Kaunas University of Technology

Faculty of Civil Engineering and Architecture

Jurgis Kunčinas Public Library in Alytus

Master's Final Degree Project

Yash Devendra Khandelwal

Project author

Assoc. prof. Vidmantas Minkevičius

Supervisor

Kaunas, 2024

Kaunas University of Technology

Faculty of Civil Engineering and Architecture

Jurgis Kunčinas Public Library in Alytus

Master's Final Degree Project

Architecture (6011PX003)

Yash Devendra Khandelwal

Project author

Assoc. prof. Vidmantas Minkevičius

Supervisor

Assoc. prof. Indrė Gražulevičiūte-Vileniškė

Reviewer

Kaunas, 2024

Kaunas University of Technology

Faculty of Civil Engineering and Architecture

Yash Devendra Khandelwal

Jurgis Kunčinas Public Library in Alytus

Declaration of Academic Integrity

I confirm the following:

1. I have prepared the final degree project independently and honestly without any violations of the copyrights or other rights of others, following the provisions of the Law on Copyrights and Related Rights of the Republic of Lithuania, the Regulations on the Management and Transfer of Intellectual Property of Kaunas University of Technology (hereinafter – University) and the ethical requirements stipulated by the Code of Academic Ethics of the University;

2. All the data and research results provided in the final degree project are correct and obtained legally; none of the parts of this project are plagiarised from any printed or electronic sources; all the quotations and references provided in the text of the final degree project are indicated in the list of references;

3. I have not paid anyone any monetary funds for the final degree project or the parts thereof unless required by the law;

4. I understand that in the case of any discovery of the fact of dishonesty or violation of any rights of others, the academic penalties will be imposed on me under the procedure applied at the University; I will be expelled from the University and my final degree project can be submitted to the Office of the Ombudsperson for Academic Ethics and Procedures in the examination of a possible violation of academic ethics.

Yash Devendra Khandelwal

Confirmed electronically

KAUNAS UNIVERSITY OF TECHNOLOGY
Faculty of Civil Engineering and Architecture

Topic (theme) of the Master Final Degree Project ___Jurgis Kunčinas Public Library in Alytus_____

Theme of the Master Final Degree Project approved by the Dean's Order_____Jurgis Kunčinas Public Library in Alytus___

Master studies **Final Degree Project** (study module M000M100)

T A S K

Aim of the work:

To verify the concept (conceptual model) established during the previous stage of the work (empirical research) in the solutions of the experimental project., and to prepare the master's final degree project integrating research and experimental design stages.

Tasks of the work:

To collect the necessary data for the project preparation, to prepare the architectural design of the selected object, to highlight the solutions determined by the concept formulated in the conclusions of the research project, to present the evaluation of the results of the experimental project.

Structure of the work:

Text. Title page, heading page, declaration of academic integrity, task of the final degree project (FDP) (if needed), summary, santrauka, content, list of figures (if needed), list of tables (if needed), list of abbreviations and terms (if needed). Main part: introduction (relevance and novelty of the topic, research problem and its level of investigation, object, objective, tasks, and methodology of the FDP); summarized data of theoretical research, empirical research and experimental design; conclusions of chapters, and the whole work conclusions. List of references, list of information sources (if needed), appendices, copies of graphical part (reduced in size).

The volume of the text (main part) is 2 – 3 author's sheets (1 author's sheet is 40 000 press characters with spaces), i.e. around **60 – 80 pages** of computer text (recommended font Times New Roman, size 12, line spacing multiple 1,15 (Methodological Guidelines for the Preparation of Written Works)).

Graphic part.

The graphical part of the work is presented in posters (70x100 cm). It should reflect the most important results of theoretical material analysis, empirical research (*hypothetical model, conceptual model highlighting the statements implemented in the experimental projec*t), and experimental design (*the scheme of the situation of the designed object, the scheme of the analysis of the current condition; project idea / strategy; detailed solutions:* ***building*** *- site arrangement proposals, plans, facades / elevations, specific sections, fragments of interior / exterior spaces, construction details, etc. (if necessary);* ***urban complex*** *- communication system, building typology, public spaces, green infrastructure (natural framework), social infrastructure, proposals for the formation of cityscape identity, master plan of a quarter / city part, etc .;* ***public spaces (or their systems)*** *- functional diagram and spatial formation zones, connections between them, path system, landscaping system, water bodies, pavements, small architectural elements, lighting, etc.; general visualization of the designed object with the contextual environment, visualizations of separate visual spaces, etc.*) as well as changes of conceptual model (if needed).

The graphic part of the work should be arranged and exhibited in a way to form a visually unified whole and reflect the content of the work. It should be attractive aesthetically. When preparing the graphical part of the work, it is necessary to exclude the non-essential information, highlight the most important research results and ideas, and unify notes, graphical expression, and colours.

The volume of the graphic part is **10 – 16 posters** of 70 x 100 cm size (vertically oriented) that integrate the results of research project and experimental design. The posters must be printed on the 2-3 mm thick cardboard.

The description of the results of theoretical and empirical research must consist of **up to 1/2** of the main text, and in the graphic part they should be represented in **1 - 2 posters**.

Model or photorealistic visualisations of the planned area / object.

Printed copy of the final work text and graphical part.

Timetable of tasks performance:

1. Discussion of the task and the principles of experimental design	2024 02 05
2. Selection of the location of the designed object according to the criteria established on the basis of the conceptual model, analysis of the location based on secondary sources, creation of the design program	2024 02 12
3. Field survey, identification of the problems and potential of the designed object, development of the first alternative of the project idea	2024 02 19
4. Review and evaluation of the results of the analytical work and the conceptual sketches of the project (Alternative I)	**2024 02 26**
5. Search for a solution strategy / idea and evaluation of alternative options according to the established criteria	2024 02 26 – 2024 03 18
6. Review and evaluation of the solution ideas (Alternative II)	**2024 03 18**
7. Development of the chosen alternative: detailing of the solutions	2024 03 25 – 2024 05 06
8. Consultative review	2024 04 08
9. Consultative review	2024 04 22
10. Review of the detailed solutions	**2024 04 29**
11. Completion of the text	2024 05 13
12. Defending the final project in the commission of supervisors	**2024 05 20**
13. Public defence of the Final Degree Project	**2024 06 04 - 2024 06 05**

Consultation time with supervisor

Weekday	**Faculty of Civil Engineering and Architecture, Room 307, Zoom or other distance learning platform**	**Workplace**
	Time and duration *	**Time and duration ***
Monday	**12:00 – 14:00**	**2 hours**
Tuesday		
Wednesday		
Thursday		
Friday		

* - 2 hours per week

Supervisor of the final degree project Vidmantas Minkevicius *Confirmed electronically*

(name, surname, signature)

Student Yash Devendra Khandelwal *Confirmed electronically*

(name, surname, signature)

February 2024

Khandelwal, Yash Devendra. Jurgis Kunčinas Public Library in Alytus. Master's Final Degree Project / supervisor assoc. prof. Vidmantas Minkevičius; Faculty of Civil Engineering and Architecture, Kaunas University of Technology.

Study field and area (study field group): Architecture (Arts).

Keywords: Multifunctional, Library, Public Library, Spatial Arrangement, Sustainability, Green Infrastructure.

Kaunas, 2024. 81 pages.

Summary

A library is a collection of typical books, multimedia collections, documents, or digital content. It is a place where people gain knowledge, history, and culture through various materials such as support learning, intellectual growth, and entertainment. In the modern era where libraries are undergoing digital transformation the traditional way of storing physical copies is being replaced by digital versions or online sources. The main reason for this transformation is to keep up with technological advancement and to give users a better experience. Additionally, the world is moving towards sustainability, and public buildings, or spaces such as libraries are playing a crucial role in integrating the concept of sustainability as a design element. Eco-friendly designs, local materials, and renewable energy sources are some of the important steps to achieve it.

Three sections organize this thesis: theoretical research, empirical research, and experimental design. The theoretical research examines the library's role, function, and effect on the city and community. Additionally, it explores the principles of sustainable development for the public library. Subsequently, the gathered data was utilized to generate a speculative framework of development principles and placemaking for library development. The empirical research included a range of analytical tools, including sociotopes, Q-Gis, expert interviews, and sociological surveys, to identify solutions and elements that contribute to the effective design of a public library. The empirical investigation concluded by developing a conceptual model for a versatile public library. Subsequently, an experimental design project was conducted to achieve the study aim and implement the variables outlined in the conceptual model. In conclusion, the project's success in establishing a dynamic and versatile public library was determined by assessing the conceptual model, four derived criteria, principles, and rules, as well as the Sustainable Development Goals (SDG) criteria produced throughout the study.

Khandelwal, Yash Devendra. Alytaus Jurgio Kunčino viešoji biblioteka. Magistro baigiamasis projektas /vadovas doc. Vidmantas Minkevičius; Kauno technologijos universitetas, Statybos ir architektūros fakultetas.

Studijų kryptis ir sritis (studijų krypčių grupė): Architektūra (Menai).

Raktiniai žodžiai: Daugiafunkcis, Biblioteka, Viešoji biblioteka, Erdvinis sutvarkymas, Tvarumas, Žalioji infrastruktūra.

Kaunas, 2024. 81 p.

Santrauka

Biblioteka yra knygų, multimedijos kolekcijų, dokumentų ar skaitmeninio turinio kolekcija. Tai vieta, kur žmonės įgyja žinių, istorijos ir kultūros naudodamiesi įvairia medžiaga, pavyzdžiui, mokymuisi, intelektualiniam augimui ir pramogoms. Šiuolaikinėje eroje, kai bibliotekos patiria skaitmeninę transformaciją, tradicinį fizinių kopijų saugojimo būdą pakeičia skaitmeninės versijos arba internetiniai šaltiniai. Pagrindinė šios transformacijos priežastis – neatsilikti nuo technologijų pažangos ir suteikti vartotojams geresnę patirtį. Be to, pasaulis juda link tvarumo, o viešieji pastatai ar erdvės, pvz., bibliotekos, atlieka esminį vaidmenį integruojant tvarumo, kaip dizaino elemento, sampratą. Ekologiškas dizainas, vietinės medžiagos ir atsinaujinantys energijos šaltiniai yra keletas svarbių žingsnių norint tai pasiekti.

Šį darbą sudaro trys skyriai: teorinis tyrimas, empirinis tyrimas ir eksperimentinis projektavimas. Teorinis tyrimas nagrinėja bibliotekos vaidmenį, funkciją ir poveikį miestui bei bendruomenei. Be to, jame nagrinėjami darnaus viešosios bibliotekos vystymosi principai. Vėliau surinkti duomenys buvo panaudoti kuriant spekuliacinę plėtros principų sistemą ir bibliotekos plėtrą. Empirinis tyrimas apėmė daugybę analitinių priemonių, įskaitant sociotopus, Q-GI, ekspertų interviu ir sociologines apklausas, siekiant nustatyti sprendimus ir elementus, kurie prisideda prie veiksmingo viešosios bibliotekos dizaino. Empirinis tyrimas baigtas sukuriant koncepcinį universalios viešosios bibliotekos modelį. Vėliau buvo atliktas eksperimentinis projektas, siekiant tyrimo tikslo ir įgyvendinti konceptualiame modelyje nubrėžtus as gaires. Apibendrinant galima teigti, kad projekto sėkmę kuriant dinamišką ir įvairiapusę viešąją biblioteką lėmė viso tyrimo metu sukurto koncepcinio modelio, keturių išvestinių kriterijų, principų ir taisyklių bei Darnaus vystymosi tikslų (SDG) įvertinimas.

Table of contents

List of Figures

List of Tables

List of abbreviations and terms

Abbreviations:

Eg. – Example

n.d. – Not Defined

DLF – Digital Library Foundation

Etc. – Et cetera

LED – Light emitting diode

EDS – Education for sustainable development

SDGs – Sustainable development goals

Introduction

What is a library and how do we remember libraries? A library is a collection of typical books, multimedia collections, documents, or digital content. It is a place where people gain knowledge, history, and culture through a wide range of materials such as support learning, intellectual growth, and entertainment.

In the modern era where libraries are undergoing digital transformation the traditional way of storing books on the bookshelf and physical copies are being replaced by digital versions or online sources. The main reason for this transformation is to keep up with the advancement in technology and to give users a better experience in the modern world keeping the libraries relevant in the increasingly modern digital world.

Additionally, the world is moving towards sustainability, and public buildings, or spaces such as libraries are playing a crucial role in integrating the concept of sustainability as a design element. Eco-friendly designs, efficient waste management systems, local materials, and renewable energy sources are some of the important steps to achieve it.

Aim

The development of a public library is a topic that warrants exploration, given its potential impact on the community and the role of libraries within the city. The research aims to conduct a comprehensive analysis of public library development, examine existing structures to identify strategies for successful development and focus on key library development factors.

Task

- The theoretical research is being conducted. The study aims to examine the impact of public libraries on both the community and the city. The study aims to analyze the impact of libraries on the overall behavior and the changes they bring to the community. The objective is to categorize the sustainable and developmental principles that guide the development of a public library. Lastly, the goal is to generalize the collected information and create a hypothetical model of a multifunctional public library's development.

- The empirical research is conducted. To create working hypotheses and develop an empirical research program based on the hypothetical model criteria. The proposed methods will be applied to the selected objects, information will be gathered, and a conceptual model of multifunctional public library development will be generated.

- An experimental design is developed. The goal is to scrutinize the current state of affairs and produce volumes that seamlessly blend into the environment. The design phase utilizes the research findings to develop a conceptual model. The goal is to develop a multifunctional public library in Tvirtoves g. 14.

Methodology and structure of the research project

Three parts make up the research: theoretical, empirical, and experimental.

1) For theoretical research, a literature review was carried out, collecting qualitative information, analyzing the impact on the community and the city, and applying sustainable development principles to the development of public libraries. The gathered information is summarized to develop a hypothetical model.
2) For empirical research, a case study about some famous libraries was carried out to understand the architectural and urban solutions; an additional qualitative survey and expert interview were carried out.
3) For the experimental design, the research-by-design methodology was used for designing the zone functions and the concept of the multifunctional library. Based on the conceptual criteria, principles, and rules on how a multifunctional library should be used, a conceptual model is designed. Lastly, the elaborated proposal is evaluated to achieve the criteria described in the research phase.

1. Theoretical and empirical research of public library development

The chapter is divided into two sections: theoretical research and empirical research. Both of the chapters include the aim task and the method of research.

1.1. Theoretical research

Aim

To understand and guide development, the research project aims to analyze factors and theories related to public space development, solve and formulate sustainable principles, and incorporate contemporary and modern elements that will activate and create a vibrant and multifunctional library space (public library).

