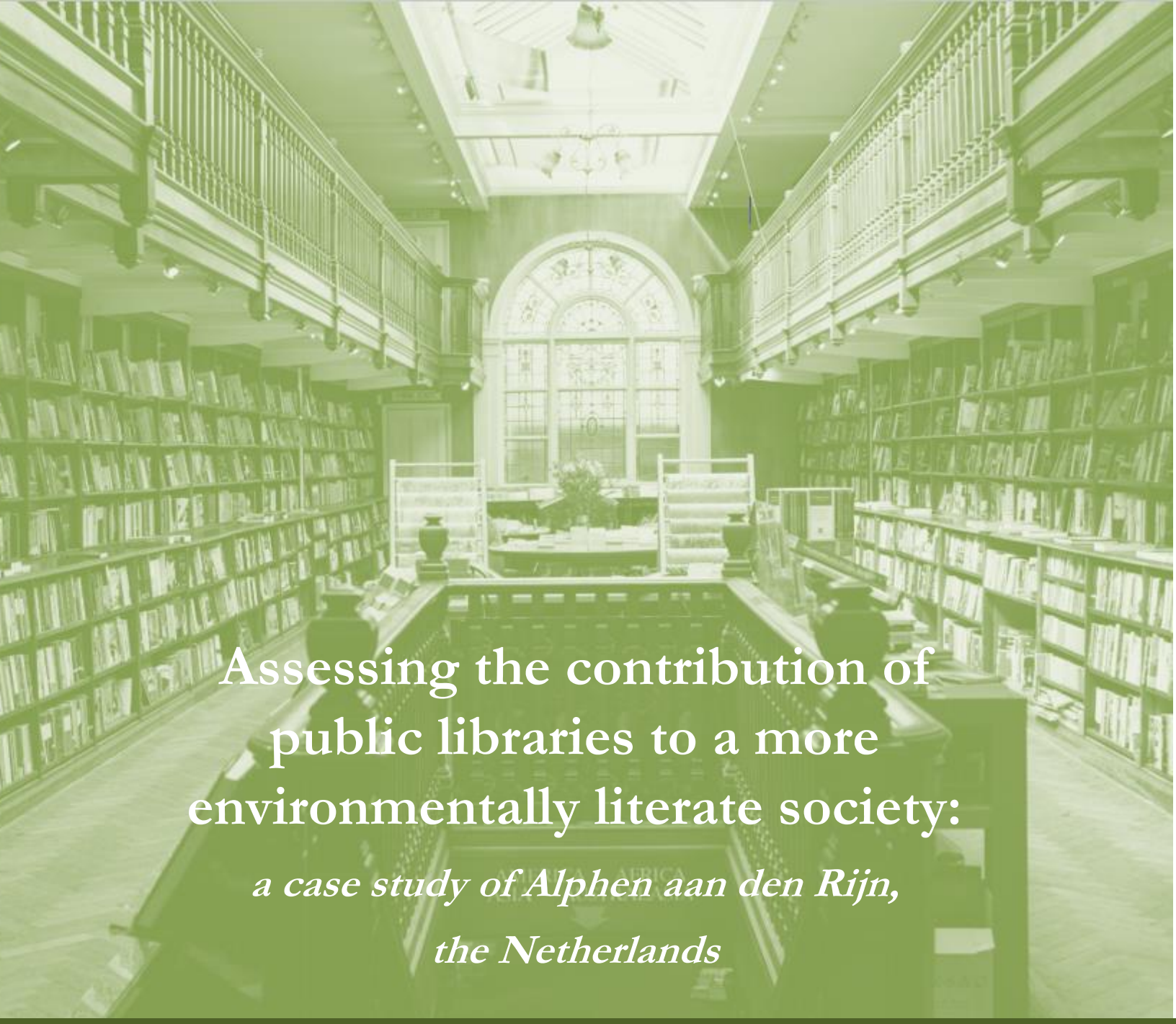

Assessing the contribution of public libraries to a more environmentally literate society:

a case study of Alphen aan den Rijn, the Netherlands

Bachelor's thesis Global Sustainability Sciences

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Abstract

The concept of public libraries itself is sustainable, as books are reused. However, public libraries could possibly contribute to a more sustainable society in other ways. Literature review shows a distinction between green libraries and sustainable libraries. Where green libraries have a sustainable building and sustainable practices, sustainable libraries include sustainability in all dimensions of their policy. This includes sustainable leadership and the organization of activities concerning sustainability. Empirical research on sustainable libraries is scarce. To decrease this lack of empirical research, the research question of this bachelor's thesis is "How can public libraries contribute to the evolution of the environmental literacy of its community?". A survey has been distributed among volunteers and employees of a local library organization in the Netherlands and analyzed using descriptive statistics, factor analysis and multiple linear regression in SPSS. This research is the first empirical study of these subjects in the Netherlands, and therefore relevant. Four underlying factors were found in the survey: opinion of the respondent, potential participation to sustainability events organized by a library, sustainability of the local library and the environmental literacy of the respondent. It was found that a gap exists between the expectations of the respondent and the actual effort of their local library concerning the contribution of local libraries to the environmental literacy of a community. Furthermore, a higher willingness to participate in sustainability events organized by a library and a more positive opinion of the respondent towards the contribution of public libraries to a more sustainable society mean a higher environmental literacy of the respondent. Moreover, the environmental literacy would be higher for a staff member compared to a volunteer. Information markets were the preferred type of event by the public. This research could provide a guideline and framework to further research. Interesting topics for future research could be the contribution of libraries to the SDGs and the involvement of social media to the success of sustainability events.

Keywords: Environmental literacy, sustainable library, green library, library knowledge innovation culture.

1.Introduction

Sustainability is a concept that is increasingly important in our lives and affecting the global community, resulting from global concerns such as climate change and the depletion of resources (Kang, 2018). The Food and Agriculture Organization of the United Nations (FAO) (2005) states that a new perspective on social change and sustainable development of communities became important as communities have become more interdependent in the present-day. Self-development of a local community is fundamental to this perspective. Therefore, according to the FAO (2005), a bottom-up approach is important to social change and the sustainability of a community (Food and Agriculture Organization, 2005). It is thus important to communicate important insights in sustainability to local communities to increase their environmental literacy, the capability to apprehend the health of an environmental system and to act to maintain or restore this environmental system (Kurbanoğlu & Boustany, 2014). In this way, bottom-up change could be enabled.

There are many methods to encourage environmental literacy, for instance through education, story-telling to children and even fashion (Hadzigeorgiou & Judson, 2017; Holgar, Foth, & Ferrero-Regis, 2009; Nazarenko & Kolesnik, 2018). Libraries can also form a means to increase the environmental literacy of a local community. Libraries form hubs of knowledge and provide resources for a community to learn and grow (Miller, 2010). They could therefore contribute to the communication of insights to the broader public. In fact, Miller (2010) states in her book *Public libraries going green* that "As learners need change, so do public libraries. (…) public libraries are challenged with the new role of connecting the public with environmental awareness and education." (p.7). In the United Nations Agenda, libraries, as educational institutes, are encouraged to contribute to achieving the Sustainable Development Goals (SDGs). Thus showing that libraries could indeed contribute to the environmental literacy of a community (United Nations, 2015). Subsequently, the International Advocacy Programme was developed by the International Federation of Library Associations (IFLA) in 2016. This programme was meant to increase the environmental literacy of librarians and to encourage the contribution of libraries to the SDGs (International Federation of Library Associations and Institutions, 2016). Environmental literacy of librarians is fundamental to a sustainable library. Sustainable management is an ethic consideration that should be embedded within all staff members of an organization (Kang, 2018). It is therefore important to raise environmental literacy among

librarians in order for sustainable management of a library to be feasible. Furthermore, librarians act as key representatives and educators towards volunteers and the community (Kang, 2018).

The amount of scientific literature concerning this topic is relatively scarce, but growing (Antonelli, 2008). Most literature is available on the Green Library Movement and the environmental sustainability of a library. According to Beutelspacher and Meschede (2020) the Green Library Movement has been active since the 1990's and according to Suresh Kumar and Sofiya (2019) started becoming popular within the library profession since 2003.

However, there is no consensus among authors about the definition of a green library, some include only the sustainability of the building and green practices whereas other authors also include providing information on sustainability, counseling and events. Therefore, it is useful to distinguish between a green library and a sustainable library, as proposed by Karioja (2013), Federowicz-Kruszewska (2019) and Rowley (2019). Where a green library embodies a green building and green practices, a sustainable library also embodies sustainable leadership, environmental literacy of the staff, counseling and events (Karioja, 2013; Federowicz-Kruszewska, 2019). Green libraries are easily and often discussed, as there are existing frameworks and certificates.[1] However, a sustainable library is less commonly discussed (Kang, 2018). A few case studies about sustainable libraries can be found. Dragaš performed two studies in Croatia, where he provided examples of green libraries and an overview of green programs that arose from the cooperation between Croatian libraries (Dragaš, 2018; Dragaš & Ercegovac, 2020). Dias (2017) and Sonkkanen, Asikainen, and Sahavirta (2012) send questionnaires to municipal libraries, respectively in Portugal and Finland, focused on sustainable practices within the libraries. Both studies consisted of five similar sections; environmental management, financial management, the library's environmental impact, environmental communication and environmental awareness (Dias, 2017; Sonkkanen et al., 2012). Akbulut et al. (2018) sent a survey to academic librarians in Turkey and they found that "Although librarians have a low level of perception and awareness in green libraries and environmental sustainability issues, they have positive opinions about the initiatives promoting education and awareness" (p. 205). Ghorbani, Babalhavaeji and Nooshinfard, (2016) conducted interviews with 12 experts in library and information science and sustainability in Iran to design a framework for sustainable development in libraries in Iran. They developed a conceptual model in which sustainable management in libraries is affected by context, causal conditions and intervening conditions (Ghorbani et al., 2016).

