheken binnen de provincie spreken we van onderling leenverkeer (aanvragen en reserveringen)

Van het totaal aantal uitleningen in de provincie Groningen zal niet meer **dan 5% bestaan uit IBL** aanvragen, schat ik.

Wat betreft leveringen: in principe levert alleen de OB Groningen aan het landelijk IBL. Het gaat in feite om HBO+ materiaal. Populaire titels worden binnen de provinciegrenzen geleverd.

Zie WSF-IBL statistiek voor gedetailleerde info.

Het aantal IBL boek aanvragen (landelijk, inclusief UB-en etc) daalt jaarlijks met ongeveer 5%.

Heerenveen

Elk bibliotheekboek kan een IBL-boek zijn, tenzij de bibliotheek geen boeken uitleent aan andere bibliotheken of het boek een naslagexemplaar is (kwetsbaar, onmisbaar, te oud). Verder heeft een IBL-boek geen bijzondere kenmerken. IBL betekent volgens mij alleen maar dat het boek door de ene bibliotheek aan de andere uitgeleend wordt t.b.v. een lener van die bibliotheek.

Het aantal uitleningen speelt hierin geen rol, dat kan variëren van 1 tot vele tientallen. Hetzelfde geldt voor populariteit. Openbare bibliotheken hebben de populairste titels vaak zelf in de collectie; juist voor de minder gangbare titels valt men terug op de collecties van WSF of Universiteitsbibliotheken.

Friesland - Noordoost

IBL boek:

Een boek dat door de ene (universiteits)bibliotheek aan de andere bibliotheek uitgeleend wordt tbv van aanvraag klant..

Dit kan een populair boek zijn, het kan een specifieke titel zijn enz.

Grote en wetenschappelijke bibliotheken zijn vaak de leverende bibliotheken en de kleine bibliotheken de vragende bibliotheken.

Friesland Zuidwest

In principe kan het ieder boek zijn, dat niet in onze provinciale catalogus beschikbaar is.

Bart Linssen – Bibliotheek Maastricht

Materialen van bibliotheken die door een lid van een andere bibliotheek (of door een andere bibliotheek) worden aangevraagd

Je hebt het eigenlijk in de hele enquête over boeken. IBL is echter ook kopieën, avm, bladmuziek.

Hans Stakenburg - ProBiblio

Voor ons is een IBL boek een boek wat aangevraagd wordt bij de plus bibliotheek of Universiteit en/of hogeschool of ander soort instelling.(b.v. bedrijfsbibliotheek)

Het boek is dan ook vaak een gespecialiseerd boek.

Deze materialen worden landelijk aangeboden en verstuurd.

Merendeel van de aanvragen/reservering gaan via ons eigen netwerk (Bicat), deze reserveringen bedragen op dit moment zo'n 1.500.000 boeken

Wij noemen dit OBL Onderling (Bibliotheek) Leenverkeer.

Deze reservering blijven in ons werkgebied.

Dienstverlening - Inrichten M.B.I. IBL distributie

Als deel van mijn onderzoek zal ik dienstverleningsconcepten onderzoeken die betrekking hebben op het distribueren van IBL boeken in en tussen de provincies. Ik heb voor aanvang van de workshop al onderzoek gedaan naar verschillende soorten dienstverleningsconcepten en ik heb deze in de vragenlijst opgenomen. Er zijn concepten ingedeeld vanuit het perspectief van de bibliotheek en er zijn concepten die ingedeeld zijn vanuit het perspectief van de eindgebruiker. Ik heb per concept een korte toelichting gegeven om duidelijker te maken waaruit het concept bestaat en wat het doel van het concept is. Ik zou graag een zo gedetailleerd mogelijke reactie van u willen ontvangen per concept. Met uw commentaar en opmerkingen kan ik een meer gedegen onderzoek kunnen verrichten naar deze verschillende concepten en kan ik deze concepten beter evalueren op basis van toekomstige scenario's. Na commentaar te hebben gegeven op de verschillende dienstverleningsconcepten vraag ik u vervolgens om een top 3 van de meest haalbare concepten te maken en deze top 3 te onderbouwen.

Conclusies - Het IBL netwerk van de bibliotheek

3. IBL netwerk - Rollen vanuit het centraal punt

Het idee van dit concept is om de gecategoriseerde IBL boek centraal op te slaan in 1 of meerdere centrale punten. Het distribueren van het IBL boek zal vanuit dit centrale punt worden georganiseerd. Gebruikers kunnen aangeven dat ze een IBL boek willen lenen. Een order bij het centrale punt zal ervoor zorgen dat het boek binnen enkele dagen de bibliotheek of het uitgiftepunt naar wens zal bereiken. Dit concept zorgt ervoor dat de IBL boeken snel en goedkoop beschikbaar zijn voor het complete landelijke netwerk.

Will Dutch Libraries Floor? Appendices

Els Boon – Bibliotheek Drachten

Een slecht idee. De centrale punten bestaan al lang, dat zijn namelijk de bibliotheken. Ik denk niet dat het veel tijdswinst oplevert en er moet een speciale collectie aangelegd worden, wat altijd een hoop geld gaat kosten.

Willy Karel – Bibliotheek Eindhoven

Je krijgt volgens mij een enorme collectie ergens centraal. Populaire titels zullen in grote getale aanwezig moeten zijn, anders kan de klant niet bediend worden.

Een centrale distributie lijkt me wel zinvol voor ouder materiaal. Nu wordt er veel oud materiaal afgeschreven en de vraag is of er nog een bibliotheek in Nederland deze titel nog in de collectie heeft. Een centraal depot voor oudere materialen lijkt me zeer zinvol.

Rob Kleingeld – Mijn Eigen Bibliotheek

In feite is dit de huidige praktijk, mits "1 of meerdere centrale punten" breed opgevat mag worden: in de meeste provincies fungeren WSF- en/of Universiteitsbibliotheek als centraal punt.

Landelijk één centraal punt - in een ver verleden als eens overwogen - lijkt me tamelijk inefficiënt en om die reden niet te verkiezen. Provinciale spreiding van collecties over WSF- en universiteitsbibliotheken geeft veel meer mogelijkheden tot direct gebruik door veel meer leners, en genereert aldus een hoger rendement. En ook uit deze collecties kun je titels aanvragen. Bij een hogere omloopsnelheid is de kans om bij een IBL-aanvraag te stuiten op een uitgeleend exemplaar wel groter, maar een goed georganiseerd verdeel- en doorstuursysteem naar andere centrale punten kan dit probleem ondervangen. Ook dit is de huidige praktijk: elke aanvraag die niet door de eerste mogelijke leverancier geleverd kan worden wordt thans automatisch doorgestuurd.

Eigenlijk een ideale situatie (al zijn er nog wel enige verbeterpunten denkbaar)

Fred Kolman – OBA

Voordeel: makkelijk te organiseren

Nadeel: van wie is die collectie. Ik kan me voorstellen dat je van alle aangeboden titels een aantal exemplaren koopt en zo gaat verspreiden. De financiering zou je dan via een formule kunnen verdelen over de deelnemers. Maar wat doe je dan met de aanvragen voor zeldzame werken. Dan zouden alle samenwerkende organisaties zouden ook hun magazijncollecties moeten afstaan. Ik vraag me af of dat haalbaar is. Decentrale organisatie heeft ook als voordeel dat je bij een calamiteit niet je volledige leenverkeer kwijt bent.

Will Dutch Libraries Floor? Appendices

Rene van der Have – OBD

Huidige situatie

Er wordt reeds gewerkt met zwaartepunt- en samenwerkingscollecties. Veelal zijn deze provinciaal georganiseerd. Dat komt onder meer door de (provinciale) subsidiëring en het uitgangspunt dat bijzondere collecties raadpleegbaar zijn voor studiedoeleinden op niet te grote afstand voor de lener.

Een landelijke collectie heeft de volgende voordelen:

- efficiënter door minder overlap
- door massaliteit efficiëntere werkprocessen
- logistiek efficiënter in te regelen

Nadelen:

- Veel werk / budget / ruimte om op 1 plek voor het hele land aan te schaffen en te beheren, is nu ingebed bij bestaande werkzaamheden
- fysieke raadpleging van collectie door bezoekers door grotere afstand moeizaam
- minder affectie met regionale literatuur- en historische boeken
- minder kennis van lokale collecties
- bij een catastrofe is 1 landelijke collectie kwetsbaar

Lieke de Veer – Mijn Eigen Bibliotheek

Wanneer 100% bekend is om welke boeken het gaat, is dit mogelijk een aantrekkelijk model. De praktijk is echter grilliger. Ervaring leert dat boeken die op deze manier opgeslagen worden en 'wachten' tot er een vraag komt, een lage uitleenfrequentie kennen. In Groningen is (al ver voor de fusie) gekozen om de magazijncollectie onder te brengen in de open uitleening van de Bibliotheek Groningen zodat leveren nog steeds mogelijk is, maar de collectie ook beschikbaar is voor klanten in de bibliotheek. Hiermee zijn veel titels ont dubbeld en dus kosten bespaard.

Als we kunnen gaan leveren vanuit *printing on demand* is centrale distributie wel een aantrekkelijk perspectief.

Heerenveen

Dit concept gaat er van uit dat van tevoren bekend is welke boeken aangevraagd zullen worden. Dat is kennis die niemand bezit. Populaire titels waar veel vraag naar zal zijn worden door elke bibliotheek sowieso aangeschaft. In het centrale punt zou men deze titels dan in veelvoud moeten aanschaffen, aangezien het niet bij 1 aanvraag per 3 weken blijft en de wachttijd oploopt bij veel belangstelling. Juist voor de minder populaire titels vallen openbare bibliotheken terug op grotere vestigingen of wetenschappelijk bibliotheken. Het zou er dus op neerkomen dat dit centrale punt alle titels zou moeten aanschaffen die er verschijnen en de meeste van deze boeken staan vervolgens te verstoffen in het magazijn, om zo nu en dan op aanvraag de kast uit te komen. De boeken kunnen beter in bibliotheken op de planken staan, zodat de bezoekers die langs de kasten lopen op hun bestaan gewezen worden en ze meer kans hebben uit die kasten te komen.