Task

1) The aim is to investigate the significance of a library in the city by studying its history, typology, role as a center, and the digital revolution in the city.
2) It is important to understand the basic aspects, characteristics, and functions of a public library through its design, presence, influence, and knowledge.
3) To incorporate sustainability into various elements of public libraries by knowing its principles and the methods for better growth.
4) To understand the concepts and answers, undertake a case study on public library development initiatives.

Method of the research

The study is based on a survey of the literature, and a qualitative technique was used to collect data on theories, principles, and so on linked to the research issue, as well as a case study of a public library. Finally, the information gathered was generalized and used to develop a hypothetical model.

1.1.1. Library in the City

Libraries in the city have a long history, ranging from private collections to public institutions. Academic, public, and special libraries categorize them, each serving a specific function and user group. Libraries have evolved into thriving community hubs, providing not only books but also a variety of educational and cultural resources, holding events, and providing technological access. Libraries have embraced technology in the age of digital transformation, offering e-books, digital archives, and online resources, proving crucial in bridging the digital divide and ensuring access to information for all.

A library is a collection of books for reading or study, housed within a specific building or room. Its roots can be traced back to the Latin words "liber" and "bibliotheca," which gave rise to the word for library in German, Russian, and Romance languages. Libraries have evolved since the mid-20th century, transforming into extensive information resources and services

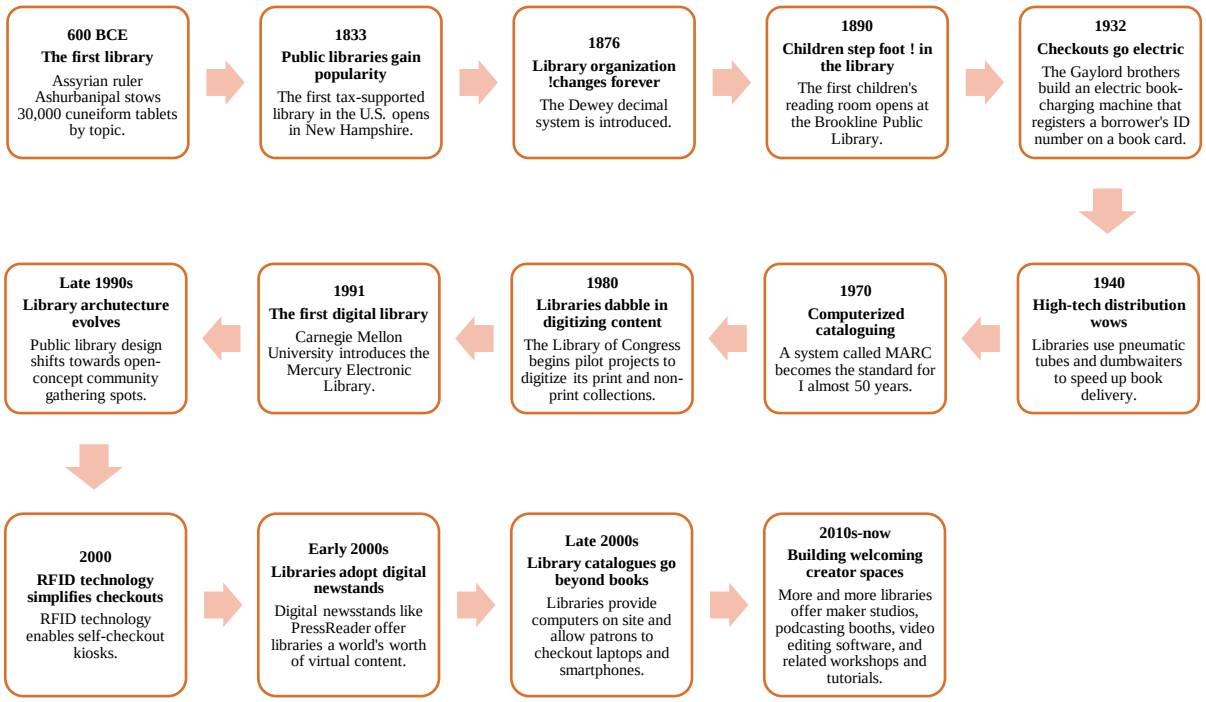


Fig. 1. Illustration of the Evolution of libraries in the 21st century (Team, 2021).

Furthermore, while studying the history of libraries, it is necessary to examine not only how the foundations were created but also the historical elements that were considered for the smooth flow of the space.

The elements can be considered as:

1) **Training and library management type**: Libraries have been protecting the majority of books and records from war, fire, and floods over the years, and they have helped to maintain their cultural heritage. When it comes to management, the major work of the active libraries is to keep and maintain the records and protect them. As scientific and industrial research emerged in the 19th century, the role of librarians expanded beyond simple record-keeping and maintenance to include subject-specific approaches, systematic cataloging, and classification to meet the evolving needs of the building.

2) **The professional librarian**: Librarians often specialize in certain areas. Their professional skills range from those of the archivist, who is concerned with records management, records appraisal, accessioning and arrangement, archival buildings and storage facilities, preservation and rehabilitation, and reference services, to those of the information scientist, who is concerned with research on the nature of information itself and the process of information flow and transfer between individuals and communities. The various branches of the information profession share many objectives, practices, and skills. (Library | Definition, History, Types, & Facts | Britannica, 2023)

3) **Types of materials**: The construction of collections involved using ancient materials, photographs, audiovisual materials, and magnetic materials, among others. The evolution of libraries in ancient times involved a tumultuous process for the search for materials that can be considered in the permanent record and that are relatively easy to use. Even during the 19th century, the introduction of photographs as a record-keeping material helped quite a lot with storing more records, which was quite efficient when it came to storage.

4) **Types of libraries:**

Table 1. Types of Libraries (LISedunetwork, 2016).

Academic	Public	Special	National	Government
School	State	Industrial	General	Ministries
College	District	Business	Agricultural	Departments
University	City	Trade	Medicine	Others
Professional Institutions	Town	Arts		
Research Institutions	Village	Music		
	Mobile	Blind		
		Prison		

- **Academic libraries:** Libraries were initially established as knowledge hubs, but later became necessary for academic institutes to improve learning and student development, as they facilitate systematic learning and resource organization.

- **Public libraries:** Advancements in technology, living conditions, and education have led to increased literacy, which has had a significant impact on society. This has resulted in a need for more reading among the public, including those interested in academics, geopolitics, democracy, and industry, leading to the formation of public libraries.

- **Special libraries:** As science and technology advanced during the industrial era, a growing number of industrial enthusiasts emerged, leading to widespread demand for specific industrial books. This also led to a growing demand for books related to business, team management, and organizational topics. Special libraries not only concentrate on specific topics but also address the disabilities that individuals encounter.

- **Government and national libraries:** Both libraries serve similar functions, discussing national developments from the perspectives of the government and the national public, as well as the intellectual, scientific, and cultural activities of the country. In the government libraries, it led to the creation of information-related books for different departments and ministries.

1.1.2. Library as a community hub and its digital transformation

Libraries provide respectful, supportive, and safe places where people can come together to participate in events and programs, express themselves creatively, or simply sit and ‘be’ with other people. Libraries assist social cohesion and cross-cultural understanding by enhancing positive social interaction. This can be of value to all members of the community but may be particularly helpful for vulnerable members of the community, such as some older and younger people or those with disabilities, itinerant workers, people newly arriving from overseas, and especially homeless people. (State Library of New South Wales, 2019)

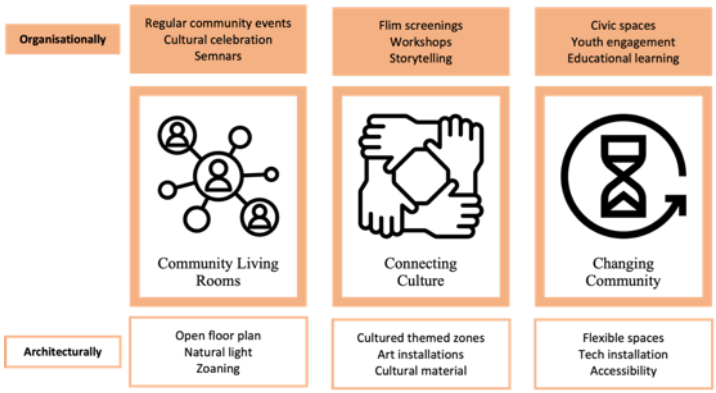


Fig. 2. Creating the library as a community hub through Organisation and architecture by the author.

- **Community living rooms**: The word itself signifies the change in function and layout from the past. Once dominated by a collection of books, the floor space now serves as a comfortable and relaxing area for people to meet and spend some time. These libraries offer a variety of different spaces—quiet contemplative nooks, places by the window, or seats near bustling thoroughfares. Libraries act as an extension of people's recreational time, in addition to continuing to serve their traditional roles. People may stay for much longer periods, seeking the amenities that longer stays require. No activity is mutually exclusive, with visitors choosing to undertake a range of activities while in the library. As library spaces become more flexible and adaptable, the number and type of uses they offer expand, attracting a greater diversity and number of users. (State Library of New South Wales, 2019)

- **Connecting cultures:** Nowadays, libraries serve not only as a place for reading, but also as a hub for cultural exchange and discussion, serving as a focal point for sharing details about events, activities, and community groups. Such places in libraries help to share information on community art projects and promote information about local government services. Some artworks, when installed in public libraries and other public buildings, help to connect those buildings through community culture.

- **Changing community:** With the moving world, library staff has also observed changing users coming to the library due to the change in demographics, aging population, increase in cultural diversity, and internal migration. This has resulted in significant modifications to the library's program and space.

1) **Aging population:** Countries with an aging population impact the functions of library servers, with the need for certain programs and an increase in home library services. It also helps the older generation maintain their independence and affection for their physical and mental health.

2) **Urban households:** As the population shifts to single households and abandons the apartment lifestyle, It creates the risk of social isolation. Public libraries can offer a good chance for homework, study, children's playtime, and social interaction.

3) **Virtual study and workspace:** Following the global COVID-19 pandemic, it has become commonplace for individuals to work from home, operate their home businesses, or enjoy a flexible workspace. Even when people are in their comfort zones, it necessitates the use of co-working spaces, video, and teleconferencing, which are now commonplace. In such a situation, libraries have begun to adapt and transform their spaces to meet modern requirements. Libraries are adapting by creating distinct zones, offering Wi-Fi connectivity, and facilitating access to the local library.

What is digital transformation? “Digital transformation is about doing things differently — creating a completely new business model by using modern information and computer technologies.” (Savić, 2021)

The shift from analog to digital has begun, affecting many parts of society, including the economy, science, education, culture, politics, and personal and professional lives. We widely use advanced technologies like artificial intelligence, machine learning, automation, and big data. This transformation has an impact on library operations in terms of changes in product and service offerings, operational agility, customer-centricity, and staffing requirements. The emphasis is on the people's requirements for effective digital transformation in libraries.

The effect of these changes can be termed as 5Vs which are velocity, Value, Variety, Volume, and Veracity which are impacted by Digital Transformation.

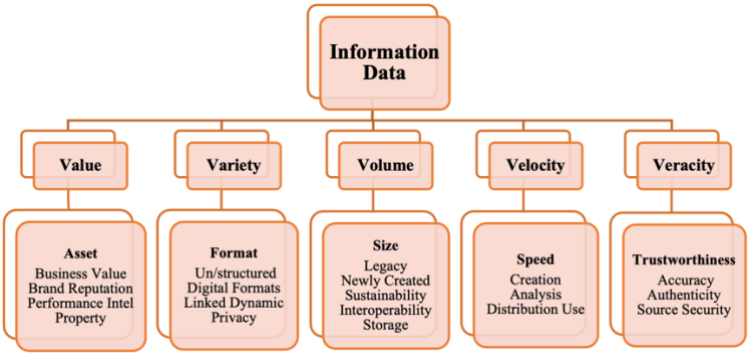


Fig. 3. Illustration of 5 Vs of data/Information (Savić, 2021).

The 5 Vs of data—Volume, Velocity, Variety, Veracity, and Value—have a significant impact on the design and architecture of modern libraries. Libraries, as repositories of knowledge and information, must address these traits to fulfill the changing demands of their customers. Because of the enormous volume of items in libraries, whether physical or digital, effective storage methods and accessible categorization are required. The speed with which information is sought and provided emphasizes the significance of efficient check-in and check-out systems. A library with a diverse collection requires adjustable shelving and digital equipment. The goal of the librarian is to assure truthfulness and value by offering user-centered places and services. Incorporating the 5 Vs into library design results in dynamic, responsive, and value-driven environments that empower individuals in their quest for information.

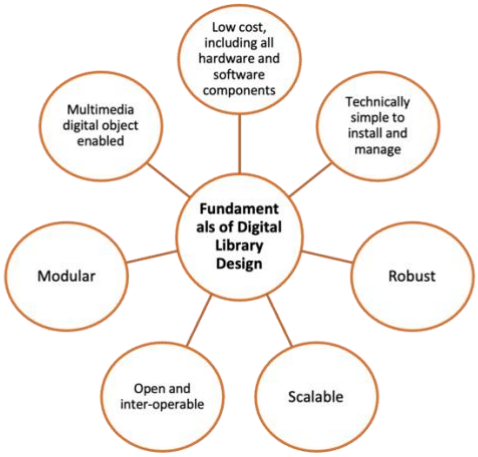


Fig. 4. Fundamentals of a Digital Library (Kumbhar, n.d.).

1.1.3. Architectural design and layout (function)

Public libraries are a vital resource for the community, involving staff, local government, and users. To adapt to evolving user needs, libraries are implementing collection assessment methods and rotating collection models. This helps determine the necessary physical space and flexibility for each branch site. Academic libraries, which previously dedicated over 50% of their area to physical collections, are now considering reducing the central library space for book stacks, ensuring that collection storage takes up 25% or less of the overall building size.

Fig. 5. Illustration of Library Evolution/Space Allocation Models (Koen et al., 2018).

Space allocation shifts: A typical academic library would have dedicated 50% of its space to collections, 25% to personnel, and 25% to patron services forty years ago. Today, library space utilization is more accurately described as a diverse mosaic of distinct but complementary space types and services. As academic institutions prepare for the future of their libraries, 50-75% or more of available space will be designated for public use. Often, less than 25% of the budget will be given to collections, while the remaining 25% will be allocated to library personnel, as well as staff for a variety of partnerships that increase services available to patrons, such as career centers, innovation hubs, technology, and academic assistance programs. (Koen et al., 2018)

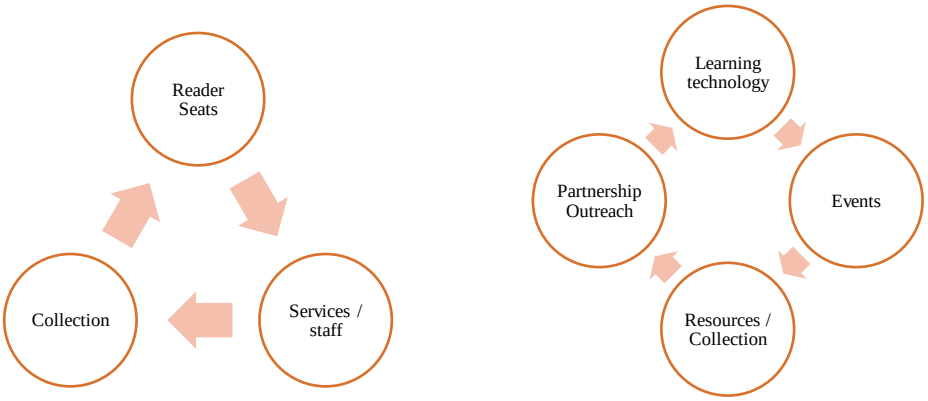


Fig 6. 50% of available space is allocated to patrons (Koen et al., 2018).