[1] See for example (Datta, 2015; Ephraim, 2003; Olsen, 2011; Suresh Kumar & Sofiya, 2019).

These studies have in common that they investigate sustainable libraries in a specific region, but the focus of the studies differs. Beutelspacher and Meschede (2020) identify a lack of empirical studies concerning sustainable libraries and thus performed a study among librarians in Germany. A study among librarians in the Netherlands is absent. The organization of libraries in Twente (region in the Netherlands) used a panel among the community to research if the community practices environmental literacy at home, whether they find it important for the library itself to be sustainable and if they find it fitting for a library to provide information about sustainability (ProBiblio & BiebPanel, 2018). This study addresses the willingness of the community to attend sustainable events and accumulate information about sustainability. However, the topic of this research is limited and does not address the importance of librarians and events in raising environmental literacy. This study will attempt to contribute to decreasing the lack of empirical research by performing a case study of a library organization in the Netherlands. The research question is therefore: "How can public libraries contribute to the evolution of the environmental literacy of its community?". To be able to answer the research question, the following sub-questions have been formulated:

1. How environmentally literate are librarians and volunteers and how do they perceive the contribution of public libraries to sustainability?
2. Can events focused on sustainability be used to stimulate environmental literacy?

2.Theory and Concepts

2.1 Library

Among the core purposes of a library are the access to information, lending books and teaching people skills such as writing skills, digital skills and information literacy, the ability to accumulate and evaluate information to solve a certain problem (Kang, 2018). According to Karioja (2013), a library consists out of 4 main compartments: the collection (books, e-books), the devices (computers, copying machine), staff (librarians and management) and space (meeting rooms and study areas). Karioja (2013) states that users interact, with all four of these components and that these interactions, mainly the interaction between staff and users, could aid the environmental literacy of the users. Furthermore, Beutelspacher and Meschede (2020) indicate that the concept of a library is sustainable by itself, as customers borrow books rather than buying them.

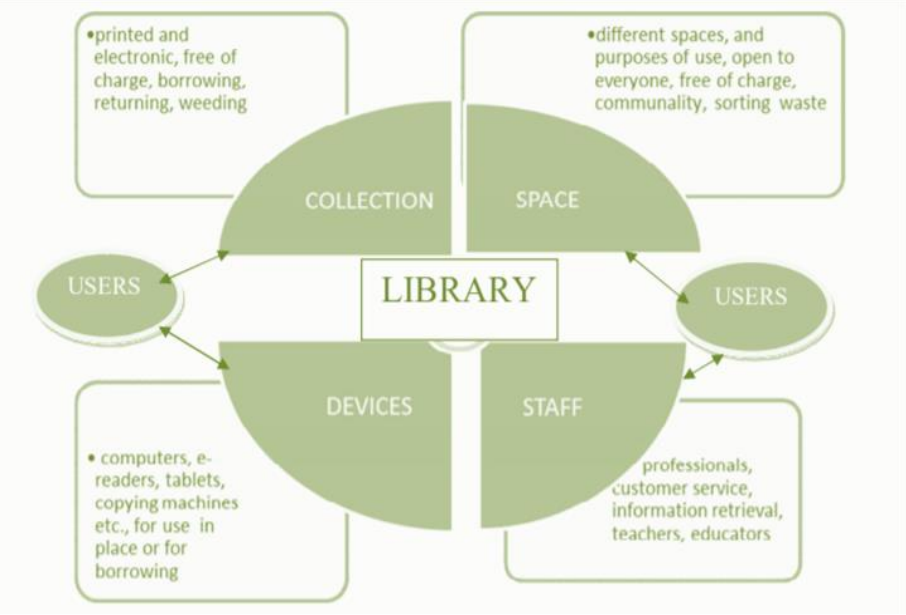

Figure 1: The four basic components of a library and their interaction with users (Karioja, 2013).

2.2 Environmental Literacy

Environmental literacy has been defined differently by different authors (McBride, Brewer, Berkowitz & Borrie, 2013). According to Roth (1992), environmental literacy is "essentially the degree of our capacity to perceive and interpret the relative health of environmental systems and to take appropriate

action to maintain, restore, or improve the health of those systems." (p. 5). McBride et al. (2013) identify three main objectives of environmental literacy: the development of problem-solving skills, developing ethics and adopting environmentally responsible behavior. Kurbanoğlu and Boustany (2014) state that environmentally illiterates are more aware of the impact of their actions on the environment by having basic understanding of the environment and sustainability, causing more environmentally responsible actions and thus protecting nature. In Educational Sciences, the *biophilia hypothesis* indicates that humans carry an intrinsic emotional relationship with nature and living organisms and that children are born with this bond (Hadzigeorgiou & Judson, 2017). It is generally believed that this bond of children with nature is where environmental literacy originates (Hadzigeorgiou & Judson, 2017). However, this bond between children and nature is not always strong; it can be weak as a result of the strong technological aspect of our world. Therefore, Hadzigeorgiou and Judson (2017) state that indirect experience with nature through education is important for the development of environmental literacy. Libraries can contribute to this indirect experience with nature and teach problem-solving skills and ethics required for environmental literacy.

2.3 Green library and sustainable library

The introduction briefly touched upon the subject of green and sustainable libraries and the distinction between these two. Many authors use these terms interchangeably which is not acceptable according to Fedorowicz-Kruszewska (2019). Therefore, both concepts will be discussed below.

The concept of a green library is most often discussed and concerns a green approach to the management of a library (Ephraim, 2003). It involves reducing the negative impact of a library on the environment by employing measures to increase the sustainability of the building and by green practices (Fedorowicz-Kruszewska, 2019). A library itself can be more sustainable by reducing the consumption of resources such as water and electricity (Suresh Kumar & Sofiya, 2019). Green practices are for instance: separating waste, recycling materials (such as books) and minimizing paper use (Kurbanoğlu & Boustany, 2014).

A sustainable library, however, concerns not only the environmental dimension similar to a green library, but also the social dimension (providing knowledge and safe work and study environment) and the economical dimension of sustainability (human potential development) (Fedorowicz-Kruszewska, 2019). Karioja (2013) developed a framework of concepts affecting the sustainability of a library, see Figure 2. Figure 2 shows that one area of sustainable management of a library concerns the environmental awareness, which is the same as environmental literacy, of

librarians and the community. This can for instance be achieved by organizing events such as markets, lectures and question and answer sessions. Some Dutch examples of these events are respectively a sustainability market in the library of Alphen aan den Rijn, a lecture about sustainable gardening in the library of Oss and a walk and talk in Alphen aan den Rijn about a sustainable home (De Bibliotheek Rijn en Venen, n.d.-a; De Bibliotheek Rijn en Venen, n.d.-b; De Bibliotheek NOBB, n.d.). Other aspects of a sustainable library are sustainable management, digitalizing the collection and the availability of books concerning sustainability. Ghorbani et al., (2016) found that the library community, nature of library, role of librarians, function of library, library infrastructure, standards implementation, and environmental management are important concepts to sustainable management in libraries.

In this study, the concept of a sustainable library will be used to address the overall sustainability of a library. The concept of a green library is seen as part of a sustainable library and includes a sustainable building and green practices. Other aspects of a sustainable library are sustainability events as defined above, environmentally illiterate librarians, sustainable management and the collection management (Karioja, 2013).

***Figure 2**: Concepts affecting the sustainability of a library (Karioja, 2013).*

2.4 Library Knowledge Innovation Culture

A library needs the intellectual capital of librarians to create sustainable innovations. Some aspects of sustainable management of a library have been discussed in section 2.3. However, innovation within a library is also important for sustainable management. Innovation could bring about new ideas, strategies and concepts to improve the sustainability of a library. Innovation takes place through knowledge creation: "Library knowledge management (…) is a process of capturing, organizing and making knowledge resource work" (Niu, Wang, Han, & Jiao, 2015, p. 156). Innovations are created through this process of accumulating and applying new explicit knowledge, knowledge that is easily accessible, and tacit knowledge, codified knowledge created by experience that is hard to transfer (Niu et al., 2015). Sheng and Sun (2007) discuss the related concept *library knowledge innovation culture (KIC)*. KIC can be defined as "a kind of value, behavior and institutional system, which gains competitive advantages and sustainable development of libraries through knowledge creation" (Sheng & Sun, 2007, p. 37). Sheng and Sun (2007) also state that a library itself cannot create knowledge, it needs its employees and their knowledge sharing and creation for this purpose.

2.5 Conceptual framework

Figure 3 shows how the key concepts of this study, discussed in the sections above, relate to one another. It shows how the three components, library, librarians and community, influence each other. Both top-down and bottom-up effects are displayed.

The first component is the library itself. The sustainability of a library can be measured using different frameworks.[2] The library can affect the environmental awareness of librarians by organizing staff events, such as online courses or workshops concerning sustainability, and by providing a healthy library knowledge innovation culture to allow librarians to accumulate and build on knowledge (Sheng & Sun, 2007). The library can also organize events in a top-down manner for the community to stimulate environmental literacy by providing information and teaching skills.