Dit neemt niet weg dat er landelijk overlegd zou moeten worden wie een bepaalde titel in de collectie opneemt, zodat er geen titels gemist worden.

Wel een goed idee: een soort 'pluscollectie' per – bijvoorbeeld – provincie, als eerste bevoorradingspunt van openbare bibliotheken. Hierin geen boeken die te populair zijn en ook niet té specialistisch.

Friesland – Noordoost

Dit concept kan snel en goedkoop zijn.

Dat zijn ook tevens de voordelen: de aanvraag kan direct naar een centraal punt gestuurd worden, dus besparing in tijd en daarmee ook in kosten en kan binnen korte tijd dus geleverd worden.

Een nadeel kan zijn dat dit concept zichzelf kan tegenwerken in kosten, omdat een veel grotere hoeveelheid boeken aanwezig moet zijn: de omloop is sneller en groter.

Friesland Zuidwest

Niet haalbaar en ook niet wenselijk.

Uitleeningen worden alleen gegenereerd naar aanvragen, collectie is verder een dood bezit en niet toegankelijk en zichtbaar voor openbaar gebruik.

Bart Linssen – Bibliotheek Maastricht

Een centrale plek voor ibl materialen lijkt ons niet wenselijk. Want waar ga je die materialen dan plaatsen? Zijn ze dan alleen beschikbaar voor IBL en niet voor de open uitleen? Wie bekostigt deze materialen? De Plusbibliotheken zouden natuurlijk wel onderling kunnen afspreken wat de zwaartepunten in hun collecties zijn en of ze hun saneringsbeleid aanpassen aan de andere collecties. Door een goede centrale catalogus (bijv. de toekomstige nbc of de 13onder1knop catalogus) is het duidelijk waar een materiaal zich bevindt en kan het evt. aangevraagd worden.

Hans Stakenburg - ProBiblio

Ik vind dit een goed concept,

Het zal voor duidelijkheid zorgen,.

Er worden nu bij alle bibliotheken plus bibliotheken discussies gevoerd over de financiën van het aanbieden van IBL. Grote bibliotheek plus bibliotheken voelen zich niet geroepen om alle IBL aanvragen te honoreren dit i.v.m. de kosten.

Distributie van de IBL materialen kan vanuit één punt ook beter en sneller.

5. IBL BOEKEN DISTRIBUTIE EN EEN "FLOATING" COLLECTIE

Het concept van een floating collectie klinkt misschien bekend in de oren. Bij dit concept zullen de gecategoriseerde IBL boeken die uitgeleend worden aan andere bibliotheken niet direct teruggestuurd worden naar de oorspronkelijke collectie, maar op de locatie blijven waar het boek is aangevraagd. De volgende lezer die het boek wil lezen en reserveert, zal het boek vanuit deze bibliotheek toegestuurd krijgen. Met dit concept worden onnodige logistieke bewegingen bespaard en daarmee wordt het transport van IBL boeken een stuk goedkoper.

Els Boon - Bibliotheek Drachten

Dit idee is beter dan het vorige. Alleen: wie betaalt deze boeken?? En iedere bibliotheek kan besluiten de boeken te houden, een lastig punt.

Willy Karel - Bibliotheek Eindhoven

In feite heb je dan 1 bibliotheek met 1 collectie.

Ik denk dat dit idee zijn tijd ver vooruit is. Per organisatie wordt een collectie toch als eigendom gezien en is in eerste instantie aangeschaft voor de eigen, soms zeer specifieke leden.

Veel IBL materiaal aangevraagd door onze klanten, wordt geleverd door universiteiten. Ik denk niet dat het voor onze collectie zinvol is om een 1x geleende universitaire titel bij ons op de plank te hebben staan. Stel je zet deze titels in een opslag, dan moet daar weer ruimte voor vrijgemaakt worden.....

Rob Kleingeld - Mijn Eigen Bibliotheek

Het concept is me bekend, althans op papier. Waarschijnlijk zijn er geen technische beletselen om dit te organiseren, en zal er in zo'n geval inderdaad sprake zijn van minder transportkosten (retourzenden is er dan immers niet meer bij). Ik heb werkelijk geen idee of zo'n concept in de praktijk ook gaat werken, het gaat nu wel érg uit van het idee van een 'Collectie Nederland' (als gezamenlijk bezit van één 'Bibliotheek Nederland'), en die bestaat gewoon niet.

Een praktijkproef zou duidelijkheid moeten brengen in de voors en tegens, ik zou er op dit moment geen zinnig woord over kunnen zeggen.

Will Dutch Libraries

Fred Kolman - OBA

Voordeel: Besparing van leenverkeer

Nadeel: aanvragen van wetenschappelijke literatuur door leden van openbare bibliotheken gaat zorgen voor "vreemde" collecties.

Rene van der Have - OBD

Nadelen:

-geen uniform beheer

- boeken kunnen makkelijk zoekraken/worden afgeschreven enz.

- past niet bij winkelformule lokale bibliotheken

-bij nieuwe aanvraag moet het boek toch via centraal punt vanwege centraal punt

Voordelen voor IBL:

-geen

Lieke de Veer - Mijn Eigen Bibliotheek

Deze vorm bespaart aanzienlijk op de transportkosten. We overwegen dit model (op termijn) voor de aanvragen binnen de provinciegrenzen. Er zijn echter nog wat hobbels te nemen. Het automatiseringssysteem is hertoe nog niet voldoende uitgerust. Managers zijn van mening dat de gemeentesubsidie voor de collectie voor de lokale gemeenschap bedoeld is en niet voor andere gemeenten. Er is vrees voor kaalslag (als materialen maar één kant op gaan). En hoe weet je nou hoe jouw collectie rendeert als het materiaal voortdurende elders is.

Vooraf in combinatie met het winkelconcept (retail), levert dit nog de nodige vraagtekens op. Op landelijke schaal (binnen de OB wereld, of in GIL verband?) zal dat niet veel anders zijn.

Heerenveen

Het idee van een 'floating' collectie is niet zo gek, maar de praktische uitvoering lijkt mij problematisch. Wie beheert (en betaalt!) een floating collectie? Elke bibliotheek heeft zijn eigen budget en zal niet blij zijn als de eigen boeken na uitleen nooit meer terugkomen. Bibliotheken zullen bovendien niet altijd belang hebben bij exemplaren uit een floating collectie die niet in hun eigen collectie passen. In - vooral - openbare bibliotheken is het publiek heel divers en er zijn veel titels die slechts eenmaal aangevraagd worden en waar verder niemand van de klanterkring interesse voor zal hebben.

Wil je alleen populaire titels in een floating collectie opnemen, dan zullen de boeken zich op een gegeven moment ook ophopen in bibliotheken waarin veel actieve aanvragers in het ledenbestand zitten.

Kortom, het idee is niet zo gek, maar de uitwerking lijkt mij op veel praktische problemen te stuiten.

Will Dutch Libraries Floor? Appendices

Friesland – Noordoost

Dit concept werkt voor de kleinere (vragende)bibliotheken nadelig. Administratief vraagt dit voor die bibliotheken tijd en geld. Immers zij komen met een grote hoeveelheid nog uit te leveren boeken te zitten.

Friesland Zuidwest

In principe wel een goede gedachte, maar je krijgt daarmee titels die niet goed in de eigen collectie passen qua niveau, onderwerp, gebruikersgroep enz.

Voordeel: kortere routes

Bart Linssen – Bibliotheek Maastricht

Het is zeker een voordeel dat er minder transport hoeft plaats te vinden. We kunnen ons voorstellen dat er een soort wisselcollectie is bestaande uit materialen die HBO plus niveau hebben. Deze collectie wordt dan bekostigd vanuit de PLUS bibliotheken. De wisselcollectie dient te worden verspreid over de PLUS bibliotheken waarna het aanvragen er voor zorgt dat de collectie vanzelf per bibliotheek gaat fluctueren. M.a.w. daar waar de vraag is gaat de collectie naar toe.

Nadelen:

- Bibliotheken waar de leden veel aanvragen ontvangen veel materialen die daar dan blijven staan. M.a.w. gevaar voor ruimtegebrek.
- Bibliotheken die veel aanvragen gaan ontvangen moeten naderhand ook meer gaan versturen. Wie gaat dat betalen? Gezamenlijke pot?
- Inwerken materialen? Hoe wordt geregistreerd welke materialen bij welke bibliotheek zijn? Kan dit automatisch of dient de catalogiseerafdeling veel extra werk te verrichten?

Hans Slakenburg – ProBiblio

Klinkt interessant, is bij ons ook een discussie voor het OBL.

Wij lopen nu tegen het feit dat alle bibliotheken hun eigen bezit toch graag in hun eigen bibliotheken terug willen hebben.

Een tweede probleem is de automatiseringssystemen.

CONCEPTEN VANUIT HET PERSPECTIEF VAN SERVICE VOOR DE GEBRUIKER

A. EEN TOENAME VAN SERVICEPUNTEN (WAAR BOEKEN EVENTUEEL VOORAF BESTELD ZIJN) WAAR EEN LEZER ZIJN OF HAAR BOEK KAN OPHALEN EN RETOURNEREN

Bij dit concept ligt de focus op de afstand die de gebruiker aflegt om zijn of haar boek op te halen en te retourneren. Op het moment kan de lezer alleen boeken ophalen en retourneren bij de bibliotheken. Dit concept heeft het idee om deze 'servicepunten' in aantal te vergroten en de afstand tussen de lezer en zijn of haar boek te verkleinen. Er moet dan gedacht worden dat er 'servicepunten' georganiseerd kunnen worden in winkels zoals een supermarkt bij de lezer in de buurt. De boeken worden in combinatie van een van de eerder genoemde concepten gedistribueerd onder de service punten.