1.1.4. Sense and psychological impact of a library

The phrase "sense of library" can have different meanings, depending on the context and from person to person. It can be interpreted as:

- **Social and community building (belonging):** Libraries offer a neutral, welcoming environment where individuals from all backgrounds may interact. They organize gatherings, seminars, reading clubs, debate groups, and other events and activities that promote social contact and a feeling of belonging.

- **Cultural and artistic events:** Libraries frequently host cultural events, art exhibitions, musical concerts, and theatrical plays. These gatherings give the community a more diverse cultural experience and give regional performers and artists a stage on which to display their abilities.

- **Understanding and perceiving:** "Sense of library" may refer to a person's perception or comprehension of the worth, function, and role that libraries play in society. This entails realizing the value of libraries in facilitating information access, increasing literacy, educating the public, and supporting research.

- **Individual relationship:** The personal connection or relationship refers to an individual's distinct and private associations, memories, feelings, and experiences associated with a specific library. People have a particular place in their hearts for libraries for a variety of reasons, and these emotional and experiential ties can be quite diverse.

- **Physical and atmospheric environment:** Libraries provide the atmosphere, personality, and mood that their physical area inspires. It includes a range of components that enhance the emotional and sensory aspects of being in a library. It depends on various factors such as climate control, furniture placement, lighting, and architectural design.

Libraries are taking part in helping the community with mental health and wellbeing initiatives. This may not seem like the most obvious thing, but libraries hold a huge impact when it comes to making a difference in mental health and wellness. Libraries maintain a wide reach into different populations within a community. Being such a centralized resource that is open to all types of people, the library is the ideal place to launch educational wellness programs and create a safe space for people to take refuge when needed. (EveryLibrary, 2021)

Some of the ways libraries can affect people psychologically are:

- **Intellectual stimulation:** Libraries provide a diverse range of written resources, including books, journals, and other works, catering to various interests and disciplines. These spaces, with natural light and comfortable chairs, promote deep concentration and cognitive engagement, allowing patrons to explore intellectual works and literature. The methodical arrangement of shelves further piques their interest.

- **Achievement and Empowerment:** The retrieval of knowledge in libraries enhances one's sense of empowerment and accomplishment. The well-organized design of the library area, including bookcases and study spaces, ensures a well-organized and accessible environment, thereby enhancing the overall usability of the library's empowering experience.

- **Support for mental health:** Libraries play a critical role in promoting mental health by hosting gatherings and workshops for individuals. These gatherings provide tools, knowledge, and coping mechanisms to enhance mental well-being. Services like mindfulness exercises, stress management strategies, and therapy sessions help individuals deal with obstacles productively. Multipurpose rooms and comfortable nooks ensure accessibility and inclusion.

Informational cities are based on knowledge, and the traditional institutions of knowledge management are libraries. Knowledge institutions like (digital) libraries support cities with worldwide information and establish a culture of lifelong learning. In advance of the highly developed ICT infrastructure of an informational world city, libraries have a high supply of digital information as well as attractive physical workplaces. In this paper, we investigate the role of libraries in informational cities and explain their important role in the ICT and cognitive infrastructure. (Mainka & Khveshchanka, 2012)

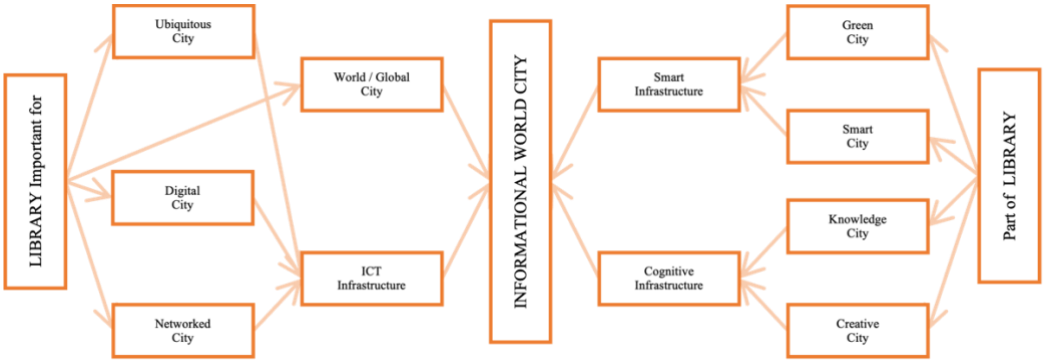


Fig. 7. The role of libraries in informational world cities (Mainka & Khveshchanka, 2012).

Library services can facilitate the importance of libraries to knowledge management in a variety of ways, as detailed below (Fagbola et al., n.d.).

- **Knowledge resource management:** As a result of exponential growth in human knowledge in a variety of formats, libraries must develop their resource access and sharing strategies from print to electronic and digital resources in concert with their mission and charges.

- **Resource sharing and networking:** Libraries have had a long tradition of resource sharing and networking. The rapid development of computer, telecommunication, networking, and digital technologies has greatly expanded these, largely due to the full cooperation and participation of all member libraries.

- **Information technology development:** To facilitate knowledge management implementation, a well-designed and operational knowledge management system should be in place. The latest information technology should be used as an enabler.

- **User services:** Knowledge management's ultimate goal is to provide users with a variety of quality services to improve communication, use, and knowledge creation.

- **Human resource management:** Library staff possess a great deal of expert knowledge, which should be regularly inventoried, indexed, and made accessible through electronic databases. The university and research communities possess abundant knowledge, and we should encourage the transfer of experience.

1.1.5. Public Library Embracing Sustainable Development Principles

In the twenty-first century, public libraries are embracing sustainable development ideas, aligning with the United Nations' Sustainable Development Goals (SDGs). They serve as community hubs, promoting information access as well as social, economic, and environmental sustainability. Libraries provide materials on climate change, renewable energy, and responsible consumerism, enabling informed decision-making. They contribute to the UN's SDGs by promoting education, inclusivity, and environmental responsibility.

- **Access to a safe and inclusive environment:** Libraries are becoming centers for environmental conservation and sustainability, providing secure spaces for learning about sustainable practices and renewable energy. They promote inclusivity and safety for all, regardless of age, gender, or social status. Libraries host talks, seminars, and events, inspiring cooperation, and idea-sharing to create a more sustainable future.

- **Support for small businesses and entrepreneurs:** Libraries play a crucial role in promoting local economic growth and sustainable entrepreneurship by providing resources like business literature, training, and access to databases. They offer information on socially aware entrepreneurship, environmental responsibility, and sustainable practices. Aspiring entrepreneurs can learn about circular economy ideas, green technology, and sustainable business models. Libraries often collaborate with regional sustainability groups for tailored advice on sustainability.

- **Information technology access:** The digital gap is a persistent issue where certain individuals lack equal access to technology and the internet. Libraries play a crucial role in addressing this gap by providing free computer and internet access to their communities. This ability to access information and online resources is essential for people's ability to stay educated and involved in contemporary life. Libraries help close this gap by enabling people to access the internet and computers, improving their digital literacy and competence, enabling them to participate in the digital economy and seek sustainable possibilities.

- **Cultural and recreational opportunities:** Libraries function as dynamic centers of culture and leisure in local communities, making a substantial contribution to the area's social cohesion and sustainability. Libraries contribute to the cultural fabric of the community by organizing cultural events, art shows, concerts, and leisure pursuits that promote creativity, mutual understanding, and unity. These gatherings provide locals and artists alike a stage on which to display their skills and celebrate variety, fostering a feeling of community and solidarity.

Fig. 8. The main SDGs for the finished public libraries (Sahavirta, 2022).

The key objectives are (Sahavirta, 2022):

- 3: Health and well-being: Reading promotes health, and library card holders live longer.
- 4: Good education: Libraries support the reading and lifelong learning of children, young people, and adults alike. All library activities, from storytime to art exhibitions and events, incorporate the environmental aspect.
- 10: Fighting inequality: Public libraries provide free-of-charge basic services that are available to all. Libraries do not tolerate any form of bullying or discrimination. Libraries are responsible employers.
- 11: Sustainable cities and communities: Libraries follow municipal environmental guidelines, and many have their own environmental program, certificate, or ecological subsidy system.
- 12: Responsible consumption: Libraries are pioneers in the circular economy and act as sharing economy platforms. Libraries provide shared premises and tools, reducing the need for consumption.
- 13. Climate Actions: Libraries recycle and conserve energy. Libraries provide up-to-date and reliable information on environmental issues and assist in finding it.

Fundamental tenets of accessibility and inclusion are essential in modern public spaces, ensuring libraries are accessible to everyone, regardless of physical ability. Libraries should be visible and connected, promoting community involvement and interaction. They should also be flexible and adaptable to changing needs and interests, allowing them to modify their design, contents, and equipment to accommodate new developments in technology, societal demands, and fashions. These fundamental principles are crucial in creating a welcoming and inclusive environment for both employees and users.

- **Accessibility and inclusivity:**

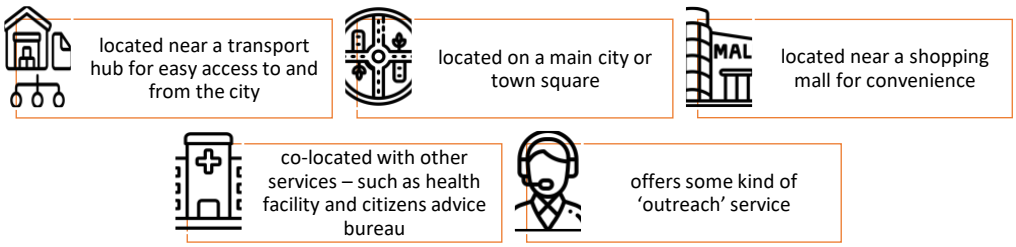


Fig. 9. Accessibility and inclusivity (Designing Libraries, Gemma, 2016).

- **Visibility and connectivity:**

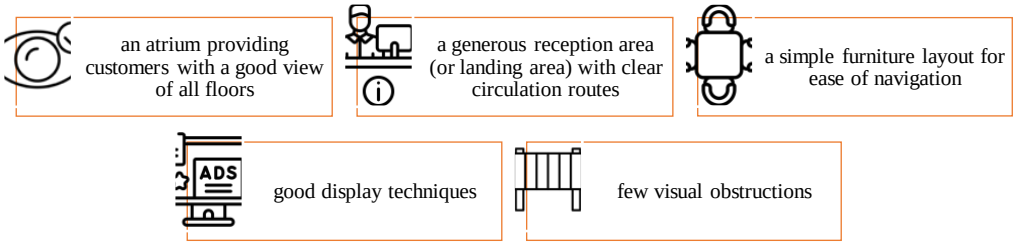


Fig. 10. Visibility and connectivity (Designing Libraries, Gemma, 2016).

- **Flexibility and adaptability:**

Fig. 11. Flexibility and adaptability (Designing Libraries, Gemma, 2016).

The world is facing the unprecedented consequences of climate change, where the terms pollution, e-waste, and depletion of natural resources have become a part of our daily lives. Libraries of the 21st century have the potential to play a leadership role and address the issue of environmental sustainability by developing green libraries. There are four major measures and practices to help develop a green library: (Gupta, 2020)

- **By having green design and interior:**

Table 2. Green Building Design Initiatives (Gupta, 2020).

Green Building Design Initiatives	Benefits
Properly designed ventilation systems	Ensures air regulation, controls impurities, reduces room temperature, controls humidity levels, and reduces energy usage.
Window shading	Keeps the room warm and cold according to the season and reduces heat gain.
Low- and Zero-VOC paints	Reduces sources of pollutants, has less odor compared to high-VOC paints which cause health issues and negatively impacts the environment.
Airtight construction	Restricts dust, pollutants, smoke, and other pollutants, and provides fresh air.
Rooftop gardens	Reduces the heat of the building, keeps the building cool, and removes CO2.
Use of sensor taps and dual-flush toilets	Decreases water usage in bathrooms.
Solar power produces power by converting sun- light into electricity and wind turbines to convert wind into energy	Libraries can use renewable energy to meet their electricity requirements and act as a role model for others.
Tree plantation around the library	Tree plantation prevents pollution and increases the aesthetic appeal of the library.
Building materials made from recycled material (e.g., flooring made from recycled rubber) are particularly useful alternatives	Saves natural resources and reduces pollution.
Use of LED lights	LED lights are more efficient and utilize less energy than conventional lighting; low heat radiation, high brightness, and longer life.
Use of soft pads in chairs	With the use of acoustic controls, soft pads are being used over the feet of the chairs to reduce noise pollution.

- **By integrating green practices into libraries' day-to-day operations:**

1) **Energy efficiency**: LED Lighting to cut operating expenses and energy consumption, swap out incandescent lightbulbs for energy-efficient LED ones. Energy Audits to find areas for improvement and put energy-saving solutions in place appropriately, conduct routine energy audits.

2) **Waste reduction and recycling**: Recycling stations throughout the library, place special containers for recycling materials such as glass, paper, plastic, and other recyclables. Paper reduction to reduce paper consumption, prioritize digital resources, use electronic communication, and promote double-sided printing. Reuse programs take steps to repurpose things in the library, such as turning old books into crafts or original artwork.

3) **Sustainable procurement and transportation**: Eco-friendly products opt for responsibly sourced, recycled, or eco-friendly office supplies, furniture, and cleaning products. Digital collections give priority to digital collections to lessen the demand for tangible items, which will cut down on waste and resource usage. Bike racks install bike racks and provide rewards to employees and patrons who come to the library by bicycle or public transportation. Carpooling programs to cut down on carbon emissions, encourage employees to carpool or take advantage of ride-sharing services.

4) **Efficiency of Materials and Resources**: Local and recycled materials to reduce the environmental impact of manufacturing and shipping, use locally produced, recycled, or recovered materials. Resource-efficient construction when building, make the most use of materials, reduce waste, and ensure that construction trash is disposed of or recycled responsibly.