Librarians can affect the environmental literacy of the community through their role as educators of the public (Kang, 2018). This takes place for example by providing information regarding sustainability (by answering questions, providing the right books) and by organizing events in a bottom-up manner within the library (if the library allows this).

[2] See for example (Datta, 2015; Ephraim, 2003; Olsen, 2011; Suresh Kumar & Sofiya, 2019).

The community can affect the environmental literacy of librarians by attending events and sharing information. An example is an event organized in the library of Oss about sustainable gardening where the organization "Stadse Boeren", which is an organization consisting of local citizens, provided knowledge (De Bibliotheek NOBB, n.d.).

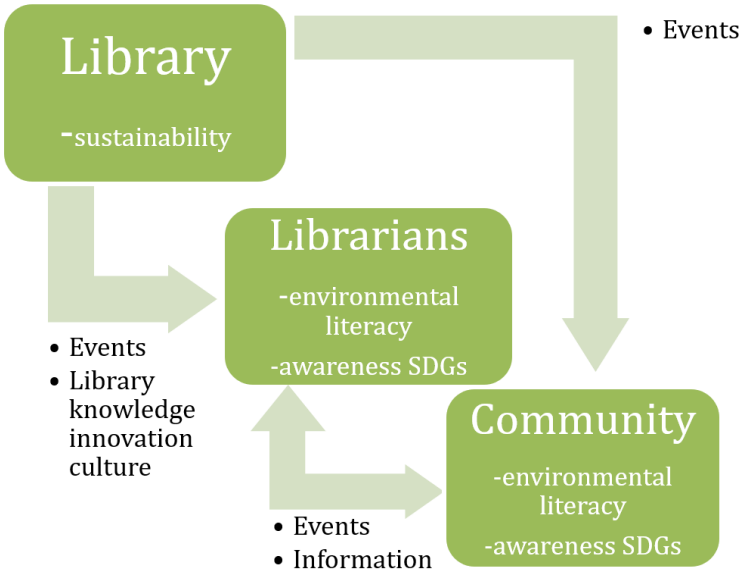

***Figure 3**: The conceptual framework illustrating relationships between the key concepts.*

2.6 Analytical Framework

The sections below will operationalize the concepts of Figure 3 before they can be analyzed.

2.6.1 Library

This component has been included in three parts in the survey. First, the local library of the respondent will be evaluated as a green library, based on the sustainability of the building and green practices of the library. The questions are formulated based on the surveys by Dias (2017) and Sonkkanen et al. (2012). Second, the library will be graded as sustainable library. The library knowledge innovation culture is a part of this, based on the article *A Review of Library Knowledge Management Research in China* by Li et al. (2015).Third, the potential impact of events organized by the library on the environmental literacy of librarians and the community has been incorporated in a part about events, based on the surveys from Beutelspacher and Meschede (2020), Dias (2017), ProBiblio and BiebPanel (2018) and Sonkkanen et al. (2012).

2.6.2 Librarians and the community

The community is represented by volunteers within this study, as volunteers are citizens helping out only a few hours a week in the library. They can therefore be regarded as a bridge between librarians and the community and representing the opinion of the community. Volunteers and librarians are asked questions in the survey to measure their environmental literacy and awareness of the SDGs. These questions are based on the survey designed by Hiramatsu, Kurisu, and Hanaki (2015). Last, they are asked for their opinion on the contribution of libraries to the availability of sustainable information.

3.Method

3.1 Digital survey

A digital survey has been used to answer the two sub-questions of this study:

1. How do librarians and volunteers perceive environmental literacy and the contribution of public libraries to sustainability?
2. Can events focused on sustainability be used to stimulate environmental literacy?

The digital survey, alias self-completion questionnaire, is a web questionnaire spread by email and digitalized using Qualtrics. The sampling method that has been used for the survey is convenience sampling, meaning that the sample is chosen by the researcher on account of its accessibility (Bryman, 2012). The survey will be spread by email among librarians and volunteers of the library organization *Bibliotheek Rijn en Venen*. This library organization embodies 10 libraries located in the municipality Alphen aan den Rijn and two surrounding municipalities. The researcher is involved with this library organization and thus has access to the required database, hence the convenience sampling. The sample size in total is 40 staff members and 187 volunteers.

To validate that the survey is embedded within and comparable to existing literature, the survey will be formulated based on existing surveys. The contents of the survey, as already briefly discussed in the Analytical framework section, are divided in the following sections : consent form, general information, environmental literacy, opinion, event participation, green library and sustainable library. In the environmental literacy part, respondents will be provided with statements concerning their environmental literacy, based on the statements used by Hiramatsu et al. (2015), and concerning their participation to sustainable foundations and activities such as tree planting, based on Abbas (2014). The opinion section is split in three subsections: the contribution of libraries to a more sustainable society, green libraries and sustainable libraries. This section is based on research from Beutelspacher and Meschede (2020), Dias (2017), ProBiblio and BiebPanel (2018) and Sonkkanen et al. (2012). The section about event participation is split in three parts: participation, promotion and preferred type of event. In the part about a green library respondents are asked to evaluate their library. This part has been based on the surveys by Dias (2017) and Sonkkanen et al. (2012). In the part covering sustainability, respondents are asked to evaluate the sustainability of their library, based on Li et al. (2015) and Sheng and Sun (2007).

The survey is included in Appendix A. Most questions are Likert scale questions, ranging from 1 to 5, 1 indicating strong agreement and 5 indicating strong disagreement. The survey has been digitalized and translated to Dutch. The Dutch survey has been optimized by performing a pilot study with a former librarian of the researched library organization. As a result, some spelling errors were corrected and some questions were reformulated.

Data collected from the digital survey is primary, quantitative data (Bryman, 2012). It is therefore possible to statistically analyze this data. First, factor analysis will be executed to see which variables build up in the responses and how they correlate to the theory. Moreover, a multiple linear regression analysis will be performed based on the factors provided by the factor analysis, to see how the environmental literacy of the respondent could be affected by the factors.

3.3 Ethical consideration and data management

Ethical principles will be carefully considered in this study, as the survey involves human participants. Bryman (2012) identifies 4 main ethical issues when participants are involved: harm to participants, lack of informed consent, invasion of privacy and deception. First, no disturbing questions are included in the survey, no personal data is required and the survey will be anonymous. Second, there is an informed consent form at the beginning of the survey with information about the survey and how data will be handled. The consent form is included in Appendix A. Third, the data is stored and accessed on a password protected laptop. Qualtrics, the program used to digitalize the survey and accumulate the data, has strict safety and privacy regulations. Last, to avoid deception of participants, in the email sent to participants and the informed consent form, it is clearly stated what the purpose of the research is, how data is handled and how privacy is protected.

4. Results

A total of 94 responses of staff members and volunteers have been collected out of the 227 surveys sent. Nine responses were removed from the sample as they were not usable since four (10% of the survey) or more questions were not answered. Leaving a sample size of n=85, the response rate is 37.4%. The response rate is significantly higher among staff members (77.5%) compared to volunteers (28.9%).

First of all, the factor analysis will be discussed in section 4.1. Descriptive results will be discussed in Section 4.2, based on the analytical framework and the factors established by the factor analysis. Section 4.3 will discuss the multiple linear regression model.

4.1 Factor analysis

Before factor analysis can be performed, suitability of the data has to be confirmed. First of all, the sample size should be sufficient. A sample size of at least 200 is usually preferred. The sample size of this research is only 85. However, the sample size is sufficient according to the Kaiser-Meyer-Okin measure of sampling adequacy (KMO). A value of 0.702 was found for the KMO. Since this is larger than 0.6, the sample size is sufficient to reliably extract factors. Another prerequisite is a significant value of the Bartlett's test of sphericity. As this value is found to be 0.00, this prerequisite is met. Furthermore, performing a factor analysis is meaningful as there is at least one correlation between two variables larger than 0.3. Thus, factor analysis is suitable for this survey. The extraction method of the factor analysis used in this research is Principal Axis Factoring (PAF). This is preferred over the Maximum Likelihood extraction method as the data of the variables is not normally distributed as results for the Kolmogorov-Smirnov test for normality are significant, indicating non-normality, for all variables. Furthermore, Oblique rotation is preferred over Orthogonal rotation as the correlation matrix shows a correlation above 0.3 for some variables (Field, 2005).

4.1.1 Preparation

The first run of the factor analysis creates nine factors. However, this is a high amount of factors for the 32 variables that are included in the factor analysis (general questions such as age and education level are left out). The scree plot, presented in Figure 4, shows two places where the line levels off. The line first levels off around factors three and four and then around factor eight. Therefore, the factor analysis has also been run limiting the amount of factors to three, four and eight factors. The factors were the most logically ordered and easy to interpret for the factor analysis limited to four factors. Moreover, the first four factors happen to be all factors with an eigenvalue above 2. Therefore, a factor analysis using the PAF extraction method, oblique rotation and limited to four factors has been used.