Des
Will Dutch Libraries Float? Appendices

Els Boon – Bibliotheek Drachten

Dit vind ik een slecht idee. Stuur ze dan rechtstreeks naar de aanvrager, dat is pas service. Op deze manier is het een halfslachtige dienstverlening met als nadeel dat de klant nog niet in de bibliotheek komt en dus ook niet geneigd is om eens iets anders te lenen of te gebruiken.

Willy Karel – Bibliotheek Eindhoven

Dit lijkt me een geweldig concept voor de toekomst. Bibliotheken zullen in de toekomst misschien toch vaker een servicepunt openen in plaats van een volledige vestiging open te houden. Makkelijk te bereiken punten zoals een supermarkten lijkt me een geweldig alternatief.

IBL materialen meesturen met levering van goederen via de bij de keten behorend transport?

Snackbar concept. In de winkel staan een soort automaten waar de op te halen boeken in worden gelegd. Klant ontvangt per mail een code om het voor hem bestemde kluisje

te openen. Voor inlevering staat er een speciale bak, die zo omgeruild kan worden door het personeel van de winkel of de chauffeur (brievbus idee)

Rob Kleingeld – Mijn Eigen Bibliotheek

Leuk idee, al zou ik niet weten hoe je dit organisatorisch rond zou moeten krijgen. Afgezien daarvan: ik heb nog nooit als bezwaar horen noemen dat klanten hun IBL-aanvragen bij de bibliotheek moeten afhalen. In de meeste gevallen gaan ze daar immers ook heen om ze in te dienen, en dan is dat kennelijk ook geen probleem. Of willen we de mogelijkheid creëren om aanvragen ook bij de sigarenboer of de kiloknaller in te kunnen dienen? Mooie voorbeelden van out-of-the-box denken, vooral doen, maar eerlijk gezegd zie ik alleen maar problemen i.p.v. nieuwe mogelijkheden.

Fred Kolman – OBA

Voordeel: heel gebruiksvriendelijk

Nadeel: Supermarkten zullen er ook wat aan willen verdienen; dus wellicht hogere IBL tarieven

Rene van der Have – OBD

Uitbreiding servicepunten is aantrekkelijk (denk ook aan benzinstations) doordat door bezuinigingen de spreiding van bibliotheken verslechterd.

Nadeel

Controle, beheer en retournering (nb. je werkt ook met exemplaren die andermans eigendom zijn)

inefficiënte verzending: (af en toe een exemplaar naar het servicepunt en weer terug)

inning boete- en leengelden lastig

Will Dutch Libraries Float? Appendices

Lieke de Veer – Mijn Eigen Bibliotheek

Bij dit concept is het niet alleen van belang dat de afstand voor de klant beperkt is, maar ook dat de afhaal- en inlevertijden ruimer zijn dan bv de openingstijden van de (kleinere) bibliotheek. Nadeel is dat het klantcontact plaats vindt op een plek waar je er als bibliotheek geen zicht op hebt. Je kunt niet reageren op vragen en je mist daardoor ook 'informatie' over de klant. Foutkansen is groter en herstelkans kleiner. Een netwerk van distributiepunten onderhouden kan arbeidsintensief zijn. En dus duur.

Het idee is wel sympathiek, zeker in kleine dorpen (maar daar is dan weer geen supermarkt). Samenwerken met dorpsbelangen e.d. behoort tot de mogelijkheden om uit te zoeken. Of ook een commerciële variant als Kiwa ingezet kan worden, zal afhangen van wat de klant ervoor over heeft.

Heerenveen

Vooraf handig in dorpen en buurten waar de bibliotheek ver weg is. Volgens mij wordt dit hier en daar al gedaan in den lande, in ieder geval bij Blebsearch in het middelbaar onderwijs.

Voordeel is duidelijk: minder reisafstand voor de klant. Nadeel is ook duidelijk: ook als er maar 1 boek aangevraagd is moet het naar het afhaalpunt gebracht worden, want anders wordt de wachttijd te lang. Dit vraagt nogal wat van de bibliotheken (arbeidsuren, benzinekosten e.d.).

Friesland Noordoost

Dit concept is vanuit service voor de gebruiker prima. Tijd- en kostenbesparend.

Friesland Zuidwest

Voordelen: dichtbij de klant. Levert voor een beperkt aantal klanten een voordeel op in plattelandssituaties.

Nadelen: klant krijgt zo weinig binding met de bibliotheek, retail gedachte is zoek.

Bibliotheek is ook een ontmoetingsplaats, zorgt voor sociale cohesie op het platteland.

Bart Linssen – Bibliotheek Maastricht

Vanwege het sluiten van veel bibliotheekvestigingen een interessante optie. En het is uiteraard klantvriendelijk omdat onze leden wellicht minder afstanden hoeven af te leggen of op andere tijdstippen de materialen kunnen gaan ophalen.

Nadelen:

- waarschijnlijk hogere kosten door ruimtes te huren, zelfbedieningskastjes, personeel (bijv van een postagentschap) die extra betaald moet worden voor de afhandelingen. Willen de klanten dit opbrengen of.... Een andere manier van financiering?

Hans Stakenburg – ProBiblio

Ik vind dit concept te ver gaan, er mag toch van een lezer best wel verwacht worden dat deze naar de bibliotheek gaat.

Tevens worden de kosten wel erg hoog

Will Dutch

De EBM van de bibliotheek is te veel. Te veel = te weinig informatie.
Gebracht worden en ook opgehaald worden

Bij dit concept is het idee om de boeken bij de lezer thuis te bezorgen en weer op te halen. Dit verkleint de afstand tussen de lezer en zijn of haar boek. De boeken zullen in combinatie van een van de distributie concepten worden gedistribueerd onder de gebruikers.

Els Boon – Bibliotheek Drachten

Een mooie service maar erg duur en het nadeel is dat de klant de bibliotheek kan vermijden, fysiek gesproken. Maar voor wie flink in de buidel wil tasten moet dit mogelijk zijn.

Willy Karel – Bibliotheek Eindhoven

Gemakservice.

Veel duurder concept om per klant 1 titel te versturen en af te leveren bij een huisadres. Veel mensen zijn niet thuis. Hoe vaak bied je iets aan? Wat als er nooit iemand thuis is, ook de burelen niet?

Afhalen bij een servicepunt?

Rob Kleingeld – Mijn Eigen Bibliotheek

Thuisbezorging zou wat mij betreft zeker onderdeel van een praktijkproef mogen zijn, al liggen ook hier de (praktische) bezwaren voor de hand (leners overdag nooit thuis, beide ouders werken, etc).

's Avonds opnieuw langskomen zal waarschijnlijk wel erg duur worden, de spullen dan maar af laten halen op een afgesproken plek (Postkantoor? Bibliotheek?) is het paard achter de wagen spannen.

Vooralsnog zijn er veel leveranciers van IBL-aanvragen (met name uit UB-kring) die hun materiaal alleen willen afstaan aan derden als er een (openbare) bibliotheek tussen zit als intermediair, en die verantwoordelijk is voor de veilige retournering. Ook in dit geval zou ik zeggen: probeer het allemaal eens uit in de praktijk, al is het voor mij de vraag of alle voordelen wel zo opwegen tegen de bezwaren.

Fred Kolman – OBA

Voordeel: Over dit concept denken wij ook na voor onze lokale reserveringen. Is natuurlijk heel publieksvriendelijk.

Nadeel: In een stad als Amsterdam is het lastig te organiseren vanwege verkeersopstoppingen. Wij overwegen meeliften met een bezorgdienst (TNT, V&D) maar dat zal het reserveren van boeken zeker duurder maken voor de klant. Maar je zou dan met twee tarieven kunnen werken: thuis bezorgen en zelf afhalen bij de bibliotheek.

Rene van der Have – OBD

Er zijn proeven gedaan. Uitkomst: klanten van de bibliotheek vinden laag of 0 tarief zwaarder wegen dan snelle en gebruiksvriendelijke levering.

Een goede regeling waarbij bibliotheken partij zijn bij de verspreiding van Ebooks heeft de voorkeur.

Will Dutch Libraries Float? Appendices

Lieke de Veer – Mijn Eigen Bibliotheek

Eveneens de moeite waard, mits flexibel ten aanzien van de ophaal- en levertijden. Je moet er niet voor thuis hoeven blijven en de kosten moeten beperkt zijn (voor de klant én de bibliotheek).

Zetten we hiervoor vrijwilligers in of een koeriersdienst?

Heerenveen

Dit is het meest gebruiksvriendelijke concept en er zullen lezers zijn die hier graag extra voor willen betalen. Dat is volgens mij wel een voorwaarde; het kan niet gratis. Daarvoor zijn de kosten voor de bibliotheken gewoon te hoog en leners zullen hier ongetwijfeld begrip voor hebben. Je zou de keuze kunnen geven: voor een laag bedrag (of gratis) aanvragen en afhalen bij de bibliotheek of afhaalpunt, of thuis afleveren voor een extra bijdrage in de kosten. Hierbij moet je ook nog bekijken of de boeken weer opgehaald worden of dat ze ingeleverd moeten worden bij de bibliotheek of een afhaalpunt.

Friesland - Noordoost

Dit concept is nog beter, daar de lezer persoonlijker benaderd wordt.

Friesland Zuidwest

Nadeel: zie A. en te duur.

Voordeel: zie A.

Bart Linssen – Bibliotheek Maastricht

De ideale situatie. Zie de voordelen van hierboven + nog meer tijdsbesparing en gemak voor de klanten

Nadelen:

- Hogere kosten door het rechtstreeks bij de klant afleveren (door bibliotheek of bijv. TNT?)
- Hoe verwerk je / registratie ?
- Wat als de klant niet thuis is? Alsnog ophalen bij een servicepunt / bibliotheek? Of...