5) **Water management and conservation:** Rainwater collection installs rainwater collection systems to gather and repurpose rainfall for non-potable water requirements and landscape irrigation. Low-flow fixtures to reduce water usage in restrooms and other spaces, install low-flow faucets, toilets, and urinals.

- **Green collection development and literacy programs**:

Environmental issues are addressed through literacy programs that encourage sustainable practices. These initiatives raise awareness and educate the community about the importance of preserving the planet and fostering a sustainable environment.

There are various ways to promote a green library through education, awareness, and literacy programs (Gupta, 2020)

Libraries promote the concept of sustainability, libraries need to maintain a useful collection of green resources and online materials and ensure better access to those resources.To create awareness among students by conducting programs, campaigns, and events, such as organizing talks, competitions, video-making, painting, poetry, and photography on the ‘green’ concept, which will educate the users and nurture creativity among them.

Libraries can play a leadership role by indulging in and making connections with like-minded people to promote sustainability by educating the students and faculty.It is crucial to understand the practices of other libraries and provide training to library professionals, enabling the upcoming generation of librarians to embrace this concept.

- **Smart and innovative technologies for green libraries:**

The latest innovative and cutting-edge technologies have the potential to reduce energy consumption and contribute to the mission of a green and sustainable world. Libraries can leverage these technologies to improve their energy performance. (Gupta, 2020)

1) **Solar Panels**: The installation of solar panels on the roof of the library building helps reduce the dependence on non-renewable sources of energy. It also promotes the use of renewable sources of energy and creates awareness among people.
2) **Motion Sensor Devices:** In libraries, cases of electricity wastage are common. Users leave the place without switching off the devices. A motion sensor device that can automatically detect your absence and switch off the electrical appliances will help conserve energy. For instance, the National Library in Singapore uses sensors to adjust the brightness or dimness of the lights**.**
3) **Automatic Lighting Controls:** It is an effective strategy that contributes significantly to energy savings by operating the lighting as per the requirement. The amount of available light adjusts according to the space occupied.
4) **Smart Automatic Energy Saving System**: Detects the entry of a person with a PIR sensor, monitors the room temperature and brightness, and adjusts the speed of the fan; accordingly, it also shuts down the complete system in the absence of any individual, which helps in reducing energy waste.
5) **Indoor Air Quality Monitoring:** The building's air quality can be monitored and assessed using the Internet of Things and ambient-assisted living technologies. The IAQ monitoring systems help maintain energy efficiency in buildings and provide excellent ventilation to ensure the healthy air quality in the library and the well-being of the users.

1.1.6. Case study of public libraries

A case study was conducted on five different types of small-town public library development located in the USA, Australia, Canada, and Israel. Each of the case studies focuses on different aspects of serving its community and achieving sustainability.

As in the previous chapter, we discussed all the principles and rules of how a library can be more beneficial for the community, how it will help people connect, and how it will help achieve sustainability. The author, mindful of the aforementioned principles and rules, devised an evaluation table to assess public library development projects and case studies, thereby enhancing comprehension of the institution's operations. The scale for the evaluation ranges from 1 to 5. Additionally, you can use the percentage to create a chart for better understanding.

Table 3. Evaluation table for public library development projects by author.

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design			
	Location			
	Accessibility			
Function	Library services			
	Community services			
Social attributes	Community engagement			
	Inclusivity			
	Educational support			
Sustainability	Energy efficiency			
	Green Spaces			

- **The McArthur Public Library, Biddeford, Maine, USA:**

The McArthur Public Library in Biddeford, Maine, is well-known for its community participation and sustainability efforts. They conduct a range of events, maintain an active internet presence, and support local authors and artists. To enhance energy efficiency, the library has also undergone eco-friendly modifications.

Fig. 12. The McArthur Public Library, Biddeford, Maine, USA (Home - McArthur Public Library, n.d.).

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design	3	11	27.5 %
	Location	4		
	Accessibility	4		
Function	Library services	5	10	25%
	Community services	5		
Social attributes	Community engagement	5	13	32.5%
	Inclusivity	3		
	Educational support	5		
Sustainability	Energy efficiency	3	6	15%
	Green Spaces	3		

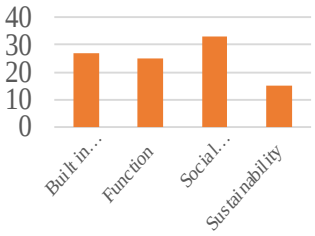


Fig. 13. The results of McArthur Public Library and the pie chart by the author.

The library actively supports its community by offering access to a variety of educational resources, encouraging literacy through programs and activities, and serving as a cultural and social hub for local citizens. In its pursuit of sustainability, the library has implemented energy-efficient technologies, promoted digital resources, and engaged the community in eco-friendly initiatives, demonstrating its commitment to both community enrichment and ecological responsibility.

- **Coromandel Community Centre Library, South Australia:**

This library, located in the South Australian town of Coromandel Valley, serves a small population and focuses on sustainability. They conduct environmental education programs, and seed libraries, and involve the community in environmentally responsible behaviors.

Fig. 14. Coromandel Community Centre Library, South Australia (Coromandel Community Centre, n.d.).

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design	3	8	22.5
	Location	2		
	Accessibility	3		
Function	Library services	3	7	19.5%
	Community services	4		
Social attributes	Community engagement	4	11	30%
	Inclusivity	3		
	Educational support	4		
Sustainability	Energy efficiency	5	10	28%
	Green Spaces	5		

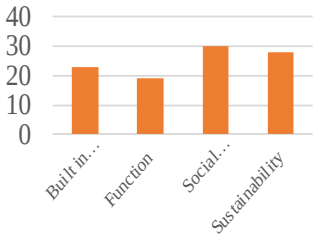


Fig. 15. The results of Coromandel Community Centre Library and the pie chart by the author.

The library serves an important community function by providing access to a plethora of educational materials, promoting local literacy and learning via various programs, and developing social ties through cultural events and gatherings. To achieve sustainability, the library has implemented initiatives such as energy-efficient construction techniques, the promotion of digital resources to minimize paper consumption, and active community engagement to support eco-friendly activities. The library provides a vital resource for its citizens while demonstrating a commitment to environmental responsibility by combining its community support and sustainability initiatives.

- **Eilat Public Library, Israel:**

The Eilat Public Library in Israel's southernmost city serves a modest population. They concentrate on digital resources, provide a large selection of e-books and audiobooks, and work with local schools to assist with educational projects.

Fig. 16. Eilat Public Library, Israel (Homepage - Eilat Municipal Library, n.d.).

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design	2	10	22.5%
	Location	4		
	Accessibility	4		
Function	Library services	5	10	22.5%
	Community services	5		
Social attributes	Community engagement	5	15	32.5%
	Inclusivity	5		
	Educational support	5		
Sustainability	Energy efficiency	5	10	22.5%
	Green Spaces	5		

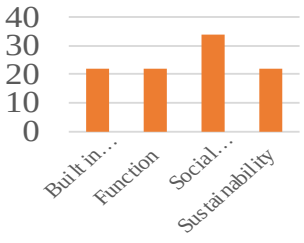


Fig. 17. The results of Eilat Public Library and the pie chart by the author.

The Library in Israel supports its community by making educational resources available to the public, encouraging reading and lifelong learning, and holding cultural and social activities. The library has used green construction methods, energy-efficient technology, and waste-reduction strategies to attain sustainability. Furthermore, it actively participates in environmental activities with the local

community, contributing to both the enrichment of its inhabitants and its dedication to environmental responsibility.

- **La Conner Regional Library, Washington, USA:**

This small-town library in La Conner, Washington, is committed to promoting environmental stewardship. They have implemented several environmentally friendly efforts, such as energy-efficient lighting and recycling programs. The library also hosts a variety of community activities and acts as a meeting place for locals.

Fig. 18. La Conner Regional Library, Washington, USA (La Conner Swinomish Library - A Place for Discovery, Connection, and Inspiration, n.d.).

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design	3	13	32.5%
	Location	5		
	Accessibility	5		
Function	Library services	5	10	25%
	Community services	5		
Social attributes	Community engagement	5	11	27.5%
	Inclusivity	3		
	Educational support	3		
Sustainability	Energy efficiency	3	6	15%
	Green Spaces	3		

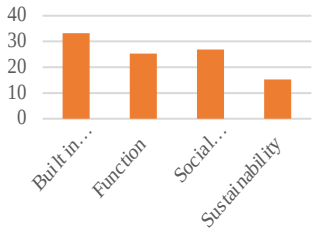


Fig. 19. The results of La Conner Regional Library and the pie chart by the author.

The La Conner Regional Library in Washington, USA, supports its community by providing access to a diverse range of educational materials, encouraging literacy and learning through various programs, and acting as a focal point for cultural events and social gatherings. The library has used green building methods, energy-efficient technology, and waste reduction initiatives to attain sustainability. Furthermore, it regularly participates in eco-friendly programs with the local community, demonstrating its commitment to both community enrichment and environmental responsibility.

- **Stanley A. Milner Library, Alberta, Canada:**

Despite not being in a tiny town, this Edmonton, Alberta, library has taken strides to become more sustainable and community-focused. They recently invested in energy-efficient architecture and completed major renovations to create a more open and welcoming atmosphere.

Fig. 20. Stanley A. Milner Library, Alberta, Canada (Stanley A. Milner (Downtown), n.d.).

Principles		Rating (1-5)	Total	Percentage %
Built in environment	Architecture and design	5	15	33.5%
	Location	5		
	Accessibility	5		
Function	Library services	5	10	22.5%
	Community services	5		
Social attributes	Community engagement	5	15	33.5%
	Inclusivity	5		
	Educational support	5		
Sustainability	Energy efficiency	3	5	10.5%
	Green Spaces	2		

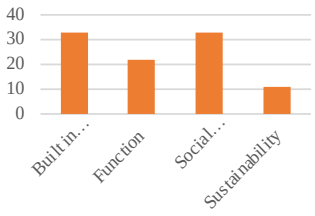


Fig. 21. The results of Stanley A. Milner Library and the pie chart by the author.

It is an important community resource because it provides access to educational materials, promotes literacy through programs, and offers venues for cultural and social participation. To achieve sustainability, the library has built environmentally friendly aspects into its architecture, adopted energy-saving technology, and prioritized digital materials to decrease paper consumption. It actively participates in community sustainability activities, demonstrating a commitment to community enrichment and responsible environmental care.

1.1.7. Hypothetical model of development principles of multifunctional library space (public library):

The first step is to determine the type of development, which may include historical elements, community involvement, a sustainable approach, recreational use, or mixed use.

The following principles govern the development of public libraries:

- Today's public library development centers on community engagement and inclusivity. It starts with a community needs assessment, focusing on inclusive design and diverse spaces. Libraries maintain relevance through regular evaluation and adaptation, keeping services and resources aligned with community needs. This approach creates vibrant hubs for learning, creativity, and connection.

- Modern public library design prioritizes accessibility, inclusivity, functionality, and sustainability. It caters to all community members, including those with disabilities, and uses eco-friendly materials, energy-efficient systems, and green initiatives. These design principles ensure spaces can adapt to various purposes, fostering a harmonious and inviting atmosphere for all.

- Public library design focuses on sustainability, integrating technologies for energy, water, waste reduction, and recycling. Natural ventilation and passive cooling strategies enhance comfort and reduce environmental impact. Libraries are also champions of biodiversity and ecosystem

protection, incorporating green spaces and conservation practices to benefit both the community and the planet.

Additionally, the four-factor model serves as a space-functional purpose tool for building new libraries, modifying existing ones, and designing specific rooms. It highlights the notion of a creative area, encouraging creativity and innovation. The paradigm has an impact on international library design trends and represents four shared goals: experience, empowerment, involvement, and innovation. Experience and empowerment are concerned with traditional library ideals such as education and social mobility, whereas engagement and innovation are concerned with contemporary values such as social capital and community harmony.

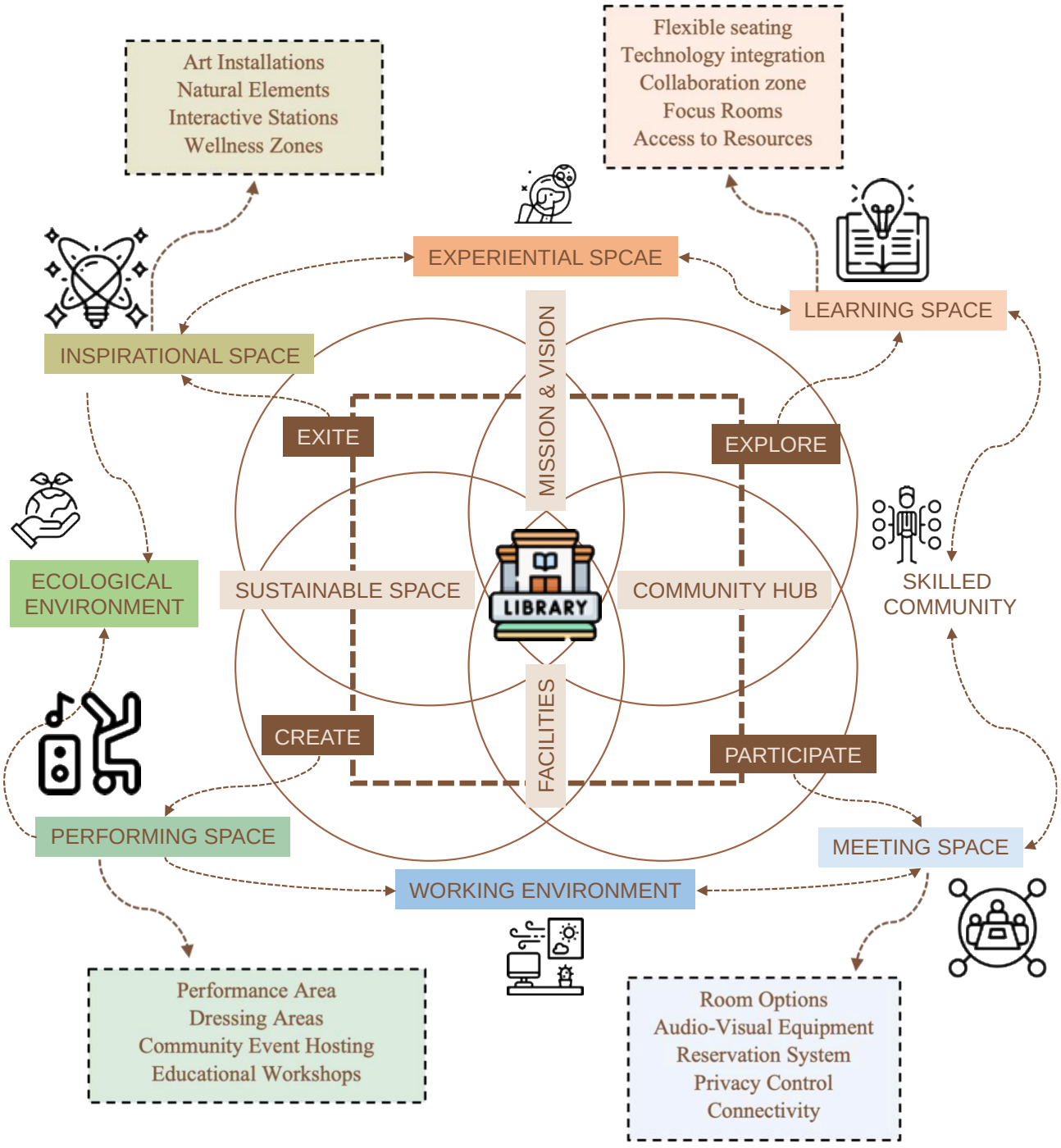


Fig. 22. Hypothetical model of development principles of a multifunctional library space.