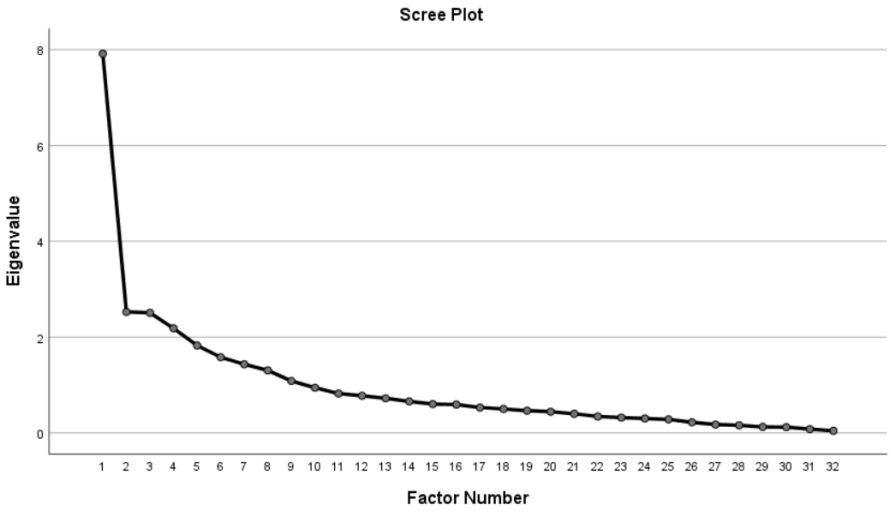

***Figure 4**: Scree plot of factor analysis using the PAF extraction method and oblique rotation.*

4.1.2 Factors

The four factors explain 38.4% of the total variance in the data. Factor 1 has the most variables and has the largest eigenvalue and contribution to the total variance explained. Table 1 shows to which factor variables from the survey belong and that the factors generally do not overlap. The variables are provided with short names, the full questions can be found in appendix B. A majority and the three highest loading variables of factor 1 consist of questions about the opinion of the respondent on green and sustainable libraries. Therefore, this factor can be seen as the opinion of the respondent on green and sustainable libraries and their contribution to a more sustainable society. This can be called *Opinion*. Factor 2 only includes variables concerning the potential participation of the respondent to a lecture or event in a library. It can therefore be seen as the willingness of the respondent to

participate in sustainability events organized by a library, in short *Participation*. The three highest loading variables and the majority of the third factor concern the evaluation of green and sustainable practices of the library where the respondent is employed. Thus, this factor can be named *Sustainable library*. Factor 4 includes all variables regarding the environmental knowledge and current participation in sustainable activities of the respondent and can therefore be called the *Environmental literacy* of the respondent.

These four factors correlate to the rough layout of the survey. The survey was divided into the following parts: environmental literacy, current participation, opinion about the contribution of public libraries to sustainability, opinion about green libraries, opinion about sustainable libraries, the desire to learn about sustainability, event participation, event promotion, preferred type of event, green library and sustainable library. The four factors could be seen as overarching factors of the different survey parts. How the factors relate to this theoretical framework has been summarized in Table 2.

Table 1: *Variables per factor, sorted by highest to lowest loading on the factor. Variables are provided with short names, the questions from the survey belonging to these names can be found in appendix B.*

Factor 1	Factor 2	Factor 3	Factor 4
Opinion activities	Lecture library	Green library	Current activities
Opinion lectures	Sustainability event	Information staff	Membership
Opinion books	Sustainability lecture	Green practices	SDGs
Opinion information staff	Event library	Books sustainability	Current lectures
Opinion information provision	Promotion	Separation	Knowledge
Opinion green practices	Desire to learn	Sustainability events library	Importance
Opinion society			Food
Opinion green libraries			Green Library Movement
Opinion knowledge staff			
Opinion initiative			
Initiative			
Knowledge sharing			
Preferred event			

Table 2: *The four factors overarching the different parts of the survey and individual variables*

Factor	Part of the survey
Environmental literacy	Importance of sustainability
	Environmental literacy (knowledge)
	Participation in current activities
Opinion	Opinion about the contribution of public libraries to a more sustainable society
	Opinion about green libraries
	Opinion about sustainable libraries
Participation	Desire to learn about sustainability
	Event participation
	Event promotion
Sustainable library	Green library
	Sustainable library

4.1.3 Reliability

To evaluate the reliability of this model, a reliability analysis has been performed for each factor using Cronbach's Alpha, a measure of internal consistency and reliability. A value of 0.7 or higher for Cronbach's Alpha is considered acceptable and thus reliable. Factor 1 (0.817), Factor 2 (0.896) and Factor 4 (0.690) are reliable factors. However, Factor 3 has a Cronbach's Alpha of only 0.544, which is a poor reliability score.

4.2 Descriptive results

First, the correlation between the factors have been calculated using SPSS, as can be seen in Table 3. A level of 0.1 for significance has been used, as the sample size of the research is relatively small. The table shows a small significant association between the factors *Opinion* and *Environmental literacy* and *Participation* and *Environmental literacy*. There is a medium significant association between *Opinion* and *Participation*.

Further descriptive statistics were analyzed for each of the 40 questions of the survey by creating frequency tables and bar charts to plot the differences between staff members and volunteers. Results for all questions can be found in Appendix C. Furthermore, the median has been obtained for each part of the survey design and for each of the four factors established by factor analysis and have

been visualized in Figure 5. Table 4 shows results for a selection of questions of the survey. The results of figure 5 and table 4 will be discussed in the sections 4.2.1 and 4.2.2.

Table 3: *Correlations between the factors Opinion, Participation, Sustainable Library, Environmental literacy and dummy variable staff.*

	Opinion	Participation	Sustainable library	Environmental literacy
Opinion	1	0.305*	0.061	0.245*
Participation	0.305*	1	-0.057	0.255*
Sustainable library	0.061	-0.057	1	0.053
Environmental literacy	0.245*	0.255*	0.053	1

*Significant at 0.1 level

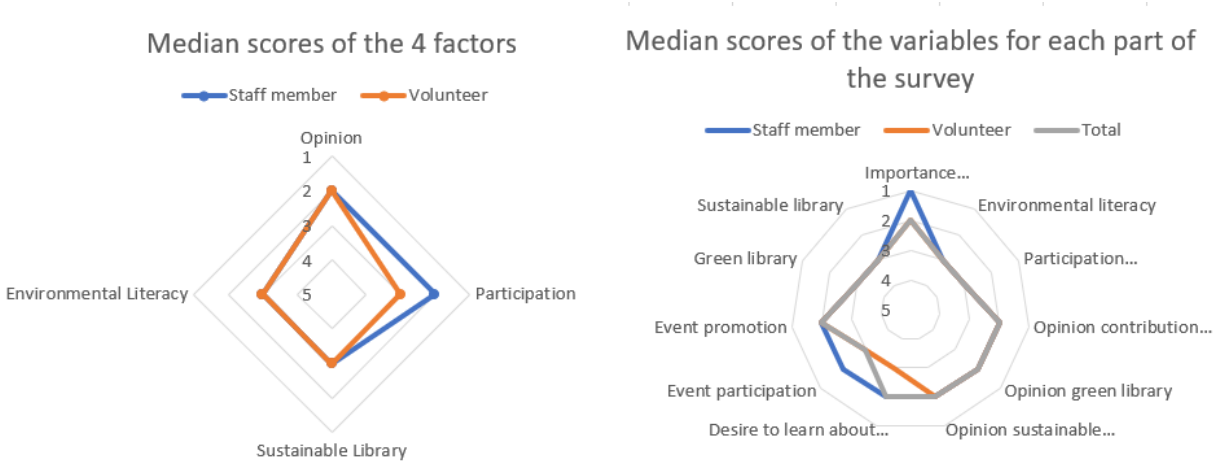

Figure 5: *Median score of all variables comprising the four factors of the factor analysis (left) and the different parts of the survey (right). Scores range from 1 (totally agree) to 5 (totally disagree).*

Table 4: *Results per question of the survey in percentages. Questions are presented with short names, the full questions belonging to these names can be found in Appendix B.*

Question name	Total	Totally agree	Agree	Neutral	Disagree	Totally disagree	Staff	Volunteer
Job type							36.5%	63.5%
Age <25	2.4%							
Age 26-35	7.1%							
Age 36-45	10.6%							
Age 46-55	15%%							
Age >55	65.9%							
Low education	41.2%							
Middle education	42.9%							
High education	15.5%							
Importance		47.1%	48.2%	4.7%	0.0%	0.0%	100% (totally) agree	92% (totally) agree
SDGs		5.9%	24.7%	24.7%	34.1%	10.6%	42% (totally) agree	24.1% (totally) agree
Opinion society		24.4%	64.6%	11.0%	0.0%	0.0%		
Desire to learn		7.1%	49.4%	38.8%	4.7%	0.0%	71.0% (totally) agree	48.1% (totally) agree
Promotion		16.5%	62.4%	20.0%	1.2%	0.0%	93.6% (totally) agree	70.4% (totally) agree
Preferred event	61.3% prefers an information market							
Information staff		1.2%	6.0%	39.8%	44.6%	8.4%	3.3% (totally) agree	6.7% (totally) agree
Sustainability events library		17.6%	34.1%	25.9%	18.8%	3.5%	77.4% (totally) agree	37.0% (totally) agree
Initiative		11.8%	61.2%	2.9%	1.2%	0.0%	74.2% (totally) agree	62.2% (totally) agree
Knowledge sharing		3.5%	45.9%	42.4%	8.2%	0.0%	45.2% (totally) agree	51.9% (totally) agree

4.2.1 Librarians and community

A majority of the respondents is aged 55 and older, 65.9% of all respondents. Most of the respondents have a low or middle education (84.1%).