Hans Stakenburg – ProBiblio

Zie antwoord bij a

MEEST HAALBARE CONCEPTEN PER PERSPECTIEF

Els Boon – Bibliotheek Drachten

Concepten vanuit het perspectief van de Bibliotheek:

Gewoon vanuit bibliotheken uitlenen aan elkaar, zoals gebruikelijk, maar met een goede

Concepten vanuit het perspectief van de lezer:

Thuisbezorging. Gemak dient de mens.

Will Dutch Libraries Float? Appendices

Willy Karel – Bibliotheek Eindhoven

Concepten vanuit het perspectief van de Bibliotheek:

Concepten vanuit het perspectief van de lezer:

2A

Rob Kleingeld – Mijn Eigen Bibliotheek

Concepten vanuit het perspectief van de Bibliotheek:

1A

Concepten vanuit het perspectief van de lezer:

2B

Vanuit het perspectief van de bibliotheek: 1A ligt het dichtst bij de huidige situatie, en die is zoals gezegd helemaal zo gek nog niet. Veel 'centrale punten' betekent: volledig gebruikergericht, geeft de gebruiker de mogelijkheid zelf collecties te raadplegen, en – desgewenst – materialen eventueel elders aan te vragen.

Vanuit het concept van de lezer: thuisbezorging wordt al veel langer gepropageerd, en mag wat mij betreft gauw een keer onderdeel van een proef worden. Afhalen bij de bibliotheek klinkt inderdaad weinig 2011, maar maakt het allemaal daarentegen wel erg eenvoudig. Bovendien bieden de meeste bibliotheken vandaag de dag de mogelijkheid om aangevraagde boeken in een andere vestiging/filiaal op te halen, dus of het nu voor veel mensen bezwaarlijk is Maar de roep om thuisbezorging is niet te stuiten, dus gauw maar eens uitproberen svp!

Fred Kolman – OBA

Concepten vanuit het perspectief van de Bibliotheek:

Floating collectie

Concepten vanuit het perspectief van de lezer:

Thuis bezorgen

Gekozen voor floating collection, omdat je dit concept nog zou kunnen aanpassen; bijv. aanvragen uit openbare bibliotheken in je collectie laten staan en uit de UKB terugsturen.

Gekozen voor thuisbezorgen; dat is voor de klant uiteindelijk veel meer service dan naar de supermarkt gaan (dan kun je net zo goed even doorlopen naar de bibliotheek).

Rene van der Have – OBD

Will Dutch Libraries Float? Appendices

Concepten vanuit het perspectief van de Bibliotheek:

Het concept van bredere spreiding afhaalpunten

Uitbreiding

Concepten vanuit het perspectief van de lezer:

Snelle levering van populair materiaal. Welk concept????

Heerenveen

Concepten vanuit het perspectief van de Bibliotheek:

Meest haalbaar binnen het huidige budget: het systeem zoals het nu werkt, met evt. extra afspraken over wie wat aanschaft, met goede verdeling van de budgetten.

Concepten vanuit het perspectief van de lezer:

Lezers willen gewoon hun materialen zo snel mogelijk hebben; hoe wij dat regelen interesseert ze niets. Thuis afleveren is voor een aantal leners een aantrekkelijke optie.

Friesland Noordoost

Concepten vanuit het perspectief van de Bibliotheek:

Concept a

Concepten vanuit het perspectief van de lezer:

Concept b

Friesland Zuidwest

Concepten vanuit het perspectief van de Bibliotheek:

floating

Concepten vanuit het perspectief van de lezer:

B

Bart Linssen – Bibliotheek Maastricht

Concepten vanuit het perspectief van de Bibliotheek:

b.

Concepten vanuit het perspectief van de lezer:

A.

Will Dutta

Lieke de Veer – Mijn Eigen Bibliotheek

Bij *printing on demand* en ebooks heeft een landelijke aanpak met een centrale distributie de voorkeur. Bij fysieke boeklevering is een landelijk aanvraagstelsel prima in combinatie met leveren vanuit de eigen of dichtstbijzijnde vestiging. Centraal is alleen haalbaar – denk ik – als dat vanuit een bestaande collectie gebeurt (KB?). Een nieuw op te zetten magazijn is veel te kostbaar. Voor de *long tail* – een opslagplaats om de laatste exemplaren van een titel beschikbaar te houden – is dit wellicht wel een optie.

Vanuit het perspectief van de lener is nog te weinig bekend wat hij ervoor over heeft. Hoeveel moeite wil een klant doen?

Een lidmaatschap is nu nog gekoppeld aan een fysieke bibliotheek. Wellicht dat in de toekomst ook een lidmaatschap mogelijk is van Bibliotheek.nl (Bibliotheek Nederland) waarbij de lener uitsluitend digitaal diensten afneemt (of in elke willekeurige bibliotheek). Daar hoort dan mogelijk een ander soort abonnement bij (afgestemd op een bepaald volume met uitleenperiode naar keuze – boete bestaat niet meer)

Friesland Noordoost

Ik heb mijn voorkeuren aangegeven, hoewel ik het wel moeilijk vind een voorkeur uit te spreken.

De klant moet op een betrouwbare, correcte manier aan zijn/haar boeken komen. Dus is het noodzaak om een goede dienstverlening te bewaken. Ik vraag mij af of dit nog mogelijk is als de afstand tussen lezer en boek weliswaar verkleind wordt, maar daarentegen de afstand tussen lezer en bibliotheek vergroot.

Bart Linssen – Bibliotheek Maastricht

Concepten vanuit het perspectief van de bibliotheek:

Voor a zijn wij geen voorstander omdat naar onze mening via een catalogus centraal is te regelen. Materialen hoeven dus niet meer centraal geplaatst te worden maar een centraal overzicht is wel gewenst zodat men collectie op elkaar kan afstemmen

Concepten vanuit het perspectief van de lezer:

Logistiek gezien is dit het best haalbare indien het te bekostigen is en er genoeg bereidwilligheid is om ibl materialen te willen uitleen

Optie b is natuurlijk de ideale situatie en zeker de moeite waard om te onderzoeken. Wellicht zelfs goedkoper dan optie a

Will Dutch Libraries Floor? Appendices

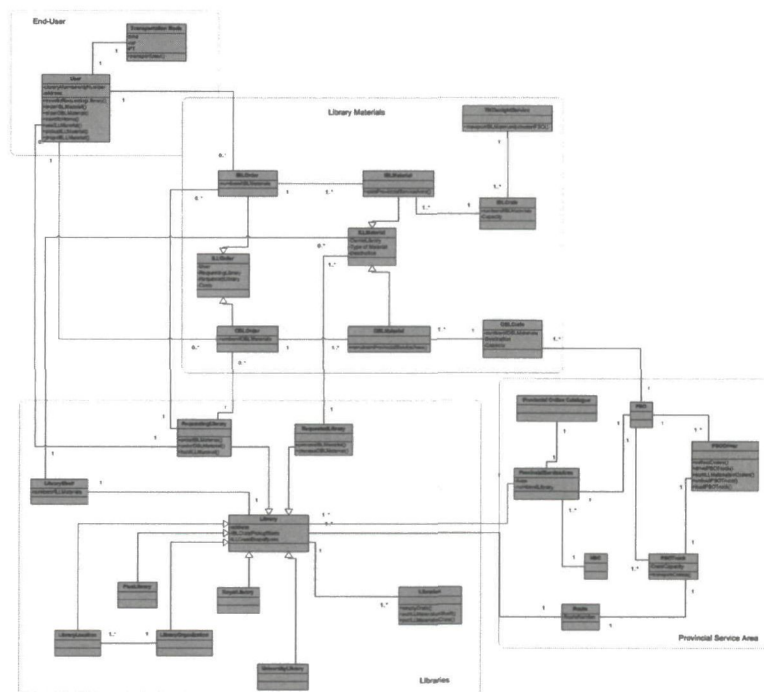


FIGURE 5: OBJECT MODEL OF THE TRANSPORT SERVICE PSO

In the first step of the conceptualization phase of the modeling of the ILL system, an object diagram is used. An object diagram is classified as a structure diagram in the Unified Modeling Language (UML). This diagram is a diagram that shows a complete or partial view of the structure of a modeled system at a specific time (36). An object diagram focuses on some particular set of object instances and attributes, and the links between the instances. A correlated set of object diagrams provides insight into how an arbitrary view of a system is expected to evolve over time.

Within this project the object model is used to identify the objects within the ILL system and the relationships between these objects. The relationships are of aggregation or composition. The objects are part of another object or contain within other objects. Within the ILL system four sub systems are identified. The identified objects and their relationships are complex within this system. There are a lot of objects with overlapping characteristics and objects belonging to several classes which makes a clear overview of the objects difficult. To enable the object model to be less complex

several objects are added to the object model. The classes RequestingLibrary and RequestedLibrary are added to define a library in its function towards a ILL order. Another clarification is to split the ILL crates in two categories. In the real world there is only one type of crate. To simplify the object model the crates are subdivided in two categories (37).

This modeling techniques has enabled the project to gain a clear insight in the architectural blueprint of the ILL system including the stakeholders, their activities and their business processes. This manner of modeling enables a static view of the objects of the system in relationship to each other. In the next steps the dynamic properties of the ILL are modeled.

Figure 5 shows the complete system contained in one IDEFo diagram, the A0, the so called Top Level Context Diagram. This diagram defines the scope of the system. All the Inputs, Controls, Outputs, and Mechanisms of the complete ILL system are shown in this diagram. Internal Inputs, Controls, Outputs, and Mechanisms are left out. This diagram does not give a complete overview of all the processes involved within the transporting of ILL materials by the PSO. In order to gain more insight in the processes of the transportation, a decomposition is made of the A0 diagram, in the next decomposition, six sub diagrams are identified, A1-A6. This first decomposition is shown in Figure 6. The decomposition gives an bigger insight in the sub processes of the transportation service and which resources and information are needed for these processes.