1.2. Empirical research of multifunctional public library development

Aim

To understand the feasibility of developing public spaces and determining the public library development structure, an examination of the architectural and urban structure, its social viability, connectedness, and complexity must be carried out.

Task

1) To develop four working hypotheses from the analytical research's hypothetical model.
- Integrating multifunctional spaces in a public library can create a community hub and satisfy different age groups.
- Equipping public libraries with unique features, including those for those with disabilities, can improve accessibility and motivate people to come.
- The sustainable facade of the space will contribute to developing a sustainable and friendly community center.
- Community involvement can help to develop a better library that satisfies the needs and demands of society.

2) Objects and methods are chosen for empirical research to prove the working hypothesis.

3) From the information acquired, design a conceptual model of a public library that is relevant and fits human needs.

Methods of the research

A study was conducted to collect data about architectural and urban solutions for the selected objects. Then, for the first hypothesis, a functional analysis and interview (a qualitative structured survey) were done for the analysis. In the second hypothesis, a Q-GIS and expert interview were conducted for the analysis. The third hypothesis employs interviews with sustainability experts and employs a public survey as a tool for analysis. Finally, the fourth hypothesis involves conducting a sociological survey and presenting the results quantitatively.

Table 4. Empirical research program.

Number	Working Hypothesis	Object	Methods	Tools
01.	Integrating multifunctional spaces in a public library can create a community hub and satisfy different age groups.	Public library projects	**Space analysis, Interview** Data collection: Types of spaces, usage Qualitative structured survey	**Sociotope AutoCAD Interview**
02.	Equipping public libraries with unique features, including those for those with disabilities, can improve accessibility and motivate people to come.	Public library projects Specialists	**Unsystematic observation** Accessibility Mapping for Inclusive **Interview with experts**	**Q-Gis Interview**
03.	The sustainable facade of the space will contribute to developing a sustainable and friendly community center.	Analogs	**Interview, Survey** Observational thinking, Investigate attitudes, behaviours, and perceptions. Visualising the facade	**Interview Survey**
04.	Community involvement can help to develop a better library that satisfies the needs and demands of society.	People leaving in Alytus	**Sociological survey** Quantitative data	**Survey form**

1.2.1. Integrating multifunctional spaces in a public library can create a community hub and satisfy different age groups.

Integration of multifunctional spaces within the public library serves a dynamic function, transforming the traditional notion of a library into a community hub. By embracing various functions, from study areas to interactive zones and event spaces, these libraries become inclusive environments catering to diverse age groups. Furthermore, these places frequently provide seminars, presentations, and meetings for adults, fostering lifelong learning and social contact.

- **Functional Analysis:** Functional analysis is the process of understanding a space or building's functional requirements and needs. It helps to understand the purpose and structure it serves. Understanding requirements, optimizing design, adaptability, and future needs, and ensuring the safety and privacy of the space.
  For functional analysis, three objects were selected to have a detailed study of how the functions are spread out in the library space, which will help to understand how the integration of different functions is placed and how semiprivate and open spaces are arranged.

The selected objects are:

1) **Les Halles Building Media Library and Multifunctional Spaces:** The library serves as a vibrant and dynamic media library with multifunctional spaces. The design offers a seamless and modern layout with a cultural essence. This architectural layout not only holds a large collection of literary gems, but it also has adaptable spaces for events, workshops, and community meetings.

Fig. 23. Les Halles building media library and multifunctional spaces.

2) **Nasushiobara City Library:** The modern architecture and peaceful surroundings provide visitors with a serene space to immerse themselves in learning and literature. The multifunctionality and diverse collection of books in the form of physical and digital sources. These flexible rooms serve as dynamic centers that stimulate interaction, creativity, and a feeling of community within the library's walls, whether hosting cultural exhibitions, interactive learning activities, or simply offering a tranquil area for independent exploration.

Fig. 24. Nasushiobara City Library.

3) **Library Building in Bauska:** The library is surrounded by a residential area with low-rise buildings. With its modern style and adjustable structure, the library is more than just a book repository. Its adaptable spaces may accommodate a wide range of activities, from participatory workshops and cultural events to educational lectures and community meetings. Its architectural flexibility enables smooth transitions between areas, providing zones for focused study, collaborative work, and even creative displays.

Fig. 25. The library building in Bauska.

The analysis is divided into two parts to examine the functional aspects. The first part focuses on the five main separations of function within the library structure: library space, public service, café and gallery, administration, and business information center.

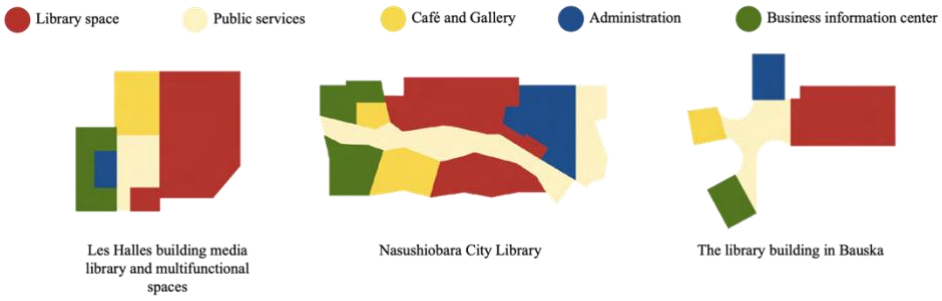


Fig. 26. Main (Five) separations of function between the library spaces.

The five main library spaces are:

1) **Library Space:** The library's stacks/collection area serves as a storage space for magazines, books, and other items. The area is equipped with shelving, lanes, and a classification system to facilitate quick access. Reading areas are places where patrons can read, study, or work peacefully. The areas may include tables, private study carrels, comfortable chairs, and occasionally, computer terminals.

2) **Public Services:** The helping desk is handled by the library staff or assistant, this is the place where people can ask for help, guidance, or information about the library. Checkout and return areas for books and items. This might feature self-service checkouts or manned counters. Additionally, public services include open spaces for various purposes.
3) **Cafe and Gallery:** A cafe is a distinct or integrated location where customers may purchase refreshments. It offers a relaxing setting for chatting or taking a rest. The gallery/exhibition space is used to showcase art, host community events and exhibitions, and enhance the library's cultural and educational aspects.
4) **Administration:** Staff office areas perform administrative and managerial tasks like cataloging, acquisitions, staff management, and general library operations. Meeting rooms include staff conference rooms, community gathering spots, and library-sponsored activities.
5) **Business Information Center:** Business-related information, such as market research reports, financial databases, and entrepreneurial tools, has its sections or services. Consultation areas where customers may get help with business-related questions like launching a firm, market analysis, or career coaching.

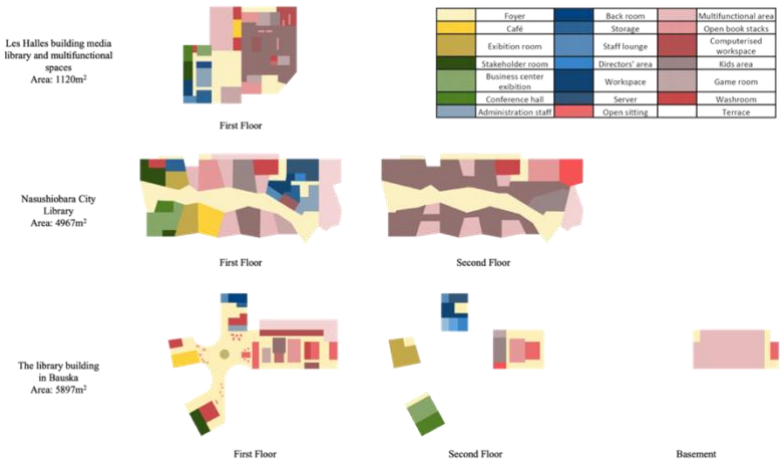


Fig. 27. Detailed separation of functions between the library spaces.

The library's detailed separation of spaces reveals that the foyer, a part of the public service, serves as the focal point for dividing semi-private and open spaces. Administration and business fall under the semiprivate category, whereas open and semi-open areas are public spaces used by people without interference.

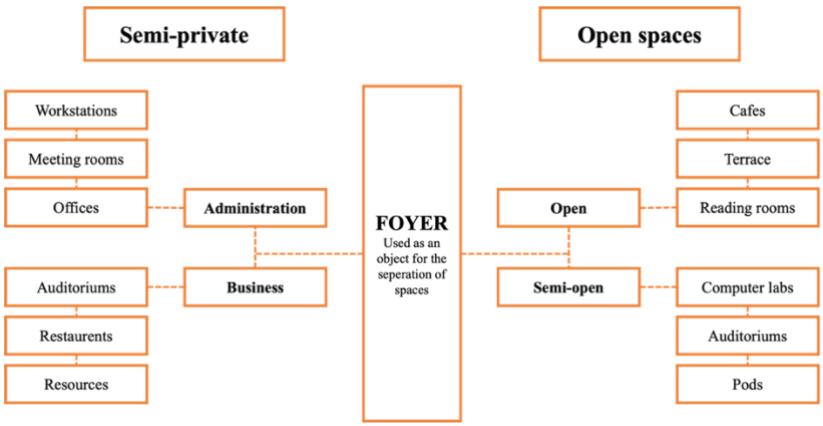


Fig. 28. Separation of spaces, keeping FOYER as a dividing object by the author.

- **Interview with the architectural expert regarding multifunctionality:** The architectural design of a public (library) space serves as a building block for creating a dynamic community. Architecturally, this integration entails a careful plan that smoothly merges flexible sections, allowing for various activities and interactions. Architects play a critical role in designing spaces that accommodate the needs and interests of different age demographics by incorporating zones for children's story hours, interactive learning spaces for teens, designated quiet areas for focused study, and communal spaces for social gatherings and events.

To better understand it, questions were posed to the experts to gain a deeper understanding of the initiative. For this, three experts were selected with backgrounds in the architecture field and practice.

1) **When designing public spaces such as libraries, how does the incorporation of multifunctional spaces correspond with your architectural philosophy?**

Expert 1: Incorporating multifunctional spaces is something that has been going on for a while now. The adaptability and user-centric design help to cater to diverse community needs. Interactive and accommodating various activities relevant to all keep the community engaged.

Expert 2: My approach focuses on a collaborative environment that inspires creativity and interaction. The area should be a place for knowledge sharing where different age groups interact. A sense of community inclusion in vibrant and socially cohesive places plays an important role.

Expert 3: The space should revolve around the different spaces, which keep evolving alongside changing needs and technological advancement. Multifunctional spaces offer seamless modifications to accommodate evolving user preferences and age groups.

2) **Design strategies or innovations that you employ to enable flexibility in the multifunctional spaces to serve a variety of activities and age-specific needs. And what are the pros and cons of such a design?**

Table 5. Positive and negative of having flexibility in multifunctional spaces.

	Partitions and Modular Furniture	Special	National	Government
Key Points:	Movable walls, Space divisions, Customizable layout.	Flexible zoning, Interchangeability, Foldable tables, Convertible seating, Storage solutions.	Adjustable height furniture, Accessible ramps, Tactile textures, Friendly spaces.	Adjustable lightning, Acoustics, Tech-driven interface.
Positive points:	1. Space pramotes changing needs. 2. Utilization of spaces. 3. Customizable layout for diverse use.	1. Major rearrangements with easily switch between activities. 2. Maximization of space for different purposes. 3. Eliminates the need for single use rooms.	1. Enhances comfort for all. 2. Forster a sense of belonging for everyone. 3. Accommodates all users with diverse abilities and ages.	1. Potential for energy efficiency through smart systems. 2. Resource utilization and streamline operations. 3. Tailoring lights according to specific requirements.
Negative points:	1. Adaptable furniture/ partitions are initially high investments. 2. Constantly reconfiguration may lack cohesive vibes. 3. Regular maintenance of the moving arts.	1. Simultaneous activities might interfere with each other. 2. Secluded spaces mighe be required for certain activities.	1. Integration of specialized features might increase the cost. 2. Difficulty in accommodating multiple features. 3. Designing for multiple needs requires careful planning and expertise.	1. Disrupt functionality by technical malfunctions. 2. Installation of technology can be expensive. 3. Regular update and maintenance.

3) **How do you identify and design for various age groups' changing requirements and preferences, ensuring that the space stays relevant and engaging in the future?**

Design principles: designing an environment that caters to different age groups while prioritizing safety, comfort, and accessibility through non-slip surfaces, natural lighting, wide corridors, and adjustable features. Additionally, the design should consider the intergenerational environment and adapt to changing preferences.
Future-proof design strategies: Critical decisions for future design trends and technological advancement through flexible infrastructure, sustainable features, and adaptable materials ensure the longevity and adaptability of a relevant space. The design engages multiple sensory elements and the environment to stimulate creative and learning spaces across diverse ages.
User-centric research and adaptation: extensive user research, such as surveys, observations, and interviews, aids in identifying changing preferences. Architects can create an adaptive environment by utilizing modular architectural features for simple reconfiguration, ensuring adaptability as tastes change. Technology integration, such as smart systems, ensures that the environment stays interesting.

The functional analysis divides library space into five distinct parts based on its intended use. A 3:7 ratio is pretty good for space optimization between semi-private and open spaces. The foyer plays a major role in dividing the spaces. From the expert's point of view Adaptability, user-centric design, collaborative environment, creativity, interaction, etc. are some of the keywords while designing multifunctional spaces. Partitions and modular furniture, multipurpose areas, accessible and inclusive design elements, and technological integration are some strategies for enabling flexibility in multifunctional spaces in the library.

1.2.2. Equipping public libraries with unique features, including those for those with disabilities, can improve accessibility and motivate people to come.

Enhancing the libraries with unique features for all individuals, including those with disabilities, not only improves community engagement but also encourages all types of people to come and get to know each other. Tools such as adjustable furniture, specialized software, and ramps can create an environment that is welcoming for everyone.