The median score of all respondents on the factor *Environmental literacy* is 3 (neutral). 95.3% of staff members and volunteers agree that sustainability is important to them. The median among staff members is 1 (Totally agree) whereas the median among volunteers is 2 (agree), this can be seen in the right graph of Figure 5 under *importance*. However, the overall median scores for the survey parts about environmental literacy and current participation are relatively lower, namely 3 for all groups. Among staff members, 42% is familiar with the SDGs. Among volunteers, this is 24.1%.

The median for the factor *Opinion* is 2. The graph on the right side of Figure 5 also shows that the median for all 3 survey parts of opinion questions is 2.

The median for the factor *Participation* of the respondent is 3 for volunteers and 2 for staff members. 56.5% of the respondents would like to learn more about sustainability. This is relatively higher for staff members (71%) compared to volunteers (48%). The median for the promotion of events is 2 among all respondents. A majority would inform acquaintances about sustainability events within a library (78,8%). The preferred type of event is an information market (57.6%).

4.2.2 Library

Figure 5 shows that the median for the factor *Sustainable library* is 3. It also shows that this is the case for the survey parts of both the green and sustainable aspects of the library where the respondent is employed. Only 7.2% agrees that their library informs how to be more sustainable at work. Respondents were also asked to give examples of green practices of their library if the question about green practices in their library was answered positively (score 1 or 2). The most occurring answer is the separation of waste. Other answers that were given more than once are the recycling or reuse of old books and no plastic coffee cups. A majority (62%) agrees that they are allowed to share their own ideas in the work environment and 42% agrees that staff members and volunteers share knowledge among one another.

4.3 Multiple linear regression

A multiple linear regression analysis can be performed based on the four factors established in the factor analysis to see how the environmental literacy is affected by the other factors. A dummy variable (*staff*) has been included for the job type of the participant, where staff member is coded as 1 and volunteer as 0. The research question is how libraries can contribute to the environmental literacy of a community. Therefore, the factor *Environmental Literacy* can be seen as the dependent variable. The analysis consists of 5 models; model 1 consists only of the dummy variable *staff*, model 2 of *staff* and *Opinion*, model 3 of *staff* and *Participation*, model 4 of *staff* and *Sustainable Library* and model 5 consists of *staff*, *Opinion*, *Participation* and *Sustainable library*. The result can be seen in Table 5.

Table 5 shows that the coefficients for model 1 and 4 are not significant at the 0.1 level. In model 2, the coefficient for *Opinion* is significant and the R^2 is 0.086. In model 3, the coefficient for *Participation* is significant and the R^2 is 0.089, approximately similar to the R^2 of model 2. The regression equation of model 2 is *Environmental literacy*= -0.111 + 0.272*opinion*, and the regression equation for model 3 is *Environmental literacy*= -1.077 + 0.408*participation*. In model 5, the coefficients for *staff*, *opinion* and *participation* are significant. The R^2 is 0.142. The higher the, R^2, the better the model fits the data. Model 5 is the only model with more than one significant coefficient and suits the data best. The regression equation of model 5, according to the table: *Environmental literacy*= -0.958 + 0.401*staff* + 0.211*opinion* + 0.340*participation*.

Table 5: *Results of multiple linear regression with Environmental Literacy as the dependent variable for 5 different models.*

Model number	Independent variables	Coefficient	Probability	Standard Error	R^2	Number of cases	Constant
Model 1					0.007	76	-0.057
	Staff	0.155	0.461	0.209			
Model 2					0.086	76	-0.111
	Staff	0.302	0.155	0.210			
	Opinion	0.272	0.015*	0.109			
Model 3					0.089	76	-1.077
	Staff	0.286	0.173	0.208			
	Participation	0.408	0.013*	0.160			
Model 4					0.012	76	-0.063
	Staff	0.172	0.420	0.212			
	Sustainable Library	0.066	0.575	0.117			
Model 5					0.142	76	-0.958
	Staff	.401	0.063*	0.212			
	Opinion	0.211	0.059*	0.110			
	Participation	0.340	0.041*	0.163			
	Sustainable Library	0.401	0.450	0.112			

* Significant at 0.1 level

5. Discussion

The conceptual framework of this research consists of three components: library, librarians and community. Figure 3 showed how these components were related. It was discussed that libraries can affect the environmental literacy of librarians and of the community by providing information and organizing events. Librarians could affect the environmental literacy of the community through their role as educators of the public (Kang, 2018). These components have been operationalized by creating the different parts of the survey and making this survey available to librarians and volunteers, who represent the community. The factor analysis provided four factors underlying this survey: *Environmental literacy*, *Opinion*, *Participation* and *Sustainable Llibrary*. Table 2 showed how these factors relate to the different parts of the survey. However, how do these factors relate to the conceptual framework provided in Figure 3? The factor *Environmental Literacy* serves to measure the environmental literacy of the librarians and community, as well as their awareness of the SDGs. The factor *Participation* serves to assess the feasibility of events organized by a library to enhance the environmental literacy of librarians and the community. The factor *Sustainable library* indicates the sustainability of the library itself, events organized to enhance environmental literacy of librarians and its KIC. The multiple linear regression then provides an equation to show how the different factors affect the environmental literacy of librarians and the community (represented by volunteers). This will be further discussed in the sections below, based on the research questions.

5.1 How environmentally literate are librarians and volunteers and how do they perceive the contribution of public libraries to sustainability?

First of all, it was found that most participants state that sustainability is important to them (95.3%). However, the score for the environmental literacy and current participation of all respondents was relatively low. This indicates that even though the respondents state to find sustainability important, a majority does not live up to this expectation when focused on knowledge and participation. Specifically the familiarity with the SDGs is low, only 24.1% among volunteers. Among staff members it is somewhat higher, 42%. It has to be pointed out that a question such as the importance of sustainability to the respondent could be seen as a rhetorical question and urge respondents to answer positively. Therefore, this interpretation has to be considered carefully. Respondents were positive about the contribution of public libraries to a more sustainable society, 89% agreed with this

statement. Respondents also generally agree with the statements that public libraries should be green and sustainable. These results correspond to what Akbulut et al. (2018) found in Turkey. They found that the environmental literacy of librarians is low, but they also found positive opinions about sustainability events among librarians in Turkey. In this research, environmental literacy of librarians (and volunteers) was found to be relatively low and librarians are in general positive about the contribution of libraries to a sustainable library and sustainability events organized by the library.

The researched libraries do not score relatively high on being green and sustainable. Respondents were the most positive about the green practices of the libraries, mainly referring to the separation of waste and recycling of old or damaged books. However, a lot of progress could be made by educating the staff members about sustainable practices at work. Furthermore, the KIC of the researched libraries is questionable. A majority of the respondents indicate that their input in work processes is appreciated, but most also indicate that knowledge is not shared among colleagues. Beutelspacher and Meschede (2020) stress the importance of leadership to green a library. This leadership could provide the right atmosphere to share and build on knowledge as intended with the KIC of libraries formulated by Sheng and Sun (2007). The right leadership and KIC could stimulate innovation to facilitate a greener and more sustainable library.

Thus, a gap can be identified between the opinion of respondents on the importance of sustainable libraries and the actual rating of the researched libraries. The opinion of respondents scored relatively higher than the rating of their own library (median 2 versus 3). This gap has previously been identified by Beutelspacher and Meschede (2020) in Germany. They found that German librarians rated the potential of libraries to promote sustainability relatively higher than the actual efforts by the libraries.

5.2 Can events focused on sustainability be used to stimulate environmental literacy?

Only a slight majority of the respondents is interested in learning more about sustainability and taking part in events concerning sustainability, despite indicating that sustainability is important to them. There is thus some resistance. Staff members are relatively more interested in learning about sustainability and events concerning sustainability than volunteers. A large majority of the respondents would however inform acquaintances about events within their library. An information market is the preferred type of event by the participant. Therefore, public libraries could be advised to focus on this type of event. The study by Probiblio and Biebpanel (2018) found that among the customers of the

libraries in Twente and in the Netherlands in general, a lecture on a sustainable subject is preferred over markets and specific activities. It is remarkable that in this research the market and specific events are preferred over a lecture. This could possibly be explained by the structural difference in participants. Probiblio and Biebpanel (2018) used a panel among visitors of libraries whereas this study used a survey among volunteers and staff members. The involvement of librarians and volunteers with the library could have influenced their opinion because of past experiences in the library. Moreover, Probiblio and Biebpanel (2018) included a larger share of relatively young participants in their research, which could also have cause the difference in the results as the share of young participants is relatively low in this research.

A small and significant positive association was found between the factors *Environmental literacy* and *Participation*. This indicates that higher willingness to participate in sustainability events in a library corresponds to a higher environmental literacy of the respondent. Model 3 of the multiple linear regression provided the following regression analysis: *Environmental literacy*= -1.077 + 0.408*participation*. This shows that an increase of 1 in *Participation* would increase *Environmental literacy* with 0.408. In the complete model, model 5, *Participation* also contributes to the *Environmental literacy*, although relatively less: *Environmental literacy*= -0.958 + 0.401*staff* + 0.211*opinion* + 0.340*participation*.

5.3 How can public libraries contribute to the evolution of the environmental literacy of its community

Together, the answers to the sub-questions, formulated in the previous two sections, can answer the research question. In the literature review, it was found that libraries can contribute to the environmental literacy of their community by providing indirect experience with nature and teaching problem-solving skills. In order to provide these in the context of lectures and activities concerning sustainability, a library should be sustainable (which incorporates organizing sustainability events). In order to be sustainable, a library should provide a sufficient KIC to stimulate sustainable knowledge creation and innovation within the library itself.