A next and final decomposition was identified and necessary to gain complete insight to be able to model the ILL system completely. The IDEFO diagrams A1-A6 are individually decomposed in the Figures 7-12. This decomposition was necessary to identify specific tasks of the resources within the transportation service of the PSO. This level of decomposition proved to be enough to be able to model the system and its elements correctly.

The use of IDEF0 diagrams enabled the project to gain insights in the processes of the transportation service. The specific sequence of the processes and the in and outputs. The complex process steps are simplified and a clear overview of the transportation system is gained.

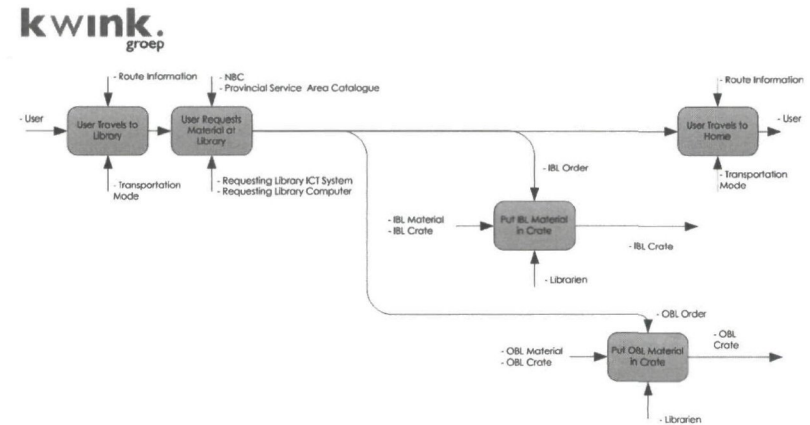


FIGURE 8: IDEFO0 DIAGRAM OF PROCESS A1

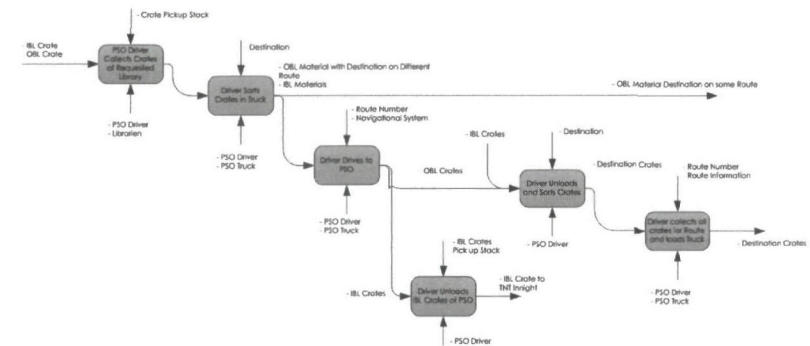


FIGURE 9: IDEF0 DIAGRAM OF PROCESS A2

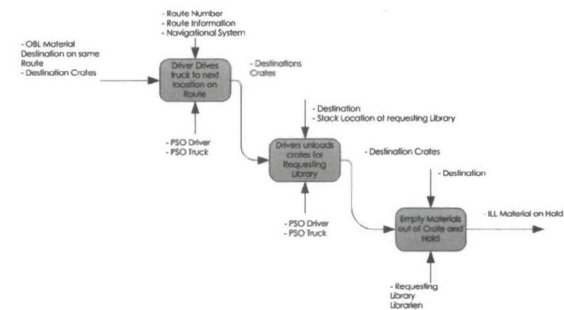


FIGURE 10: IDEF0 DIAGRAM OF PROCESS A3

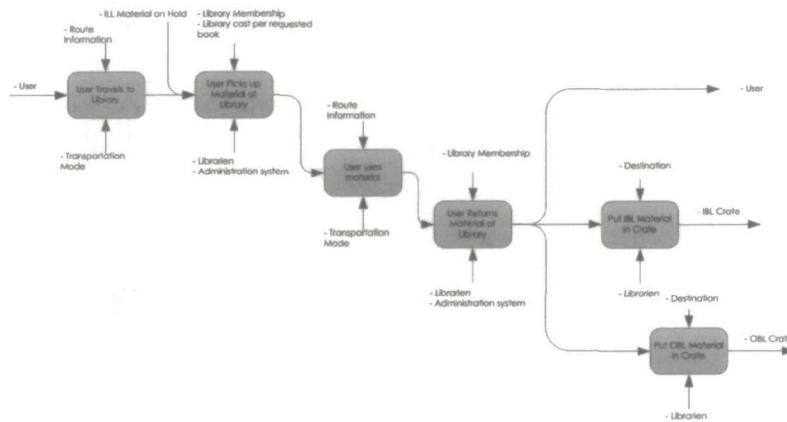


FIGURE 11: IDEFO DIAGRAM OF PROCESS A4

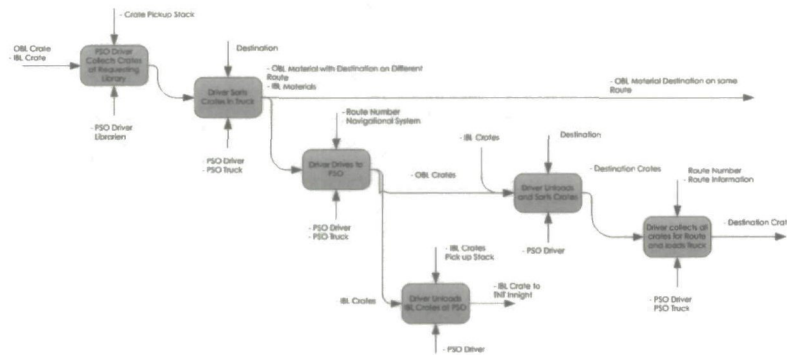


FIGURE 12: IDEFO DIAGRAM OF PROCESS A5

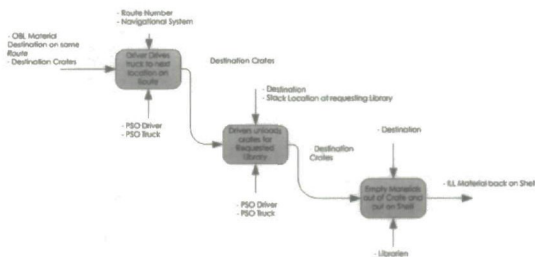


FIGURE 13: IDEFO DIAGRAM OF PROCESS A6

APPENDIX J: FLOW CHART MODELING

A flowchart is a type of diagram that represents a process, showing the steps as boxes of various kinds, and their order by connecting these with arrows. This diagrammatic representation can give a step-by-step solution to a given problem. Processes are represented in these boxes, and arrows connecting them represent flow of control (52).

Flowcharts are used in designing complex processes. Like other types of diagram, they help visualize what is going on and thereby help the viewer to understand a process and find flaws and bottlenecks. The two most common types of boxes in a flowchart are:

- a processing step, and denoted as a rectangular box
- a decision, usually denoted as a diamond.

A flowchart is described as "cross-functional" when the page is divided into different swim lanes describing the control of different organizational units. A symbol appearing in a particular "lane" is within the control of that organizational unit. This technique allows the location of the responsibility for performing an action or making a decision correctly, showing the responsibility of each organizational unit for different parts of a single process (39).

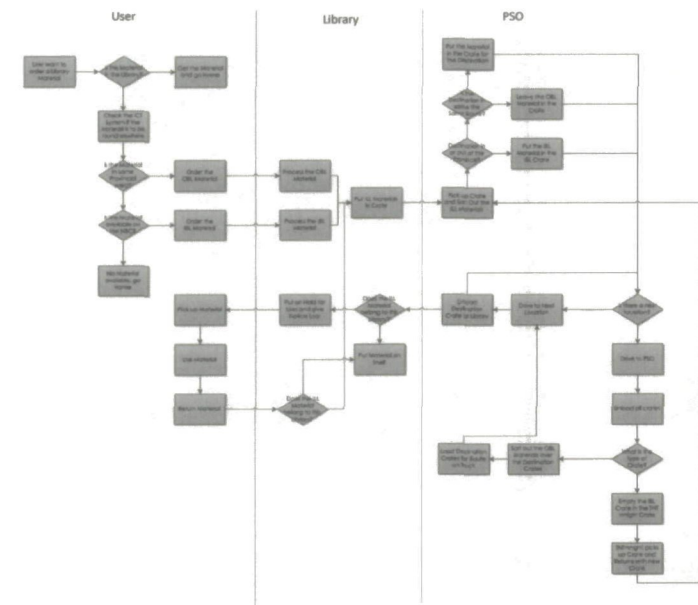


FIGURE 14: FLOW CHART MODEL TRANSPORT SERVICE PSO

In Figure 14 the flow chart model of the ILL is shown. Within the processes identified in the process oriented models in Appendix I, the identified organizational units are the user, the library and the PSO. These three organizational swim lanes are identified in the model in Figure 14. The flow within the flow chart starts with the order of an ILL material and flows through the system in till the material is back at the library of origin. The most information is gained on the side of the PSO. The processes understood by the project before the flow chart model was designed was more complex than shown in the figure above. This model enabled a more clear overview of processes and the decisions needed by the relevant entities in the system.

Using a flow chart model enables the conceptualization to be more comprehensive. Tasks identified in the process oriented modeling in appendix I are set in sequence of decision and flow using the flow chart modeling. This creates an insights in the responsibilities of the stakeholders involved directly with the transportation of ILL materials. Particular bottlenecks and flaws in the flow of the system were not identified.