To understand the unique features that will improve library movement, two types of tools were used: Q-Gis, which is used to understand the flow of traffic in existing libraries in Lithuania, and interviews with experts.

- **Q-GIS analysis:** Q-GIS is an open-source geographic information system software that allows users to analyze information available on it. Various fields can use Q-GIS for different types of analysis, including network analysis, which aids in calculating paths, connectivity in transportation, and street networks.

For this analysis, three objects were selected that are located in Lithuania.

1) **Kaunas Country Public Library:** It is located on the edge, close to the central area of the city, surrounded by the residential area, the city center, and the main streets of the city, which are easily accessible through different modes of transportation. A large open space surrounds it, drawing people in.

Fig. 29. Kaunas Country Public Library.

2) **Vilnius Municipal Central Library:** The library is in the heart of the city, surrounded by a residential area. Close to historical streets and cultural landmarks. Its central location in the cityscape makes it more accessible for all kinds of people.

Fig. 30. Vilnius Municipal Central Library.

3) **Jurgis Kunčinas Public Library in Alytus:** The library's proximity to parks and the flowing Nemunas River creates an inviting atmosphere for locals to come and enjoy the culture and literature. Also, being close to one of the main streets helps the library gather a larger audience and make the space more usable for different events.

Fig. 31. Jurgis Kunčinas Public Library in Alytus.

From the selected objects in the radius of 500 and 1000 meters, bus stops and streets were analyzed to understand all the accessible routes that lead to the public libraries. The reason for selecting the particular radius is due to accessibility for pedestrians, which usually takes 10–12 minutes. The public library in Kaunas boasts 3 bus stops within a 500-meter radius and 18 within a 1000-meter radius, ensuring strong public transportation connectivity to the library. When it comes to street connectivity, the library has good pedestrian and vehicular connectivity, but it lacks bike lanes, which is quite important to promote sustainability. For the Vilnius library, there are 7 and 33 bus stops in a 500 and 1000-meter radius, which are almost double that of Kaunas, and that is one of the reasons that make the library more accessible. The street network is pretty much the same as in Kaunas. Finally, the Alytus Library provides easy access to public transportation, with 11 and 20 bus stops located within its radius. Because the city is small, it has good pedestrian connectivity, but it also lacks vehicular connectivity.

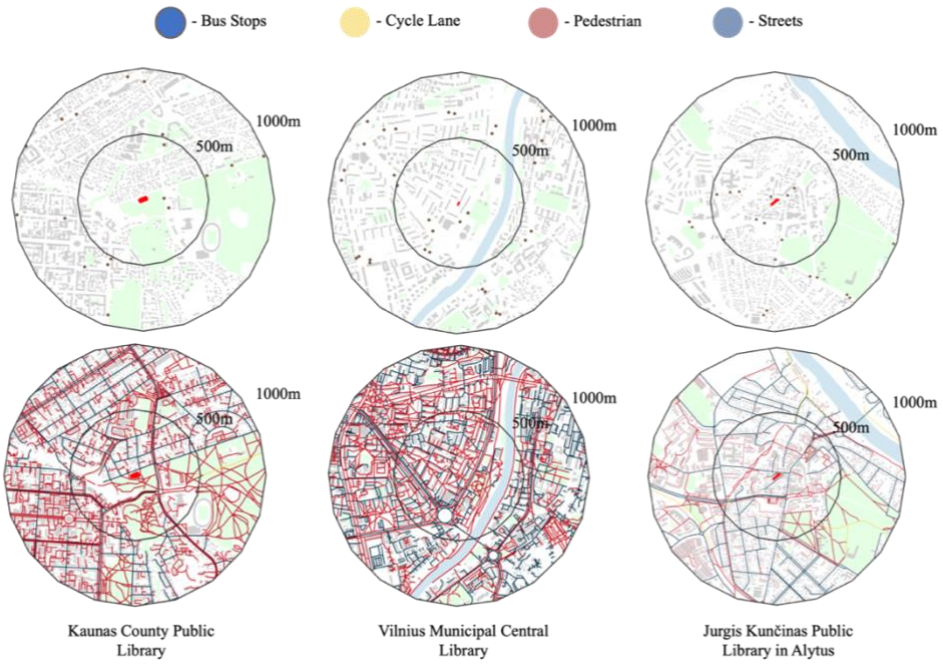


Fig. 32. Q-gis analysis for the bus stops and the street networks by the author.

- **Interview with the architectural expert regarding unique features:** Incorporating unique features in public libraries by accommodating individuals with disabilities enhances accessibility and inclusivity. Design considerations such as ramps, furniture, wide aisles, and elevators cater to attracting diverse users. The imposition of sensory-friendly spaces, quiet zones, and lightning created a welcoming environment.

To gain more comprehensive knowledge, experts were asked questions related to the unique features of the public library.

1) **What features should be addressed when designing or upgrading public library facilities to enable accessibility for people of all abilities?**

Sustainable Design:

Energy efficiency:

- Insulation: Using better insulation material can reduce the need for heating and cooling.
- Efficient use of energy: installation of the HVAC system, efficient lighting, appliances with low energy consumption, etc.
- Renewable energy: installation of solar panels, wind turbines, geothermal systems, etc.

Green spaces:

- Improved air quality: Indoor and outdoor air quality can be improved by installing plants, as they help filter pollutants.
- Biodiversity: Green spaces provide habitat for various species.
- Temperature regulation: Urban heat and contributing to cooler surroundings can be achieved through proper vegetation.

Natural lighting:

- Weel-designed natural lightning creates visual comfort and reduces the need for artificial lightning.
- Health benefits: Natural light helps to keep the mood and productivity positive.
- Reduce energy consumption: Utilizing natural light and installing LED lights reduces the dependency on artificial lights.
-

Universal Design:

Technology accessibility:

- Adaptive technology: incorporating features that allow disabled users to interact with their surroundings, like voice commands, screen readers, etc.
- User-friendly interface: Creating interfaces that are easy to operate and understand caters to diverse users with varying levels of technological proficiency.

Interior layout:

- Flexible and adjustable spaces: creating spaces that can be modified to accommodate different needs. Adjustable furniture, adaptable layouts, etc. are some examples.
- Circulation paths: Unobstructed and wide pathways allow easy movement for individuals.

Entrance and circulation:

- Accessible circulation: pathways, corridors, and stairways with handrails and clear indicators provide better navigation.
- Barrier-free entrance: No obstacles, ramps, or elevators for people with mobility issues create easy navigation.

Inclusive Space and Flexibility:

Multisensory experience:

- Sensory inclusivity: Designing spaces with lighting, noise damping, and textures creates accessible and enjoyable spaces for people with different sensory needs.

Quite Zones:

- Calm spaces are soundproof or away from high-traffic zones, providing a peaceful environment.
- Comfortable and calming features: comfortable sitting, soft light, and sound damping for a soothing atmosphere.

Flexible furniture arrangement:

- Adaptable furniture: furniture that can be rearranged according to the need and the event or group size.
- Accessible furniture design: designing furniture with inclusivity in mind, considering the needs of individuals with diverse needs.

Community Engagement:

Program diversity:

- Multi-functional spaces are those that can handle or accommodate different activities and events.
- Needs assessment: programs involving the community to understand their requirements and preferences.

Community input:

- Participatory design: community involvement in brainstorming sessions, design workshops, taking notes, and feedback.
- Transparent communication means keeping the community updated about the design process and plans and seeking input.

Collaborative spaces:

- Gathering spaces: community centers, parks, and open spaces for interaction between the community.
- Interactive design elements: community art projects, installations, and flexible spaces that invite participation.

2) How can an architect define the library setting to guarantee that individuals of all abilities find the library environment welcome and functional?

It involves fostering library involvement, which encompasses library design and considerations across various aspects.

- Universal design, wayfinding, clearances, and pathways are some principles that focus on ensuring the space is accessible to diverse people, clear signage and color contrast, intuitive layout, and space for wheelchairs to navigate comfortably.
- Sensory considerations include color contrast, noise control, and lightning. These factors focus on bringing light and glare, creating quiet zones that are soundproof, and using contrasting colors for signage.
- Accessibility features ensure that the place is accessible for all by installing ramps, automatic doors, indicators, elevators, stalls, etc.
- Consulting groups involve engaging individuals with diverse abilities during the design process, conducting trials, and taking feedback.
- Flexible furniture incorporation of multipurpose furniture with height-adjustable tables, chairs suitable for a variety of uses, movable for reconfiguration, etc.
- Collaborative areas with writing surfaces and screens at adjustable heights, including comfortable settings and standing desks for groups to work collectively.
- Technology integration includes features such as computer-equipped rooms, wifi-accessible areas, charging stations, digital books, and more.
- Adjustment space that allows future resource allocation and adjustment to evolving needs.

After analyzing the objects using Q-GIS, it became quite clear that the location plays an important role in the place's success. For the public space, good connectivity through public transportation plays an important role. Pedestrian pathways and the vehicular network make the place more connected. However, a successful place doesn't always require a robust network, as demonstrated by the Alytus library, which is highly user-friendly. Unique features of a library, such as sustainable design, universal design, inclusive space, flexibility, and community engagement, are some of the features addressed to make the space welcoming. Consideration of principles, features, flexibility, and integration can help cater to the accessibility needs of the space. Additionally, when asked by the community, accessibility, and functionality play a vital role in the space.

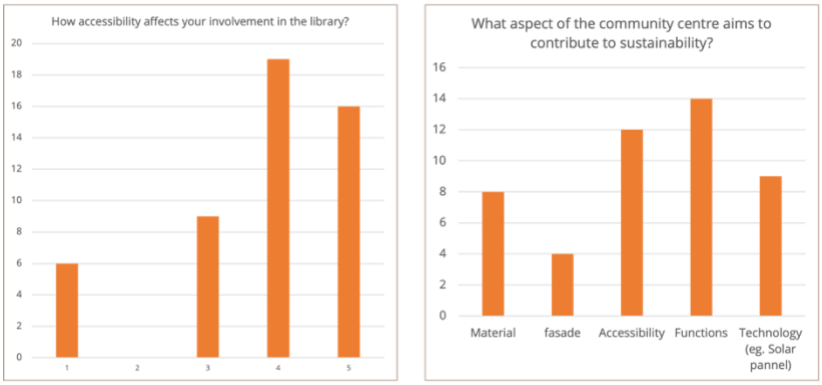


Fig. 33. Graph showing accessibility and functionality as key elements by the author.

1.2.3. The sustainable facade of the space will contribute to developing a sustainable and friendly community center.

A sustainable facade not only serves as an aesthetic element but is also the face of conscientious design. According to the experts, a crafted facade creates a welcoming atmosphere while showing sustainable elements. The design involves eco-friendly materials, and innovative technology reduces environmental impact while enhancing energy efficiency.

To understand why a sustainable facade is important in a building that is focused on educating people, two tools were used: interviews with experts in this particular field and a survey to understand people‘s perspectives.

- **Interview with experts in the field of sustainability:** For the interview, the questions were constructed around sustainable elements, materials, goals, and design strategy. The main focus was to understand how simple things, like a building facade, can help to understand the importance of sustainability.

1) Will incorporating all sustainable elements and materials into a facade help people learn about sustainability?

It is possible to promote sustainability by using the façade as a powerful tool and constructing it with eco-friendly materials and elements. Its influence can be behavioral learning, the demonstration effect, or public involvement.

- Behavioral learning: People frequently learn by observing and copying others. A visually beautiful and well-designed sustainable facade may demonstrate the potential and benefits of utilizing environmentally friendly building materials and practices. The process demonstrates the integration of sustainability into design, thereby empowering individuals to make eco-conscious choices.
- Demonstration effect: Sustainable façade practices serve as a real-world demonstration. When a person sees a building with a sustainable element that functions normally, it can motivate them to have similar practices in their homes. To seek sustainable options in construction and lifestyle, the impact of sustainability can influence decision-making.
- Public engagement: A sustainable facade can serve as a focal point for public interaction. Workshops, seminars, or guided tours might be used as a teaching tool to showcase the qualities and advantages of the materials and design choices. Place interactive elements or information panels to illustrate the facade's sustainable characteristics, thereby promoting public conversations and enhancing knowledge about sustainable construction techniques.

2) How does education for sustainable development act as the catalyst for local transitions toward achieving sustainable development goals?

EDS plays an important role in attracting the local community towards the SDGs by motivating behavioral changes, raising awareness, and setting long-term goals.

--Behavioral changes:

- Empowerment through knowledge: EDS provides all the required knowledge to understand sustainability issues. It encourages critical thinking and problem solving, as well as responsible consumption, waste reduction, and eco-friendly practices.
- Promotion of sustainable lifestyles: By promoting sustainable practices, EDS drives behavioral changes. It motivates an individual to switch to renewable energy, reduce energy consumption, and so on.

-- Awareness:

- Creating consciousness: EDS raises awareness about ongoing global changes and their implications, encouraging the community to participate in achieving the SDGs. It promotes the interconnection between social, economic, and environmental aspects of sustainability.
- Community engagement: Encouragement from EDS for community involvement in collaborative work fosters the participation and engagement of members to achieve sustainable goals.

--Long-term changes:

- Institutional and policy impact: EDS helps establish the institutional framework and policies for the betterment of future generations that value sustainability. It is critical to educate individuals on how to foster and contribute to policymaking for the SDGs in various sectors.

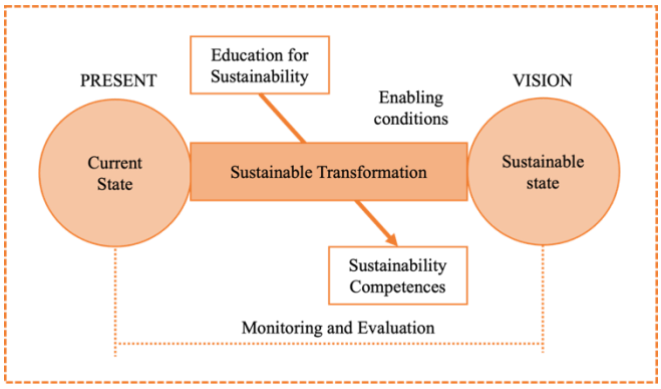


Fig. 34. The framework of how EDS promotes the SDGs (Kioupi & Voulvoulis, 2022).

3) What environmentally friendly design components are integrated into the façade to ensure its usefulness and eco-friendliness in educating the community?

In designing the façade for environmental friendliness and educating values, a combination of both passive and active design elements can create a better approach.

--Passive design:

- Natural ventilation: including openable windows for better airflow and reducing the need for a mechanical cooling system.
- Daylight: Incorporating natural light penetration into the building helps reduce the need for artificial lights.
- Insulation: a sustainable and efficient insulation material to control interior temperature during various weather conditions.
- Shading devices, such as overhangs and awnings, are used to control solar heat and excessive heating during hot periods.