This research found that a slight majority of the respondent would be interested in learning more about sustainability and participate in lectures or activities concerning sustainability, the preferred type of event being a sustainability market. A regression equation has been formulated in the previous chapter : *Environmental literacy*= -0.958 + 0.401*staff* + 0.211*opinion* + 0.340*participation*. This equation shows that the environmental literacy would be relatively higher for staff members compared to volunteers, as the coefficient 0.401 for staff is included in the equation for staff members (0.401*1)

and not for volunteers (0.401*0). Moreover, a more positive opinion of the contribution of libraries to a sustainable society and participation to sustainability events would mean a higher environmental literacy. However, a green and sustainable library has no significant impact on the environmental literacy of its community, as this coefficient was not significant at the 0.1 level. Furthermore, it can be concluded that the researched libraries have not yet fulfilled their potential contribution to a sustainable society, indicated by the gap between the opinion of green and sustainable libraries by the respondents and the rating regarding sustainability of the library where the respondent is employed.

5.4 Limitations

First of all, the data collected by the survey and that has been used in the factor analysis is ordinal data. However, the use of regular factor analysis for this type of data is controversial (IBM, 2020). According to IBM (2020), a problem that could arise when factor analysis is used for categorical data is the occurrence of difficulty factors, which are factors that are based on similar distributions instead of similar content. However, it is a common occurrence among researchers to use factor analysis for ordinal data despite the controversy (IBM, 2020).[3] In this research, it was decided to use factor analysis for the ordinal data, since it is a common practice and the results show factors encompassing similar content. This could possibly dispose of the worries about difficulty factors.

Another limitation of this research is that it is not generalizable to the population of librarians, volunteers and visitors of Dutch libraries. The survey has been distributed among one library organization and can therefore only be generalized for the 10 researched libraries. To ensure generalizability, further research could be performed among multiple public library organizations. Moreover, volunteers have been viewed in this research as representing the local community. However, this cannot be generalized to the local community. First, the age dispersion among volunteers possibly differs from the community, a majority of the volunteers is aged 55 years or older. Second, the opinion, participation and environmental literacy of the volunteers could differ from the community because of their close involvement with the local libraries. Nevertheless, this research provides a valuable contribution to insights about the contribution of public libraries to the environmental literacy of a community, since it is the first empirical research regarding this subject in the Netherlands. The added value will be elaborated in the following section.

[3] See for example Hof (2012).

5.5 Implications

This research serves to bridge the lack of empirical research of the contribution of public libraries to a more sustainable and environmentally literate society within the Netherlands. Beutelspacher and Meschede (2020) identified this lack of theoretical and empirical research. Even though this research is not generalizable to other library organizations within the Netherlands, it covers valuable insights of 10 libraries in South-Holland. Therefore, it decreases the lack of empirical research. The factors established by the factor analysis and the survey could serve as framework for other researchers or library organizations to easily execute a similar study, for example to establish points of improvements of libraries to contribute to a more sustainable society. This could help overcome the lack empirical research. This study did not generate the right information to provide a causal relationship between the participation to a sustainability event and an increase in environmental literacy. This could be a valuable topic for further research. Beutelspacher and Meschede (2020) stated the need to examine the employee's and public's opinion of efforts of libraries to improve environmental literacy. This study covered this subject and more. As mentioned by Beutelspacher and Meschede (2020), research regarding the contribution of social media to promoting environmental literacy through public libraries and the specific contribution of libraries to the SDGs could prove insightful.

Furthermore, this research possibly contributes to a more educated society regarding sustainability. This thesis will be made available to the researched library organization, which has expressed interest in the report. This thesis will moreover be made available to respondents who expressed interest in the report. The library organization could benefit from the findings of this research by applying it in their policy. Specifically useful for this library organization are the findings belonging to the factor *Sustainable Library*, where the respondents rated the greenness and sustainability of the library where they are employed. In general, the median score for this factor was 3 (neutral). The greenness of the library was generally rated relatively positive, the most mentioned green practices being waste separation and the reuse of old or damaged books. However, the sustainability of the library organization could be improved. Advice for improvement would be to improve the education of employees about sustainability at work and to organize more events focused on sustainability. According to the results, information markets would be the best type of event to attract visitors to the event. Educating employees could be organized by, for instance, providing information about the green and sustainable policies of the library organizations or by organizing interactive sustainability

games.[4] This advice, although specific to this library organization, and the results of this study could be used as input for policies of other library organizations. It also provides an example of how to perform an empirical research about this subject to other library organizations that may want to gain insight about how to contribute to a more environmentally literate society.

[4] See for example 2030SDGsGame (n.d.) and Utrecht University (2019).

6. Conclusion

A case study of a local library organization has been performed to answer the research question: "How can public libraries contribute to the evolution of the environmental literacy of its community?". A survey has been distributed among staff members and volunteers to find how they perceive environmental literacy and the contribution of public libraries to sustainability. factor analysis established four main factors of the survey focusing on *Opinion*, *Participation*, *Environmental Literacy* and *Sustainable Library*. Using multiple linear regression, it was found that a higher willingness to participate in sustainability events organized by a library and a more positive opinion about the contribution of a library to a more sustainable society, mean a higher environmental literacy of the respondent. Moreover, the multiple linear regression showed that a staff member would experience a relatively higher environmental literacy compared to a volunteer. Furthermore, even though the respondents generally state to find sustainability important, a majority does not live up to this expectation because of a lack of knowledge and participation. A gap has been identified between the expectations of the contribution of libraries to the environmental literacy of a community and the actual efforts of libraries. This effort is required since it was found that sustainable libraries have no direct impact on the environmental literacy of a community, only indirect through participation of sustainability events. The type of event that was preferred among the respondents is an information market. This research was performed to decrease the lack of empirical research surrounding sustainable libraries and the public's opinion of efforts of libraries to contribute to a more sustainable society. However, more research is needed to bridge this lack of empirical research. Interesting topics for further research would be contribution of public libraries to the SDGs or the influence of social media on the contribution of libraries to the environmental literacy of a community. Last, this research could serve as a guideline and inspiration for further research among library organizations elsewhere.

References

2030SDGsGame. (n.d.). 2030 SDGs Game. Retrieved June 12, 2020, from https://2030sdgsgame.com/2030-sdgs-game/

Abbas, M. Y., & Singh, R. (2014). A Survey of Environmental Awareness, Attitude and Participation Amongst University Students: A Case Study. *International Journal of Science and Research*, 3(5), 1755–1760. Retrieved from https://www.researchgate.net/publication/336133232_A_Survey_of_Environmental_Awareness_Attitude_and_Participation_Amongst_University_Students_A_Case_Study

Akbulut, M., Alaca, E., Büyükçolpan, T., Cevher, N., Kurbanoğlu, S., Soylu, D., & Yıldırım, B. (2018). Green (Environmentalist) Approaches to University Libraries: A Research Across Turkey [abstract]. *Bilgi Dünyasi*, 19(2), 203–230. https://doi.org/10.15612/bd.2018.693

Antonelli, M. (2008). The Green Library Movement: An Overview and Beyond. *Electronic Green Journal*, 1(27). Retrieved from https://escholarship.org/uc/item/39d3v236#main

Beutelspacher, L. & Meschede, C. (2020). Libraries as promoters of environmental sustainability: Collections, tools and events. *IFLA Journal*, 1-12. Retrieved from https://journals-sagepub-com.proxy.library.uu.nl/doi/10.1177/0340035220912513

Datta, S. (2015). Green is the new black: bringing the libraries into the green scene. *International Journal of Digital Library Services,* 5(3), 59–68. Retrieved from http://www.ijodls.in/vol-5-issue-3-2015.html

De Bibliotheek NOBB. (n.d.). *Hoe duurzaam is jouw tuin*? Retrieved April 26, 2020, from https://www.nobb.nl/activiteiten/evenement/7581-hoe-duurzaam-is-jouw-tuin

De Bibliotheek Rijn en Venen. (n.d.-a). *Duurzaam Bouwloket*. Retrieved May 7, 2020, from https://rijnenvenen.op-shop.nl/2335/duurzaam-bouwloket/13-05-2020

De Bibliotheek Rijn en Venen. (n.d.-b). *Duurzaamheidsmarkt*. Retrieved May 7, 2020, from https://rijnenvenen.op-shop.nl/1867/duurzaamheidsmarkt/09-11-2019

Dias, S. M. (2017). Environmental Sustainability for Public Libraries in Portugal: a first approach. *Electronic Green Journal*, 1(40). Retrieved from https://escholarship.org/uc/item/9t8791rq

Dragaš, B. (2018). Zelene knjižnice za zelenu pismenost [abstract]. *Vjesnik Bibliotekara Hrvatske*, 60(4), 221–241. https://doi.org/10.30754/vbh.60.4.530

Dragaš, B., & Ercegovac, S. (2020). Prema sudioničkom upravljanju u kulturi [abstract]. *Vjesnik*

Bibliotekara Hrvatske, 62(2), 149–190. https://doi.org/10.30754/vbh.62.2.765

Ephraim, P. E. (2003). The greening of libraries. *Library Management*, *24*(3), 160–163. https://doi.org/10.1108/01435120310464862

Fedorowicz-Kruszewska, M. (2019). Sustainable libraries-fashion or necessity? *JLIS.It*, 10(1), 92–101. https://doi.org/10.4403/jlis.it-12500

Field, A. P. (2005). *Discovering Statistics Using SPSS* (2nd ed.). Thousand Oaks, Canada: SAGE Publications.