APPENDIX K: SETUP OF THE DISCRETE SIMULATION MODEL IN ARENA

The simulation model is build is Rockwell Automation's Arena (41). This is a software tool to enable the simulation of discrete event simulation modeling. Using Arena, the models from the conceptualization phase are translated into a simulation model that can be run in a certain time period to assess the processes and objects of the system and measure the performance of the system. While setting up the simulation model, the "Handbook Arena" by Beerens, Gransjean, van Kaam and Verbraeck is used (42).

A representation of the exploratory network of libraries from the Arena software is shown below:

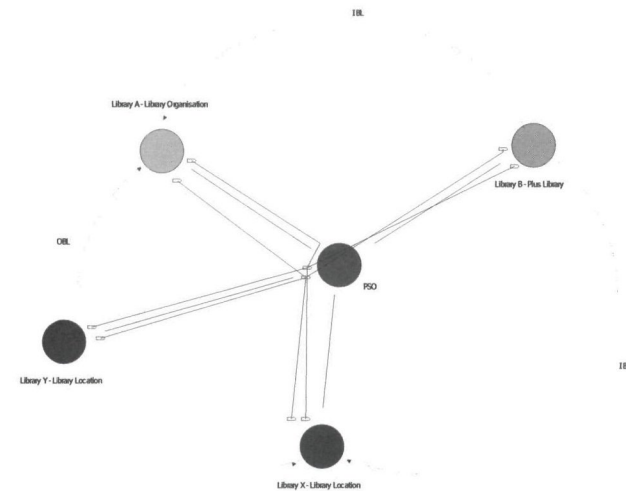


FIGURE 15: SETUP OF THE SIMULATION MODEL BUILD IN ARENA

In Figure 4-1 the setup of the exploratory model build in Arena is presented. In this small representation of a provincial service area and the libraries operating in this area the choice is made to use a set of four libraries of different size in this model. All the relevant categories of libraries in the Netherlands are represented in the model:

- PSO
- Plus Library (Library B)
- Library Organization (Library A)
- Library Locations (Libraries X and Y)

Each library has a different size of collection available for ILL and a different amount of members requesting ILL materials. In this model the PSO collects and distributes the IBL and ILL from all the libraries.

The next step is to build the individual locations and the operations and processes that are part of the subsystem. All the libraries are modeled the same in Arena. Below, in Figure 16, library A is shown modeled in Arena.

Library A - Library Organisation

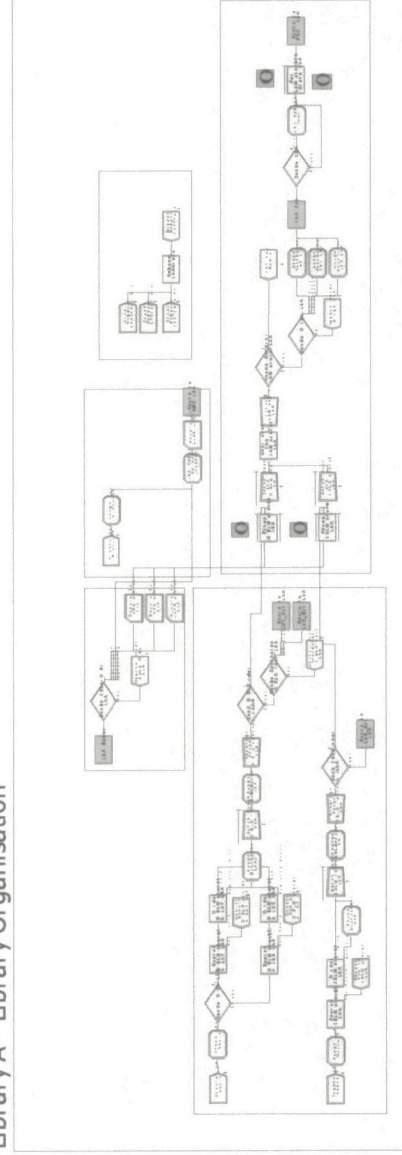


FIGURE 16: LIBRARY ORGANISATION (LIBA) MODELED IN ARENA

Within a library, several sub systems exist. To describe all the subsystems, the description starts at the top left corner and work around clockwise. In the top left corner, the library materials that enter the library come into the library. The materials are recorded for statistics and send to the users to be picked up. Next to the right, the library materials are created and recorded in the provincial collection. After a material is returned to the library of owner, it passes here to be returned in the provincial collection. In the top right corner, the service level of the library is modeled. The service level is the amount of days the PSO calls the library. In this case the library is called three times a week. In the bottom right the users receive their material on the left, use the material, return the material and go home. The material is processed in a crate to wait for pickup by the PSO. In the bottom left corner the orders are created. Both OBL and IBL orders are created, but at both different rates (see Appendix L). The users are created and materials are searched at random in the different library collection within the simulation model. The materials are picked up from the collections and matched with the correct user. The materials are put in the crates at their current location and the user enter a queue to wait for their materials. Once the PSO has picked up, sorted and distributed the library material that is ordered, the user is removed from the queue.

PSO

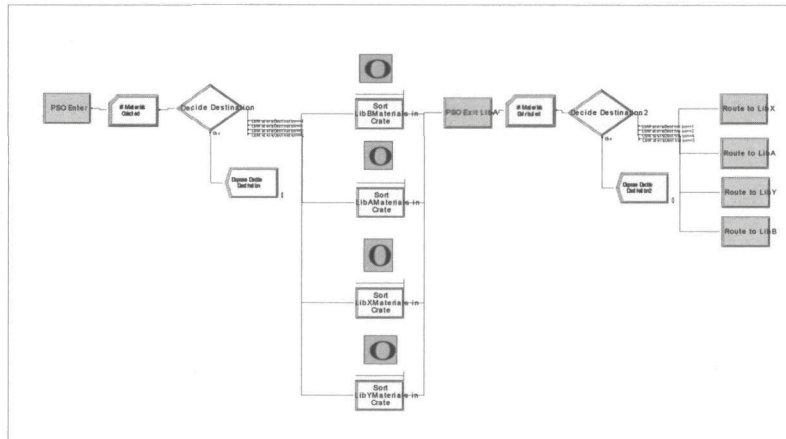


FIGURE 17: THE PSO MODELED IN ARENA

The next element in the simulation model is the PSO. The PSO collects the materials and transports the materials to the PSO headquarters. Once collected the materials are sorted in the crates of the destination of the materials. The library materials stay overnight (or longer, dependant on the service level of that particular library) and are distributed to the destination library on the next day.

Next to the models, Arena and its interface are used to measure the KPIs and create dynamic graphs to monitor the behavior of the simulation model.

APPENDIX L: DATA COLLECTION

While collecting the relevant data that is used to specify the simulation model, the data was collected in several spreadsheets. The spreadsheets are shown below in Tables 0-4. All the information is derived from interviews with PSOs and the use of internet. The library sector is a public funded sectors, so all the data was available for free.

In Table 2 and Table 4 various assumptions are made. The assumptions are explained in detail in Appendix N.

Plus Libraries sends 33.000 IBL materials to libraries:

33.600	Shipments total per year
196	per year/library
0,8	per day
0,1	per hour

0-1: DETERMINATION OF ORDERS IBL (48)

BISC Utrecht (OBL)

50	Libraries
147.933	Requests per year per library total
2959	per year/library
11.4	per day / library
1.4	per hour / library

SFB Flevoland (OBL)

10	Libraries
8000	Requests per year per library total
800	per year/library
3.1	per day / library
0.4	per hour / library

Average

0.9	per hour / library
-----	--------------------

TABLE 2: DETERMINATION OF ORDERS OBL (10) (7)

2010	Users/requests			Users/requests			Order Distribution				Materials		
	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
From LibB	0	0%	0	0%	-	-	-	-	0%	0%	1000	1000	0
									70%	30%			
LibA	1,36	50%	0,05	50%	1,40	0,05	-	0,95	0,41		2.500	-	2.500
									75%	-	25%		
LibX	0,95	35%	0,03	35%	0,98	0,03	0,71	0,24			1.750	-	1.750
									60%	40%			
LibY	0,41	15%	0,01	15%	0,42	0,01	0,24	0,16			750	-	750
	2,71	100%	0,1								5.000		

2011	Users/requests			Users/requests			Order Distribution				Materials		
Increase 135%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	0	0%	0	0%	-	-	-	-	0%	0%	1000	1000	0
									70%	30%			
LibA	1,83	50%	0,06	50%	1,89	0,06	-	1,28	0,55		2.500	-	2.500
									75%	-	25%		
LibX	1,28	35%	0,04	35%	1,33	0,04	0,96	0,32			1.750	-	1.750
									60%	40%			
LibY	0,55	15%	0,02	15%	0,57	0,02	0,33	0,22			750	-	750
	3,66	100%	0,1	1							5.000		

2012	Users/requests			Users/requests			Order Distribution				Materials		
Increase 145%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	0	0%	0	0%	-	-	-	-	0%	0%	1000	1000	0
									80%	20%			
LibA	2,65	50%	0,09	50%	2,75	0,09	-	2,12	0,53		2.500	-	2.500
									90%	-	10%		
LibX	1,86	35%	0,06	35%	1,92	0,06	1,67	0,19			1.750	-	1.750
									70%	30%			
LibY	0,80	15%	0,03	15%	0,82	0,03	0,56	0,24			750	-	750
	5,31	100%	0,2	1							5.000		

2013	Users/requests			Users/requests			Order Distribution				Materials		
Increase 155%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	0	0%	0	0%	-	-	-	-	0%	0%	1000	1000	0
									80%	20%			
LibA	4,11	50%	0,14	50%	4,26	0,14	-	3,29	0,82		2.500	-	2.500
									90%	-	10%		
LibX	2,88	35%	0,10	35%	2,98	0,10	2,59	0,29			1.750	-	1.750
									70%	30%			
LibY	1,23	15%	0,04	15%	1,28	0,04	0,86	0,37			750	-	750
	8,22	100%	0,3	1							5.000		