- Natural materials are sourced locally and recycled, ensuring eco-friendliness to minimize the carbon footprint.

--Active design:

- Solar panels, including photovoltaic panels, generate renewable energy to offset the building's energy requirements.
- Green walls or roofs: living walls and green roofs improve insulation, airflow, and biodiversity.
- Rainwater harvesting: a water collection system for irrigation and plumbing reuse.
- Smart building: using technology to make the building autonomous by installing sensors and an HVAC system.
- Interactive displays are educational displays on the façade that showcase real-time consumption of the building.

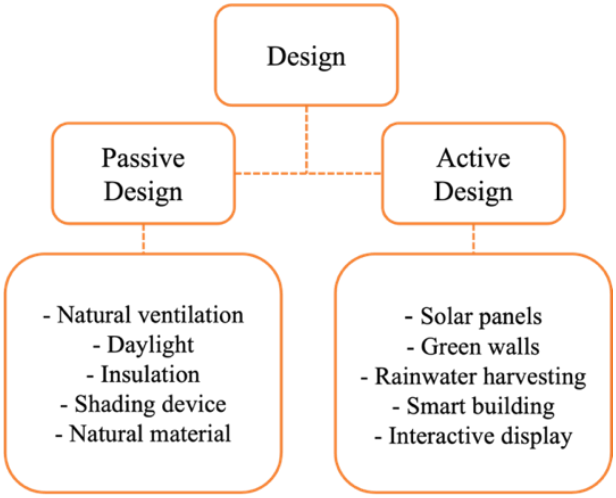


Fig. 35. Passive and Active Design Elements.

- **The survey focused on sustainable elements:** The survey concentrates on understanding the behavior of individuals towards the facade, and colors and t understanding their knowledge about sustainable elements.

1) Rate this picture according to your knowledge based on sustainable design elements that you can observe. (Least 1 to Most 5)

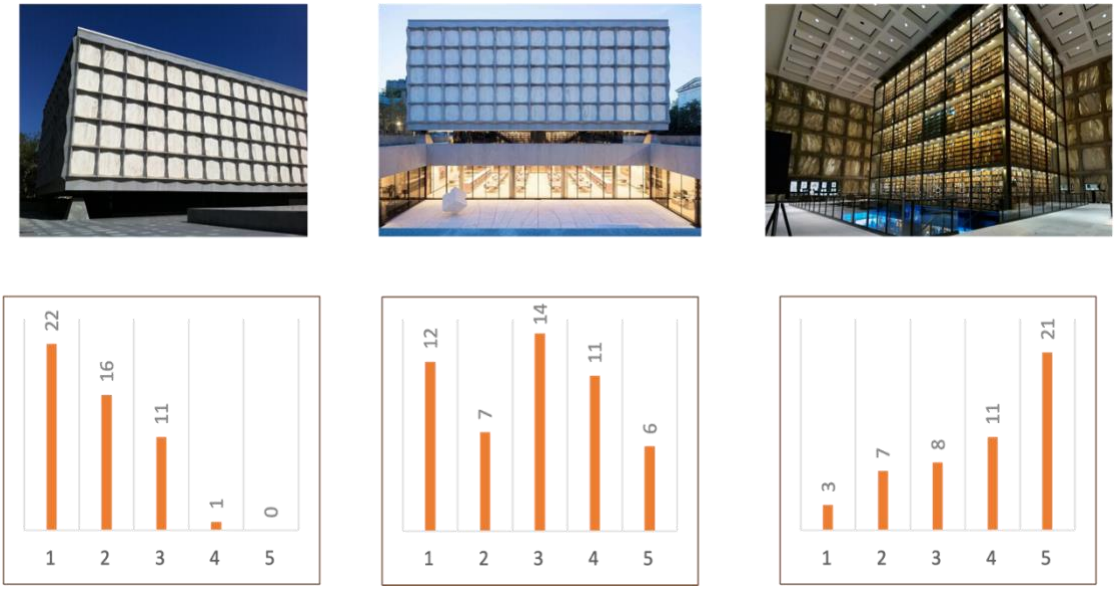


Fig. 36. Graph representing individual answers by author.

Three pictures of the famous public library "Beinecke Rare Book and Manuscript Library" were given to the individuals to get their perspective on how much they think the façade or the interior is sustainable and as we can see in the first two pictures the façade was selected from different angles and as we can observe that in the first picture the façade represents a concrete block where people think that the building is least sustainable where 22 out of 50 people rated for it. Whereas in the second picture from the other angle showcases a small glass façade the people's perspective change as 25 people (3-4) rated that the building might be sustainable. And in the last picture where the interior is showcased, people think that the building is sustainable. From this observation, one thing that can be noticed from the individual perspective is that glass is a sustainable material and concrete is not sustainable.

2) **What type of material would you like to see in the library facade that focuses on sustainability?**

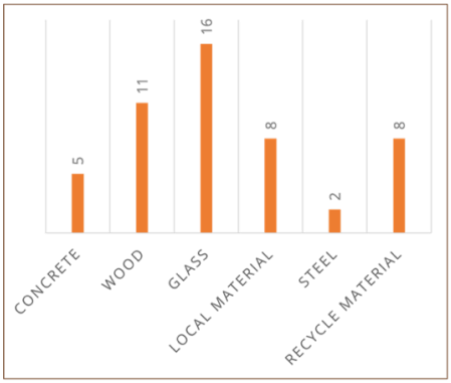


Fig. 37. Graph representing the most sustainable material according to individuals by the author.

Glass and wood are some materials that are considered sustainable from an individual perspective. Also, local and recycled material is considered sustainable depending on the material. Whereas concrete and steel are considered the least sustainable materials.

3) **Rate how you would like the library in your city to be in terms of its color influence. (on the scale of darkness 1 and vibrancy 5)**

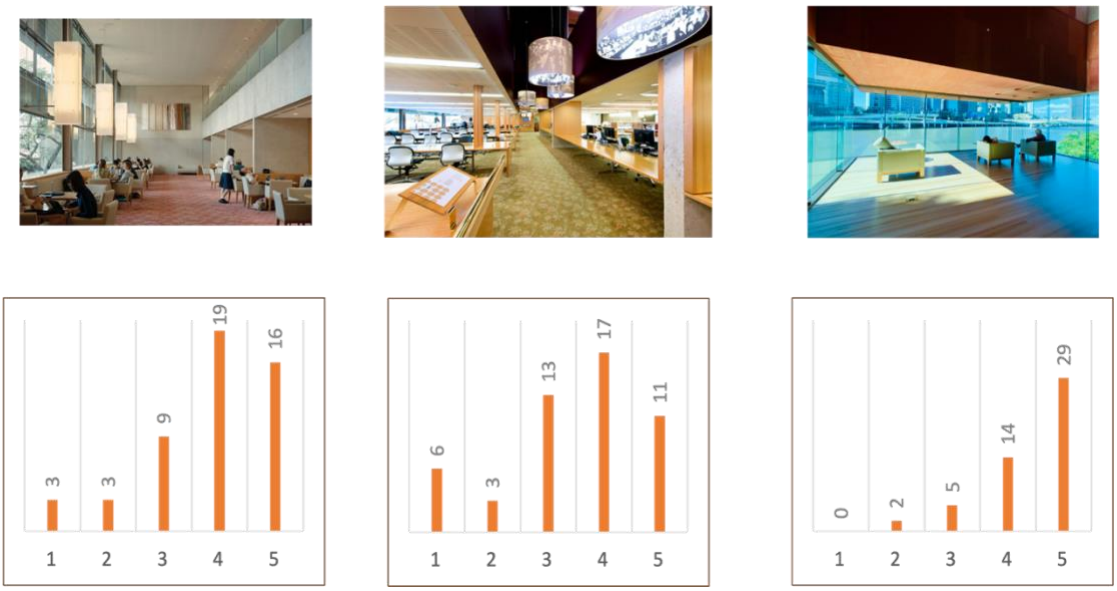


Fig. 38. Graph representing the influence of color in the interior space by the author.

Different types of library interiors were selected to understand how people think of color in library spaces. In the first picture, it was a reading area where most people thought that the colors used were vibrant, but some thought that the red flooring made it feel dark. In the second picture, the room is a digital one, and despite the dark flooring, the walls add a touch of vibrancy. In the last picture, even the vibe and space feel dark, but the view from the windows makes the space feel more vibrant in terms of color and its influence.

A sustainable facade serves as an educational tool that helps to understand an individual's behavioral learning. The demonstration effect and public engagement also help educate people by balancing passive and active design elements in a sustainable facade. After analyzing the answers from the survey, it can be observed that with a little bit of change in the view of the building, the perspective of the people changes drastically. Glass and wood are considered sustainable materials, while recycled and local materials are equally valuable.

1.2.4. Community involvement can help to develop a better library that satisfies the needs and demands of society.

The development of the public library space should be part of the community's involvement and vision. So, to understand the needs and requirements of the people, an online sociological survey was conducted.

- **Sociological survey:** The sociological survey was created using the web-based interface Google Forms (*Google Forms*, n.d.). The survey was addressed to all the people living in Alytus. The survey was based on a quantitative analysis format.

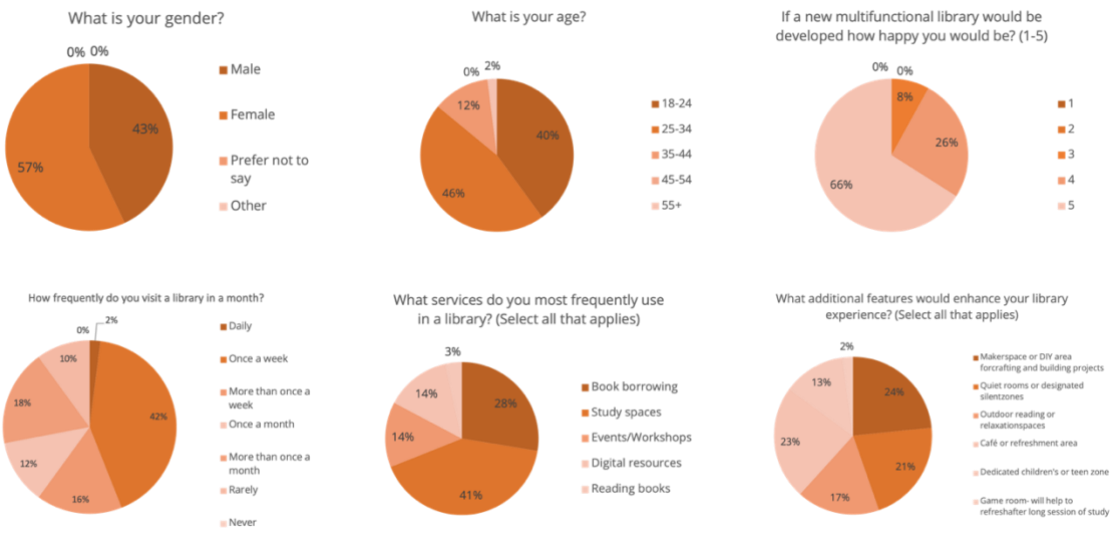


Fig. 39. Pie chart of the sociological survey questions by the author.

The survey got a total of 50 responses, which was enough to conclude. Even though 66% of people were happy with the development of the new library, only 42% visited it once a week. In terms of space use, 41% of people go to study, and 28% go to borrow books. Makerspace, quiet rooms, and a cafe are some of the main features that enhance the library experience.

Fig. 40. Sociological survey showcasing the needs of the community by the author.

People's needs and preferences are quite clear: they need a modern library with modern features but with the touch and feel of a traditional library. Some people are not clear about what they want the library space to be like. Natural lighting and green spaces are important environmental factors to make the space welcoming. People also value noise control and access to public transport. To serve social needs, 42% of people think that community involvement is important.

People understand that a public library in the city is their preferred option. People like to go to the library according to their needs, where they enjoy reading books and studying. To make the library more active, it is important to have additional features such as DIY areas, quiet zones, open spaces, etc. that attract more people to visit the library. Creating a multifunctional public library with various features and recreational spaces, tailored to the community's demands, will be the best solution.

1.2.5. A conceptual model of multifunctional public library space development.

Working hypotheses use the data from the empirical research to create a conceptual model. From the hypothetical model made during the analytical research, four standards were derived, and from the information received from the empirical research, four standards were elaborated to make a working conceptual model.

1) **Mission and Vision:** The goal is to motivate the diverse community through knowledge and learning while creating a dynamic hub for all age groups that seamlessly involves integrated spaces, adaptability, user-centric design, and a space with cutting-edge technology.

- Integrated spaces: the development of multifunctional areas to cater to various activities, from reading corners to collective spaces that accommodate diverse learning styles.
- Adaptability: To cater to community demands, develop a framework for flexible programming, delivery, and physical layout.
- User-centric design involves engaging users to understand their needs, requirements, services, and programs accordingly.
- Technology: doing research and development on digital resources and technology that improves the engagement and digital elements of a library.

2) **Community Hub:** Creating a community hub with multifunctionality within the public library space involves diverse spaces, a welcoming atmosphere, and active engagement.

- Diverse spaces: creating cozy reading areas, open collaborative spaces, incorporating technological zones, event spaces, and dedicated kids' areas.
- The atmosphere involves training staff to behave in a friendly manner, incorporating accessible design elements for diverse individuals, maximizing natural light, and utilizing color and furniture to create a warm decor.
- Engagement programs that provide engaging spaces, collaborate with local communities and schools, host interactive exhibitions, and develop a feedback mechanism.

3) **Facilities:** The development of facilities designed with accessibility, sensory considerations, and zoning in mind aims to create space for all individuals.

- Accessibility includes features such as technological accessibility, ramps, and elevators, wide spaces for disabled people, appropriate restrooms, and braille and audio listening materials.
- Sensory considerations: quiet spaces for reading and calming, sensory-friendly spaces with a calm atmosphere, visual clues for the disabled, and sensory outdoor spaces to cater to various senses.
- Zoning provides design flexibility to accommodate multi-use spaces, designates areas for specific activities, and facilitates easy access to resources for better service.

4) **Sustainable Space:** Creating a sustainable, multifunctional library, integrating elements, providing access to sustainable education, and encouraging behavioral changes.

- Elements include green spaces that incorporate plants and habitats, renewable energy that provides energy efficiency, water conservation, and sustainable materials that are sourced locally or recycled.
- Availability: workshops offering education and outreach, events collaborating with locals to promote local materials, and resource sharing to reduce waste.
- Behavioral changes: conscious consumption and education related to sustainable elements and materials; integration of eco-friendly practices within the library; and community engagement to promote sustainable efforts.

The conceptual model helps to understand the possibility of combining different activities and spaces, which aids in the development of a multifunctional public library. However, based on four standards, the best of a library is keeping sustainable standards in community hubs and library facilities, combining the mission and vision of multifunctional public space.