Food and Agriculture Organization. (2005). *Communication for Development Roundtable Report: Focus on Sustainable Development* (9). Retrieved from http://www.fao.org.proxy.library.uu.nl/3/y5983e/y5983e00.htm#Contents

Ghorbani, M., Babalhavaeji, F., & Nooshinfard, F. (2016). Sustainable Management Requirements in Libraries of Iran: A Framework on Grounded Theory. *Libri,* 66(3), 213–222. https://doi.org/10.1515/libri-2016-0022

Hadzigeorgiou, Y., & Judson, G. (2017). Toward More Effective Storytelling for Raising Environmental Awareness in Young Students. *Journal of Advances in Education Research*, *2*(1), 12–18. https://doi.org/10.22606/jaer.2017.21002

Hiramatsu, A., Kurisu, K., & Hanaki, K. (2015). Environmental Consciousness in Daily Activities Measured by Negative Prompts. *Sustainability*, 8(1), 24–43. https://doi.org/10.3390/su8010024

Hof, M. (2012). *Questionnaire Evaluation with Factor analysis and Cronbach's Alpha*. Retrieved from http://www.let.rug.nl/nerbonne/teach/rema-stats-meth-seminar/student-papers/MHof-QuestionnaireEvaluation-2012-Cronbach-FactAnalysis.pdf

Holgar, M., Foth, M., & Ferrero-Regis, T. (2009). Fashion as a communication medium to raise environmental awareness and sustainable practice. In Flew, T (Ed.) *Communication, Creativity and Global Citizenship: Refereed Proceedings of the Australian and New Zealand Communication Association Conference 2009*. Australian and New Zealand Communication Association, Online, pp. 1253-1275.

IBM. (2020). Exploratory Factor analysis with categorical variables. Retrieved June 9, 2020, from https://www.ibm.com/support/pages/exploratory-factor-analysis-categorical-variables

International Federation of Library Associations and Institutions. (2016, December 8). *IFLA – Launch of IFLA's International Advocacy Programme with four Regional Workshops*. Retrieved April 26, 2020, from https://www.ifla.org/node/11048?og=7409

Kang, Q. (2018). Library directors' concerns and attitudes towards going green and sustainability in China: An unexplored area. *Journal of Librarianship and Information Science*, 52(2), 382-398. Retrieved from https://journals-sagepub-com.proxy.library.uu.nl/doi/10.1177/0961000618818874

Karioja, E. (2013). *How to evaluate libraries' sustainability? an approach to an evaluation model and indicators*. Retrieved from http://library.ifla.org/114/1/115b-karioja-en.pdf

Kurbanoğlu S., Boustany J. (2014) From Green Libraries to Green Information Literacy. In: Kurbanoğlu S., Špiranec S., Grassian E., Mizrachi D., Catts R. (eds) *Information Literacy. Lifelong Learning and Digital Citizenship in the 21st Century*. ECIL 2014. Communications in Computer and Information Science, vol 492. Springer, Cham

McBride, B. B., Brewer, C. A., Berkowitz, A. R., & Borrie, W. T. (2013). Environmental literacy, ecological literacy, ecoliteracy: What do we mean and how did we get here? *Ecosphere*, *4*(5), 1–20. https://doi.org/10.1890/es13-00075.1

Nazarenko, A., & Kolesnik, A. (2018). Raising Environmental Awareness of Future Teachers. *International Journal of Instruction*, *11*(3), 63–76. https://doi.org/10.12973/iji.2018.1135a

Niu, L., Wang, Y., Han, X., & Jiao, T. (2015). A Review of Library Knowledge Management Research in China. *Proceedings of the 2015 International Conference on Social Science and Higher Education*. https://doi.org/10.2991/icsshe-15.2015.127

Olsen, R. (2011). *Green and Growing*: *The Impact of a LEED Library on an Organization's Sustainable Practices* . Retrieved from https://www.ifla.org/past-wlic/2011/109-olsen-en.pdf

ProBiblio, & BiebPanel. (2018). *Flitspeiling over duurzaamheid: Rapportage Cluster Twente*. Retrieved from https://www.bibliotheektwenterand.nl/images/biebpanel/2018/Rapport_BiebPanel_Flitspeiling_2018-2_Duurzaamheid_Twente.pdf

Roth, C. E. (1992). *Environmental Literacy: Its Roots, Evolution and Directions in the 1990s*. Retrieved from https://eric.ed.gov/?id=ED348235

Rowley, J. (2006). Libraries and environmental management. *Library Management*, 27(4/5), 269-279. doi:https://doi.org/10.1108/01435120610668205

Sheng, X., & Sun, L. (2007). Developing knowledge innovation culture of libraries. *Library Management*, 28(1/2), 36–52. https://doi.org/10.1108/01435120710723536

Sonkkanen, L., Asikainen, M., & Sahavirta, H. (2012). *Green@ Library: ecological sustainability of*

libraries. Retrieved from http://sustainability.libraries.fi/G@Len.pdf

Suresh Kumar, P.K., Sofiya, A. (2015). Application of green concepts in the libraries of thiruvananthapuram: An investigation. *Library Philosophy and Practice*, (2976), 1-20. Retrieved from https://digitalcommons.unl.edu/libphilprac/2976/?utm_source=digitalcommons.unl.edu%2Flibphilprac%2F2976&utm_medium=PDF&utm_campaign=PDFCoverPages

United Nations. (2015). Transforming our world: the 2030 agenda for sustainable development. Retrieved June 12, 2020, from https://sustainabledevelopment.un.org/post2015/transformingourworld

Utrecht University. (2019). Students play interactive game for a sustainable Utrecht. Retrieved June 12, 2020, from https://www.uu.nl/en/news/students-play-interactive-game-for-a-sustainable-utrecht

Appendix A: Survey

Investigator: Whitney Frederiks

Supervisor: Dr. G. Capponi

Study title: Libraries and Sustainability

Institution: Utrecht University, Faculty of Geosciences

Thank you for taking part in this online research survey as part of a bachelor's thesis in Global Sustainability Science at Utrecht University. The survey is estimated to take […] minutes to complete. This information and consent form will provide a short overview about the purpose of this research and how data and privacy will be handled.

The purpose of this study is to analyze how public libraries can contribute to the evolution of the environmental literacy of its community. Little empirical scientific research has been conducted on sustainable libraries and how a sustainable library can affect the environmental awareness of its staff and community by providing information and organizing events. This survey has been distributed among staff members and volunteers of the library organization Rijn en Venen as staff members of libraries and activities within libraries are fundamental to evolving the environmental awareness of a community.

This survey will be anonymous, your name will not be asked. There are no sensitive personal questions included in the survey. The data will not be used for any other purpose than the research report and research presentation. Your response will be securely stored online by Qualtrics and accessed only on a password protected laptop.

By clicking "I consent", the participant:

- Has read and understood the information provided above
- Agrees to participate in this research voluntarily
- Agrees that data will be used for the bachelor's thesis report and presentation
- Understands that the research is anonymous and no personal questions will be asked
- Understands that they can refuse to answer any question

- Understands that they can withdraw at any point in the survey
- Understands that information provided by the participant will be treated confidentially

If you have any questions, please do not hesitate to contact me at w.r.frederiks@students.uu.nl. The research report, once finished, will be made available to you if interested. Let me know by sending an email to the address mentioned above.

Q1: Do you consent?:

1. Yes I consent
2. No I do not Consent

Part 2: General

Q2: What is your main activity within the library (choose the best fitting):

1. Staff
2. Volunteer
3. Management

Q3: What is your age?

1. <30
2. 30-50
3. >50

Q4: What is your highest level of education?

1. Vmbo, mavo, havo, vwo
2. Mbo
3. Hbo
4. Wo

Q5: What is the library where you work most often:

1. Alphen aan den Rijn
2. Office

3. Boskoop
4. Hazerswoude-Dorp
5. Hazerswoude-Rijndijk
6. Leimuiden
7. Nieuwkoop
8. Roelofarendsveen
9. Ter Aar
10. Woubrugge
11. Zoeterwoude-Dorp

Part 3: Environmental literacy

Environmental literacy

Importance: Sustainability is important to me.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Knowledge: I feel like I have enough knowledge to form an opinion about environmental issues and sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

SDGs: I'm familiar with the Sustainable Development Goals developed by the United Nations.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree

5. Strongly disagree

Green Library Movement: I'm familiar with the Green Library Movement.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Food: What type of food is the most harmful to the environment?

1. Cheese
2. Beef
3. Salmon

Participation

Separation: I separate my waste (Plastic, paper, glass).

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Current lectures: I attend lectures about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Membership: I'm a member of a foundation or organization striving for a sustainable earth, for example Greenpeace or WWF.

1. Strongly agree

2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Current activities: I attend organized activities focused on sustainability, such as planting trees.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Part 4: Opinion

Opinion society: Public libraries can contribute to a more sustainable society.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion green libraries: Public libraries should be green (i.e. minimal and green energy use, minimal water use etc).

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion green practices: Public libraries should incorporate sustainability into library practices (i.e. waste separation, recycling old books, minimal use of paper etc).