TABLE 3: CURRENT AND FUTURE SITUATION ORDERS FOR OBL AND IBL AND LIBRARY COLLECTION SIZES

Will Dutch Libraries Float? Appendices

2010	Users/requests			Users/requests			Order Distribution				Materials		
	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	1,26493	35%	0,049	35%	1,31						2100	2100	0
LibA	1,26	35%	0,05	35%	1,31						2.100	-	2.100
LibX	0,72	20%	0,03	20%	0,75						1.200	-	1.200
LibY	0,36	10%	0,01	10%	0,38						600	-	600
	3,61	100%	0,1	100%							6.000		

2011	Users/requests			Users/requests			Order Distribution				Materials		
Increase 135%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	1,70766	35%	0,0662	35%	1,77						2100	2100	0
LibA	1,71	35%	0,07	35%	1,77						2.100	-	2.100
LibX	0,98	20%	0,04	20%	1,01						1.200	-	1.200
LibY	0,49	10%	0,02	10%	0,51						600	-	600
	4,88	100%	0,2	100%							6.000		

2012	Users/requests			Users/requests			Order Distribution				Materials		
Increase 145%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	2,47611	35%	0,0959	35%	2,57						2100	2100	0
LibA	2,48	35%	0,10	35%	2,57						2.100	-	2.100
LibX	1,41	20%	0,05	20%	1,47						1.200	-	1.200
LibY	0,71	10%	0,03	10%	0,73						600	-	600
	7,07	100%	0,3	100%							6.000		

2013	Users/requests			Users/requests			Order Distribution				Materials		
Increase 155%	OBL (/h)			IBL (/h)		Total	Lib B	LibA	LibX	LibY	Total Collection	HBO	no HBO
LibB	3,83797	35%	0,1487	35%	3,99						2100	2100	0
LibA	3,84	35%	0,15	35%	3,99						2.100	-	2.100
LibX	2,19	20%	0,08	20%	2,28						1.200	-	1.200
LibY	1,10	10%	0,04	10%	1,14						600	-	600
	10,97	100%	0,4	100%							6.000		

TABLE 4: FLOATING COLLECTION ORDERS FOR OBL AND IBL AND LIBRARY COLLECTION SIZES

Will Dutch Libraries Float? Appendices

APPENDIX M: SIMULATION RUN SETUP

The simulation run setup is an important step in determining the length and number of replications to be used while simulation the alternatives. Long simulation and many replications cause extreme long waiting times for an analyst but very accurate results (19). In order to find a tradeoff between long waiting times and accurate results from the simulation runs; the startup time, the length of a simulation run and the number of replications are calculated below.

STARTUP TIME

The startup time is based on the number of materials within a collection that needs to be in an equilibrium after a certain period. By visual conformation it showed that all the library collections were in a state of equilibrium after 2 months. To be certain, the 2 months must be calculated by minimum of three to have a correct startup time (19).

In order to double check, the cycle time of a library material is determined. In the model without floating, the cycle time is 18 hours. With floating, the cycle time is 157 hours. Both these numbers are in order and within the earlier determined 6 months startup time.

A test run is done with a startup time of 6 months and several key performance indicators are tested on their standard deviation. With a correct startup time, the standard deviation should not differ significantly from each other (19). After looking at the results, it showed that this was indeed the case.

The startup time is determined:

- Without floating: 1040 hours equals 6 months
- With floating: 1040 hours equals 6 months

LENGTH OF SIMULATION RUN

Within literature it states that the length of a simulation run should be at least 3 times the longest cycle time of a material within the system (19). In this case that would be 54 hours without floating and 471 hours with floating.

In this case a simulation run of 1 year (2080 hours) is chosen. The main reason of the increase in needed simulation time is the historical data that is used and no fluctuations within the year exist. The data provided by the stakeholders are of one calendar year and simulating one year enables a possible comparison. Also, after testing, the duration of a simulation run (without animations) tended to be short enough for the analyst.

NUMBER OF REPLICATIONS

The number of replications that need to be determined need to be calculated. The reason to use multiple replications is because the model uses stochastic variables. While using multiple replications, the stochastic outcome of the variables are evened out with a low standard deviation to the results are reliable and conclusions can be drawn from these results (19). Negative aspects of using multiple replications is the computational time.

After testing the simulation model with 5 replications, the reliability of the model was 97,5-98,4%. This is a very high reliability. Because the simulation model is not large, a test has been made with 10 replications resulting in better reliability and a remaining small computational time. The choice has been made to use 10 replications.

APPENDIX N: ASSUMPTIONS MADE DURING DESIGN OF SIMULATION MODEL

- The sizes of the collections of the libraries is fictive but validated by an expert
- The sizes of the members of the libraries is fictive but validated by an expert
- The relationship between number of end-users and number of orders is to be assumed similar, validated by an expert
- The relationship between the size of collection and the number of end-users is assumed to be similar, validated by an expert
- The library materials handled in the system are materials that are ordered for ILL. The collections are based of materials for ILL and the other materials that do not receive order do not exist in this system
- The number of orders generated for IBL is assumed to be an average of orders of one Plus Library. This is calculated by the total number of IBL order divided by the number of Plus Libraries in the Netherlands
- The number of orders for OBL is derived from two provincial service areas in the Netherlands, Utrecht and Flevoland. The average of both the provincial service areas is taken as the order generation of OBL in the system
- Within the model it is assumed that the distribution of orders over the different libraries is dependent on the size of the library collection on that moment. The theory behind this assumption is that the chance a user orders a materials at a bigger collection is higher than in a smaller collection
- It is assumed that the end-users order their materials at random. No categorization is done in the materials and demand for certain categories is not available in this model
- It is assumed that the end-user always picks up the material it has ordered. Only when the material the end-user tries to request is not available will the end-user leave the system without using a library material.
- It is assumed that once a material is requested, it is not available for another user to request.
- It is assumed that an end-user uses library materials with a triangular distribution with a mean of 7 days, a minimum of 3 days and a maximum of 21 day. This is validated by an expert.
- For the exploratory model is assumed that one network of libraries contains:
 - 1 Plus Library
 - 1 Library Organization (LO)
 - 2 Library Locations (both of different size of collection and size of end-users)
- Assumed is that the libraries are open 5 days a week and 8 hours per day. Assumed is that the libraries are closed in the weekend.
- The following service levels are assumed in the model. These are validated by an expert to be near reality:
 - Plus Library: 5 times a week
 - LO: 3 times a week

- LL X: 2 times a week
- LL Y: 1 time a week
- Assumed for the current situation is that the Plus Library does not order library materials. In the floating collection the Plus library participates. This is validated by an expert.
- It is assumed that the materials from the Plus Library are of scientific nature (>HBO Level)
- It is assumed that the capacity of the transportation service is 3 crates per library of each 15 materials. This is calculated using simulation runs. The nearest to reality is the capacity is just sufficient to handle all the materials. This is calculated to be 45 materials per day per library. See # for more details. This is validated by an expert to be near to reality. However, the real number of crates per library is not determined by number, but by demand.
- It is assumed that the trucks on route pick up materials and bring the materials to the PSO first before distributing them to the destination. In the real world the materials with a destination on the same route are delivered immediately. Because the model is so small compared to reality, this is not done.
- It is assumed that the NBC is introduced and that the end-user order their ILL materials through this system

APPENDIX O: VALIDATION OF SIMULATION MODEL

In the validation stage, the model must undergo several structural tests to check if the model behaves as expected to the changes in input parameters. This is necessary because it needs to undergo experiments in a later stage in the project. With these tests, some input variables are changed into extreme values and checked how the model responds to these changes. Three tests have been done and the results of the tests can be viewed below.

- Capacity of a shipment

In this test the capacity of a shipment is lowered to a minimum. Instead of allowing 45 materials (3 crates) per library per pickup day, the variable is changed to 15 materials (1 crate). As can be seen in the appendix, the model behaves like expected. The majority of the library materials are not collected by the PSO and do end up in long queues. This delays the wait for materials for the end-user dramatically. This is as expected because the capacity at the current situation is just sufficient to transport the materials.

Capacity of the Truck						
number of crates per pickup day		45		15		Difference
		hours	days	hours	days	
Waiting times	A	32,0	4,0	856,62	107,1	2578%
Current	X	29,7	3,7	791,37	98,9	2563%
	Y	34,8	4,4	681,19	85,1	1856%
Waiting times	B	15,3	1,9	56,17	7,0	267%
Float	A	14,7	1,8	59,5	7,4	305%
	X	19,7	2,5	55,43	6,9	182%
	Y	28,3	3,5	28,52	3,6	1%

FIGURE 18: CAPACITY OF SHIPMENT

- Percentage of users requesting materials

In this test the distribution of the requests over the libraries is changed. In the current situation the library users from library A request materials with the distribution of 70% to library X and 30% from library Y. This distribution is reversed. The expected effect occurs. Library Y receives too many orders and the current service level cannot provide this service. Also the library collection is too small to handle the requests resulting in the emptying of the collection. This can be seen in the appendix.

Collections		User from Library A: X (70%)/ Y(30%)	User from Library A: X (30%)/ Y(70%)	Difference
Current situation	B	989,61	985,65	0%
	A	2370,25	2237,41	-6%
	X	1598,31	1580,73	-1%
	Y	647,93	62,72	-90%

FIGURE 19: PERCENTAGE OF USERS REQUESTING MATERIALS

- The speed of the collection and distribution of library materials

In this test the speed of collection and distribution of the PSO transport service is varied. The current speed in the model is half a day to reach the PSO and half a day to reach the destination location. In the appendix the results are presented and the effects of the waiting times are as expected. When dropping the time to 0 days, the waiting times of the end-users decreases and when the speed is changed to 3 days, the waiting times increase.

Speed of Delivery								
Speed		0,5 days		0 days	Difference	3 days	Difference	
		hours	days	hours	days	hours	days	
Waiting times	A	32,0	4,0	26,75	3,3	-16%	70,63	8,8
Current situation	X	29,7	3,7	24,21	3,0	-19%	66,65	8,3
	Y	34,8	4,4	30,88	3,9	-11%	72,43	9,1
Waiting times	B	15,3	1,9	9,4	1,2	-39%	39,54	4,9
Floating Collection	A	14,7	1,8	10,65	1,3	-28%	42,64	5,3
	X	19,7	2,5	14,16	1,8	-28%	51,76	6,5
	Y	28,3	3,5	23,92	3,0	-16%	65,55	8,2

FIGURE 20: THE SPEED OF THE COLLECTION AND DISTRIBUTION OF LIBRARY MATERIALS

APPENDIX P: RESULTS OF THE SIMULATION RUN

2000

NMC Fleet		Total
Collected	5817	11558
Distributed	5701	

Materials transported

Throughout time Materials Total

	usr	day
B	130.2	16.3
A	148.1	17.9
X	141.5	17.7
V	100.6	20.1
AVG	143.8	18.6

Waittime End User

	usr	day
B	21.6	4.1
A	21.6	2.7
X	30.6	3.4
HL	25.6	3.2
Y	35.4	4.4
HL	34.0	4.2
AVG	26.0	3.6

Capacity of Trucks per pickup day

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

Part of Library Collection within Library

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2001

NMC Fleet		Total
Collected	6666	12883
Distributed	6334	

	usr	day
B	276.0	34.4
A	488.2	61.0
X	488.2	61.0
V	533.1	66.6
AVG	440.6	55.1

	usr	day
B	256.0	34.4
A	488.2	61.0
X	488.2	61.0
V	533.1	66.6
AVG	440.6	55.1

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2002

NMC Fleet		Total
Collected	7255	13868
Distributed	6426	

	usr	day
B	408.3	57.4
A	896.7	108.3
X	896.7	108.3
V	905.1	113.6
AVG	783.3	97.8

	usr	day
B	408.3	57.4
A	896.7	108.3
X	896.7	108.3
V	905.1	113.6
AVG	783.3	97.8

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2003

NMC Fleet		Total
Collected	7564	13931
Distributed	6957	

	usr	day
B	705.4	88.2
A	1333.7	160.5
X	1333.7	160.5
V	1344.3	164.3
AVG	1076.0	134.5

	usr	day
B	705.4	88.2
A	1333.7	160.5
X	1333.7	160.5
V	1344.3	164.3
AVG	1076.0	134.5

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2000

NMC Fleet		Total
Collected	2653	5246
Distributed	2653	

Materials transported

Throughout time Materials Total

	usr	day
B	130.2	16.3
A	148.1	17.9
X	141.5	17.7
V	100.6	20.1
AVG	143.8	18.6

Waittime End User

	usr	day
B	21.6	4.1
A	21.6	2.7
X	30.6	3.4
HL	25.6	3.2
Y	35.4	4.4
HL	34.0	4.2
AVG	26.0	3.6

Capacity of Truck

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

Verschl within Collecte

Met	B	A	X	Y
B-->	99%	4%	2%	1%
A-->	1%	99%	1%	1%
X-->	1%	1%	99%	1%
Y-->	1%	1%	1%	99%

2001

NMC Fleet		Total
Collected	3332	10524
Distributed	5291	

	usr	day
B	130.2	16.3
A	148.1	17.9
X	141.5	17.7
V	100.6	20.1
AVG	143.8	18.6

	usr	day
B	21.6	4.1
A	21.6	2.7
X	30.6	3.4
HL	25.6	3.2
Y	35.4	4.4
HL	34.0	4.2
AVG	26.0	3.6

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2002

NMC Fleet		Total
Collected	8242	14475
Distributed	8176	

	usr	day
B	130.2	16.3
A	148.1	17.9
X	141.5	17.7
V	100.6	20.1
AVG	143.8	18.6

	usr	day
B	21.6	4.1
A	21.6	2.7
X	30.6	3.4
HL	25.6	3.2
Y	35.4	4.4
HL	34.0	4.2
AVG	26.0	3.6

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

2003

NMC Fleet		Total
Collected	8242	14475
Distributed	8176	

	usr	day
B	130.2	16.3
A	148.1	17.9
X	141.5	17.7
V	100.6	20.1
AVG	143.8	18.6

	usr	day
B	21.6	4.1
A	21.6	2.7
X	30.6	3.4
HL	25.6	3.2
Y	35.4	4.4
HL	34.0	4.2
AVG	26.0	3.6

3	crates per library
15	materials per crate

Initial	Average	In process
1000	897.24	132.46
B	2500	2388.21
A	1795	1588.53
X	750	647.38
V	1398.53	897.24
AVG	2388.21	1588.53

Verschl within Collecte

Met	B	A	X	Y
B-->	99%	4%	2%	1%
A-->	1%	99%	1%	1%
X-->	1%	1%	99%	1%
Y-->	1%	1%	1%	99%

	2020				2021				2022				2023					
	NRC Fleet redistribution				NRC Fleet redistribution				NRC Fleet redistribution				NRC Fleet redistribution and 13th capacity					
# Materials transported	Collected	Distributed	Total		Collected	Distributed	Total		Collected	Distributed	Total		Collected	Distributed	Total	nc-2023		
	4013.2	4011.2	8024.4	81%	5025.7	5009.7	10035.4	49%	8007.8	8007.8	16015.6	50%	10887.1	10817.5	21704.6	83%		
Throughput time Materials Total																		
	B	1,500.95	155.12	-1%	B	1,571.53	156.48	41%	B	1,562.84	155.36	1%	B	1,500.24	154.01	0%		
	A	1,024.70	127.77	-4%	A	1,018.00	127.00	-35%	A	878.70	109.84	-3%	A	720.30	90.04	-22%		
	X	1,024.70	127.77	-4%	X	1,021.88	124.05	-11%	X	850.17	106.27	-22%	X	717.50	89.09	-28%		
	Y	1,044.70	130.59	-8%	Y	974.60	121.83	-15%	Y	834.51	103.00	-27%	Y	748.45	93.56	-34%		
	AVG	1202.8	154.3		AVG	1138.6	142.3		AVG	1008.9	128.6		AVG	938.4	117.0			
Waittime End User																		
	B	ORL	15.2	1.90	100%	B	ORL	17.02	2.20	200%	B	ORL	24.13	3.02	77%			
	A	ORL	16.1	2.01	8%	A	ORL	17.83	2.23	18%	A	ORL	22.08	2.76	49%			
	X	ORL	19.42	2.48	3%	X	ORL	19.97	2.50	3%	X	ORL	25.8	2.60	9%			
	Y	ORL	23.07	2.78	1%	Y	ORL	25.58	3.20	19%	Y	ORL	32.88	4.11	69%			
	AVG	ORL	32.54	4.07	13%	AVG	ORL	36.92	4.62	28%	AVG	ORL	45.43	5.68	59%			
	IBL	34.79	4.35	8%	IBL	35.4	4.43	9%	IBL	37.07	4.63	15%	IBL	40.32	6.17			
	AVG	23.5	2.9		AVG	25.6	3.2		AVG	31.0	3.5		AVG	43.12	5.4			
Capacity of Truck																		
	B	2100	2018.97	81.0%	B	2100	1997.22	100.7%	B	2100	1913.49	186.51	14%	B	2100	1802.79	297.21	14%
	A	1200	1115.5	84.5	A	1200	1071.63	128.3%	A	1200	1088.26	211.71	29%	A	1200	853.43	346.57	29%
	X	600	543.81	96.19	X	600	526.07	73.13	X	600	455.78	244.22	37%	X	600	381	215	37%
	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%		
	B	1500	1500	100%	B	1500	1500	100%	B	1500	1500	100%	B	1500	1500	100%	Y	Y
	A	1500	1500	100%	A	1500	1500	100%	A	1500	1500	100%	A	1500	1500	100%	X	X
	X	1500	1500	100%	X	1500	1500	100%	X	1500	1500	100%	X	1500	1500	100%	Y	Y
	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%	B	B
	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	AVG
Virechli within Collectie																		
	B	1500	1500	100%	B	1500	1500	100%	B	1500	1500	100%	B	1500	1500	100%	B	B
	A	1500	1500	100%	A	1500	1500	100%	A	1500	1500	100%	A	1500	1500	100%	A	A
	X	1500	1500	100%	X	1500	1500	100%	X	1500	1500	100%	X	1500	1500	100%	X	X
	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%	Y	1500	1500	100%	Y	Y
	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	1500	1500	100%	AVG	AVG

APPENDIX Q: RESULTS TEST SIMULATION RUNS WITH TRIPLE CAPACITY

2013				
<i>NBC (triple capacity)</i>				
		Total		
Collected	17805	35479	208%	
Distribute	17674			
	uur	dag		
B	129,6	16,2	0%	
A	141,8	17,7	-1%	
X	139,6	17,4	-1%	
Y	157,3	19,7	-2%	
AVG	142,1	17,8	-1%	
	uur	dag		
B	OBL			
A	OBL	32,2	4,0	-3%
	IBL	21,3	2,7	-2%
X	OBL	29,4	3,7	-3%
	IBL	24,4	3,1	-4%
Y	OBL	33,1	4,1	-6%
	IBL	32,9	4,1	-3%
AVG		28,9	3,6	
9	crates per Library			
15	materials per crate			
	Initial	Average	In process	
B	1000	964,01	35,99	4%
A	2500	2087,03	412,97	17%
X	1750	1278,81	471,19	27%
Y	750	444,78	305,22	41%
	B	A	X	Y
B	964,01	0	0	0
A	0	2087,03	0	0
X	0	0	1278,81	0
Y	0	0	0	444,78
1.193,66	964,01	2087,03	1278,81	444,78
	B	A	X	Y
B	100%	0%	0%	0%
A	0%	100%	0%	0%
X	0%	0%	100%	0%
Y	0%	0%	0%	100%