1. Strongly agree
2. Agree
3. Neutral
4. Disagree

5. Strongly disagree

Opinion information provision : Public libraries should help informing customers about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion books: Public libraries should have books concerning sustainability available.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion lectures: Public libraries should organize lectures to inform customers about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion activities: Public libraries should organize events such as markets or exhibits to inform about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion information staff: Staff members of a public library should be informed about how to be more sustainable within the library.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion knowledge staff: Staff members of a public library should be aware about sustainability issues to be able to inform customers.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Opinion initiateve: Staff members of a public library should have the opportunity to initiate events or activities.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Attendance

Moreknowledge: I would like to learn more about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Event library: I would visit an event organized by the library.

1. Strongly agree

2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Lecture library: I would visit a lecture organized by the library.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Sustainability event: I would visit a sustainability event (such as a lecture or market) organized by the library.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Sustainability lecture: I would visit a lecture regarding sustainability organized by the library.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Promotion: I would inform acquaintances about lectures or markets about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree

5. Strongly disagree

Preferred event: Which of the events focused on sustainability below would you prefer to visit?

1. Lecture
2. Information market with diverse stalls
3. Specific activity such as tree planting or gardening
4. Walk-in for questions

Part 5: Green library

Green library: My library has a sustainable building (minimal and green energy use, minimal water use).

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Green practices: My library has sustainable practices (i.e. waste separation, minimal use of paper).

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

   If Strongly agree or agree: You indicated that your library has sustainable practices. Please explain why by providing examples: ……..

Part 6: Sustainable library

Information staff: My library informs me about how to be more sustainable at work.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree

5. Strongly disagree

Books sustainability: My library has books available about the environment or sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Sustainability events library: My library organizes events (lectures, market) about sustainability.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Initiative: I feel like I'm allowed to share my ideas within the library.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Knowledge sharing: Colleagues share knowledge among each other.

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

Appendix B: Variable names

Variable abbreviation	Question or statement in survey	Answer
Importance	Sustainability is important to me.	Likert scale 1-5
Knowledge	I feel like I have enough knowledge to form an opinion about environmental issues and sustainability.	Likert scale 1-5
SDGs	I'm familiar with the Sustainable Development Goals developed by the United Nations.	Likert scale 1-5
Green Library Management	I'm familiar with the green library movement.	Likert scale 1-5
Food	What food is the most harmful to the environment?	1)Cheese 2) beef 3)salmon
Separation	I separate my waste (Plastic, paper, glass).	Likert scale 1-5
Current lectures	I attend lectures about sustainability.	Likert scale 1-5
Membership	I'm a member of a foundation or organization striving for a sustainable earth, for example Greenpeace or WWF.	Likert scale 1-5
Current activities	I attend organized activities focused on sustainability, such as planting trees.	Likert scale 1-5
Opinion society	Public libraries can contribute to a more sustainable society.	Likert scale 1-5
Opinion green libraries	Public libraries should be green (i.e. minimal and green energy use, minimal water use etc).	Likert scale 1-5
Opinion green practices	Public libraries should incorporate sustainability into library practices (i.e. waste separation, recycling old books, minimal use of paper etc).	Likert scale 1-5
Opinion information provision	Public libraries should help informing customers about sustainability.	Likert scale 1-5
Opinion books	Public libraries should have books concerning sustainability available.	Likert scale 1-5

Opinion lectures	Public libraries should organize lectures to inform customers about sustainability.	Likert scale 1-5
Opinion activities	Public libraries should organize events such as markets or exhibits to inform about sustainability.	Likert scale 1-5
Opinion information staff	Staff members of a public library should be informed about how to be more sustainable within the library.	Likert scale 1-5
Opinion knowledge staff	Staff members of a public library should be aware about sustainability issues to be able to inform customers.	Likert scale 1-5
Opinion initiative	Staff members of a public library should have the opportunity to initiate events or activities.	Likert scale 1-5
Desire to learn	I would like to learn more about sustainability.	Likert scale 1-5
Event library	I would visit an event organized by the library.	Likert scale 1-5
Lecture library	I would visit a lecture organized by the library.	Likert scale 1-5
Sustainability event	I would visit a sustainability event (such as a lecture or market) organized by the library.	Likert scale 1-5
Sustainability lecture	I would visit a lecture regarding sustainability organized by the library.	Likert scale 1-5
Promotion	I would inform acquaintances about lectures or markets about sustainability.	Likert scale 1-5
Preferred event	Which of the events focused on sustainability below would you prefer to visit?	1)Lecture 2)Information market 3)Specific activity such as tree planting or gardening 4)Walk-in for questions
Green library	My library has a sustainable building (minimal and green energy use, minimal water use etc).	Likert scale 1-5
Green practices	My library has sustainable practices (i.e. waste separation, minimal use of paper etc).	Likert scale 1-5
Information staff	My library informs me about how to be more sustainable at work.	Likert scale 1-5
Books sustainability	My library has books available about the environment or sustainability.	Likert scale 1-5

Sustainability events library	My library organizes events (lectures, market) about sustainability.	Likert scale 1-5
Initiative	I feel like I'm allowed to share my ideas within the library.	Likert scale 1-5
Knowledge sharing	Colleagues share knowledge among each other.	Likert scale 1-5

Appendix C: Data per question of the survey

Results per question of the survey in percentages. Questions are presented with short names, the full questions belonging to these names can be found in Appendix B.

Question name	Total	Totally agree	Agree	Neutral	Disagree	Totally disagree	Staff	Volunteer
Job type							36.5%	63.5%
Age <25	2.4%							
Age 26-35	7.1%							
Age 36-45	10.6%							
Age 46-55	15%%							
Age >55	65.9%							
Low education	41.2%							
Middle education	42.9%							
High education	15.5%							
Importance		47.1%	48.2%	4.7%	0.0%	0.0%	100% (totally) agree	92% (totally) agree
Knowledge		7.1%	52.9%	35.3%	4.7%	0.0%	57% (totally) agree	62% (totally) agree
SDGs		5.9%	24.7%	24.7%	34.1%	10.6%	42% (totally) agree	24.1% (totally) agree
Green Library Movement		1.2%	18.8%	25.9%	37.6%	16.5%	45.2% (totally) agree	5% (totally) agree
Food	92.9% correct answer							

Separation		78.8%	20%	1.2%	0%	0%		
Current lectures		2.4%	4.7%	30.6%	41.2%	21.2%		
Membership		8.2%	22.4%	9.4%	40.0%	20.0%	22.58% (totally) agree	35.2% (totally) agree
Current activities		0.0%	8.2%	15.3%	51.8%	24.7%	12.9% (totally) agree	5.6% (totally) agree
Opinion society		24.4%	64.6%	11.0%	0.0%	0.0%		
Opinion green libraries		27.1%	54.1%	16.6%	1.2%	1.0%	87.1% (totally) agree	77.8% (totally) agree
Opinion green practices		44.7%	52.9%	2.4%	0.0%	0.0%		
Opinion information provision		22.4%	48.2%	24.7%	4.7%	0.0%	80.6% (totally) agree	64.8% totally (totally) agree
Opinion books		40.0%	55.3%	4.7%	0.0%	0.0%		
Opinion lectures		16.7%	53.6%	27.4%	2.4%	0.0%	76.7% (totally) agree	66.7% (totally) agree
Opinion activities		18.8%	45.9%	29.4%	4.7%	1.2%	83.9% (totally) agree	53.7% (totally) agree
Opinion information staff		24.7%	56.5%	15.3%	3.5%	0.0%		

Opinion knowledge staff		7.0%	41.2%	38.8%	11.8%	1.2%	51.6% (totally) agree	46.3 (totally) agree
Opinion initiative		7.1%	34.1%	45.9%	12.9%	0.0%	58.1 (totally) agree	31.5% (totally) agree
Desire to learn		7.1%	49.4%	38.8%	4.7%	0.0%	71.0% (totally) agree	48.14% (totally) agree
Event library		10.6%	60.0%	23.5%	4.7%	1.2%	83.9% (totally) agree	63.0% (totally) agree
Lecture library		8.2%	42.4%	35.3%	12.9%	1.2%		
Sustainability event		8.2%	50.6%	34.1%	7.1%	0.0%		
Sustainability lecture		7.0%	41.2%	38.8%	10.6%	2.4%		
Promotion		16.5%	62.4%	20.0%	1.2%	0.0%	93.6% (totally) agree	70.4% (totally) agree
Preferred event	61.3% prefers information market							
Green library		7.1%	27.1%	37.6%	14.1%	14.1%	42.0% (totally) agree	29.9% (totally) agree
Green practices		3.5%	28.2%	35.3%	24.7%	8.2%	29.0% (totally) agree	33.3% (totally) agree

Information staff		1.2%	6.0%	39.8%	44.6%	8.4%	3.3% (totally) agree	6.7% (totally) agree
Books sustainability		10.6%	38.8%	40.0%	7.1%	3.5%	70.96% (totally) agree	37.1% (totally) agree
Sustainability events library		17.6%	34.1%	25.9%	18.8%	3.5%	77.4% (totally) agree	37.0% (totally) agree
Initiative		11.8%	61.2%	2.9%	1.2%	0.0%	74.2% (totally) agree	62.2% (totally) agree
Knowledge sharing		3.5%	45.9%	42.4%	8.2%	0.0%	45.2% (totally) agree	51.9% (totally) agree