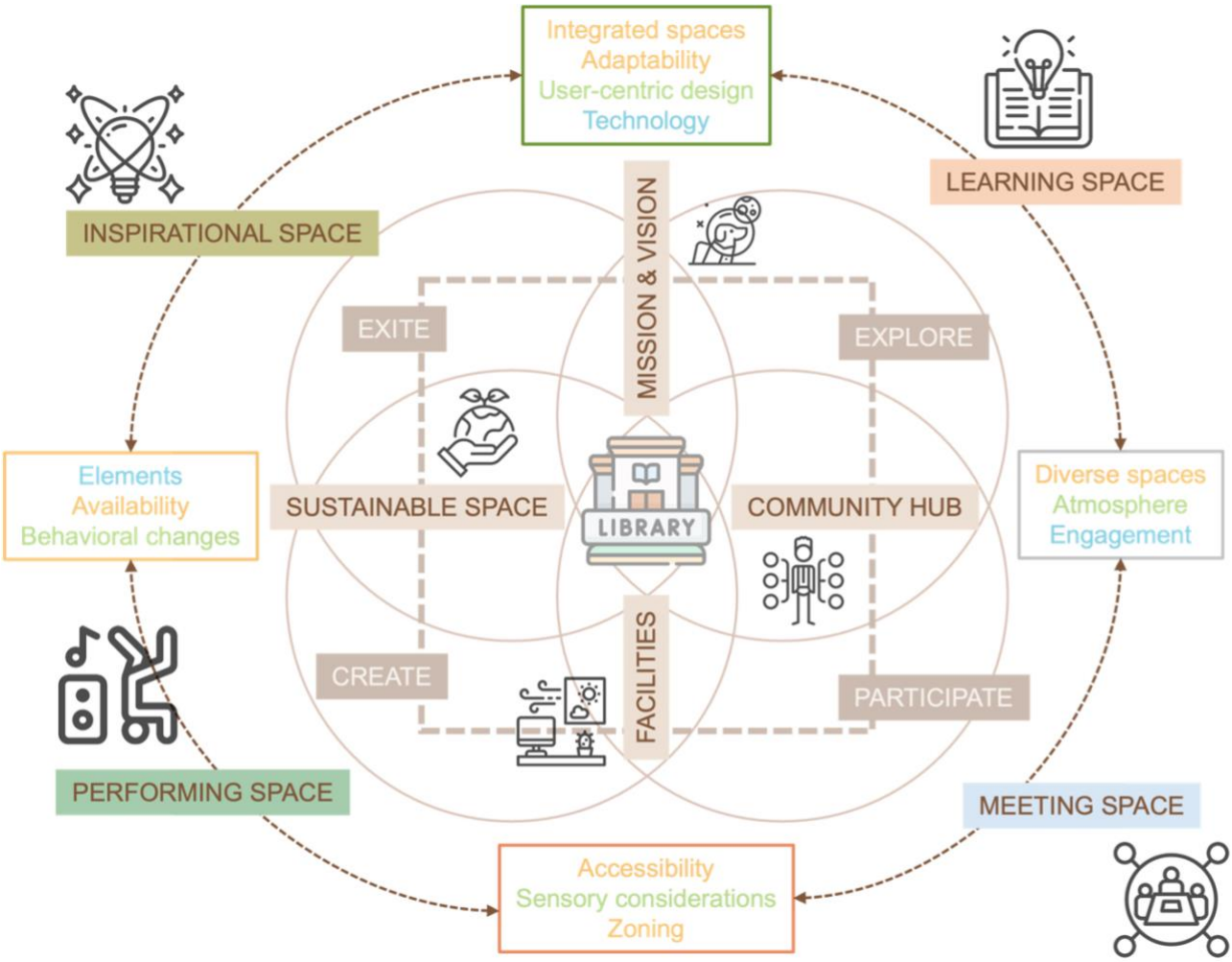


Fig. 41. Conceptual model of a multifunctional public library development.

2. Experimental design of a multifunctional public library in Tvirtoves g. 14 in Alytus

This chapter will develop the experimental design for a multi-functional public library located at Tvirtoves g. 14. The first part of the experimental design is to create concept alternatives for the multi-function public space according to its function, volume, and spatial arrangement, respecting the surroundings. The second part will entail the development stage, during which we will refine the concept and produce final drawings. Lastly, we will evaluate the final design of the multi-function space based on factors and principles derived from the research phases.

2.1. General information of the territory of Tvirtoves g. 14

The site is located close to the city center of Alytus. The site is surrounded by the main highway which helps to connect the city with its neighborhood, gymnasiums, schools, etc. Also, the site is situated close to the famous Sakura Park which is one of the most attractive sites in the Alytus.

Fig. 42. The situation of Tvirtoes g. 14 territory.
https://www.google.com/maps/@54.3966605,24.0395344,627m/data=!3m1!1e3?entry=ttu

Furthermore, the surrounding area is quite developed and needs to be recognized and reorganized to increase its efficiency. The allocated site is an existing parking lot area that has the possibility of extension towards Tvirtoves g. 12 and g. 8. The extension will serve the purpose of this experimental design, which will be beneficial for the surroundings and the cityscape. This extension has increased the total plot area from 320 m2 to 2931 m2.

Fig. 43. Tvirtoves g. 14 and its extended territory.

According to the Alytus master plan, the territory is designated for the development of a public structure. Additionally, the development area is limited to a maximum height of 15 meters within the regulations, and 12 meters within the surrounding buildings to ensure compliance.

2.2. A conceptual alternative of the multifunctional public library

The alternative concept focuses on the Tvirtoves' spatial arrangement around the project territory. First, we need to reorganize the surroundings, prioritize the pedestrian streets, consider the parking area, and extend Sakura Park to emphasize its significance and presence in the city, as previously mentioned. lastly, the concept of the multifunctional public library in Alytus will be zoomed in, and the volume and function will be explained.

The site is situated next to the Alytaus jaunimo centers, Alytaus Dzūkijos mokykla, Alytus Saint Benedict Gymnasium, Alytaus apskrities S. Kudirkos ligonine, Biciuliu ratas, vairavimo mokykla, and government buildings, but even after being surrounded by major public buildings, the problem of unorganized parking, missing linkages, and connectivity in the surrounding area, and due to the highway, the problem of high traffic exists, which makes the surrounding area unpleasant and less safe.

To address this issue, the neighborhood underwent minor modifications that increased 85 parking spaces, a 7% boost in greenery, and an extension to Sakura Park, thereby enhancing its significance. A better connection between the old and new buildings through new bike lanes and pedestrian paths with surrounded greenery and a new roundabout helps to decrease traffic, which helps to ensure a smooth pedestrian flow.

Allocated site	
Existing Sakura park	
Existing building	
Existing bicycle lanes	
Extension to the Sakura park	
New vegetation	
New bicycle lanes	
Pedestrian paths	
Reorganisation of existing parking	
New roundabout	
Increase in the green spaces	

Fig. 44. Suggested changes in the neighborhood.

2.2.1. Proposed concepts for the spatial arrangement of the multifunctional public library in tvirtoves g. 14, Alytus

There are two proposed concepts for the spatial arrangement of the public library: alternatives 1 and 2. After explaining the concept's alternatives, a conclusion was drawn based on the conceptual model made during the research phase and the four criteria that were derived from it, as well as the principles and rules on how libraries can be more multifunctional and usable.

Both alternatives are being arranged differently, keeping in mind the five main zones of the public library (library spaces, public services, cafe and gallery, administration, and business information). The first alternative arranges all five zones in a singular structure, while the second alternative groups the zones into three separate structures: one for library services, another for gallery space, and a third for administration and business information, which interconnects all the zones.

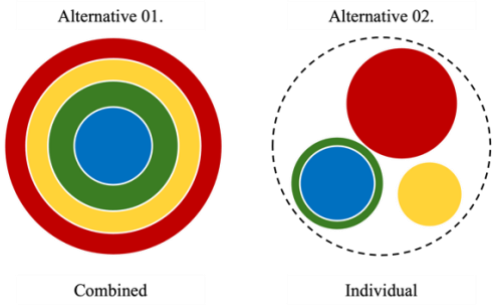


Fig. 45. Concept alternatives by the author.

1) Concept alternative 1:

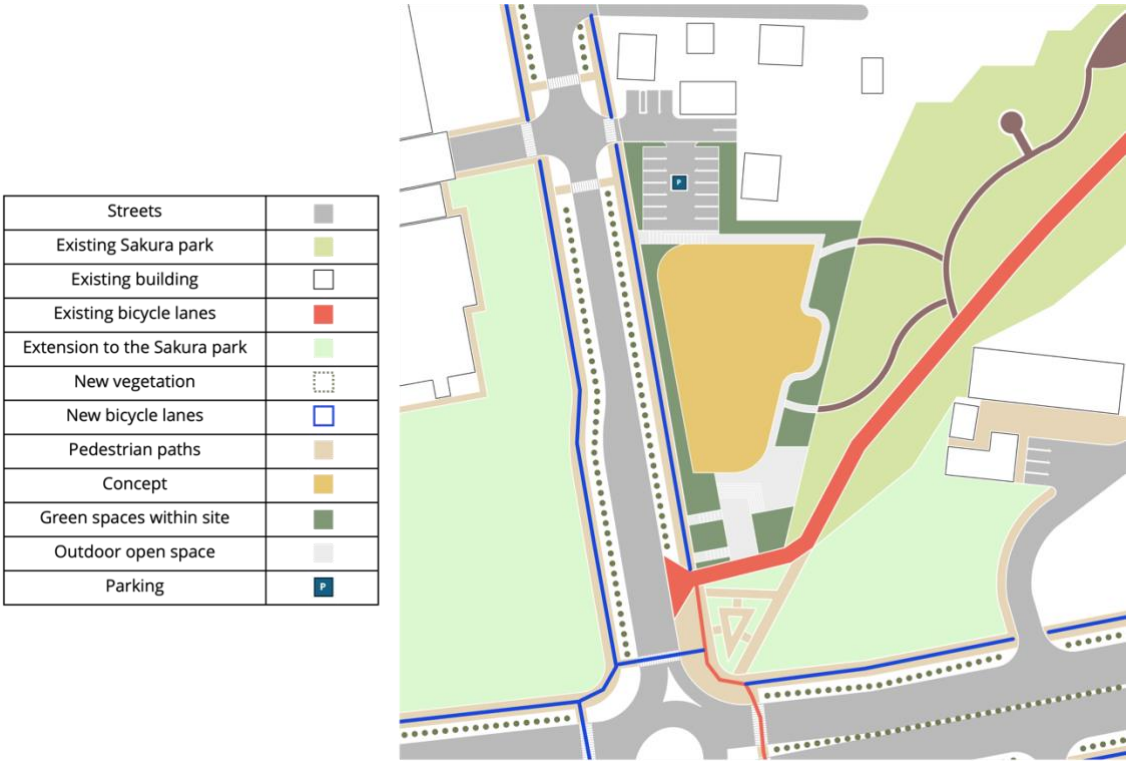


Fig. 46. Alternative 1 scheme of the arrangement of library building by the author.

The idea of alternative 1 spatial arrangement centers on a single three-story tower. This structure is planned with one level below ground level, 4.5 m below the reference point of level 0, and two levels above ground level. In terms of placement, the building is carefully placed in the middle of the land. To the north of the structure, there is an open parking area inside the plot that may accommodate up to 14 parking spaces. On the southern end of the building, there is a public area that welcomes pedestrians. There is also a dedicated pedestrian walkway that links the building's main entrance directly to the basement level, providing guests with easy access.

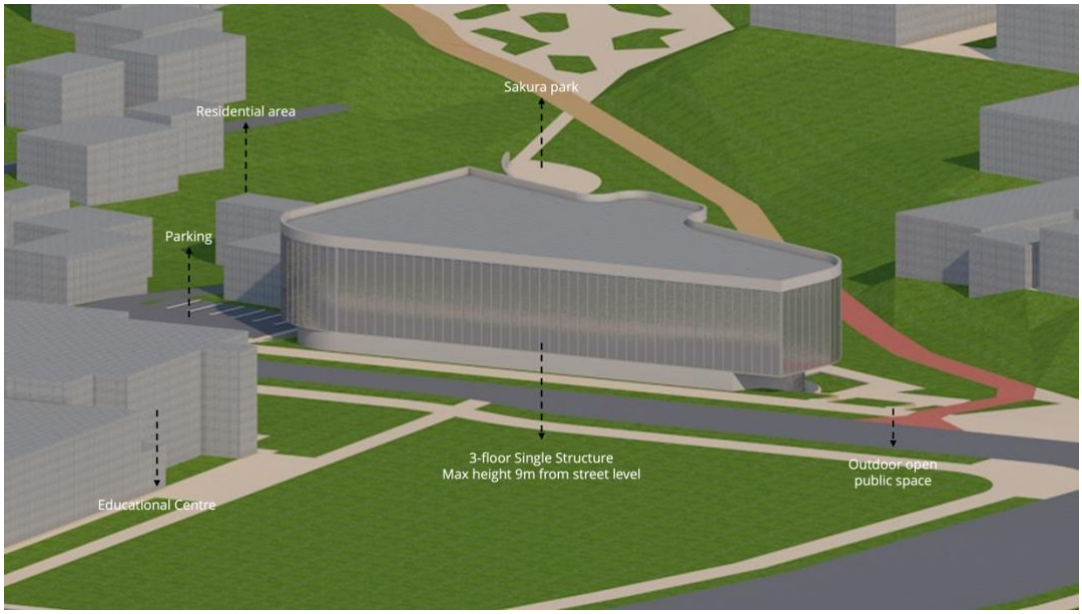


Fig. 47. Volume functional representation of alternative 1 by the author.

This alternative proposes a careful and deliberate approach to urban planning and architectural design.

- **Impact on the community:** The layout of the plot aims to enhance the neighborhood, suggesting that the building's presence will yield positive outcomes. Factors such as architectural style, scale, and function that complement the existing urban fabric may be included.
- **Sakura Park:** An important public area implies that protecting sightlines to the park is a priority. This decision is expected to improve the quality of life for both residents and tourists by protecting green space and encouraging a sense of openness in the area.
- **Façade:** Strategically directs tourists' attention towards Sakura Park. The building actively connects with its surroundings and invites contact with the park, emphasizing its position as a community hub.
- **Interior spatial arrangement:** The building's interior architecture offers guests uninterrupted views of Sakura Park from within. This design component not only improves the overall aesthetic appeal of the space but also generates a sense of connection with nature and promotes well-being among users.

The alternative arranges all five main zones of the public library (library spaces, public services, cafe and gallery, administration, and business information) within a single structure. This implies that a single building or physical structure houses all these zones. This arrangement implies a cohesive and centralized approach to library organization, closely integrating all functions and services under one roof. Users can easily navigate between different zones without the need to move between separate buildings.

2) Concept alternative 2:

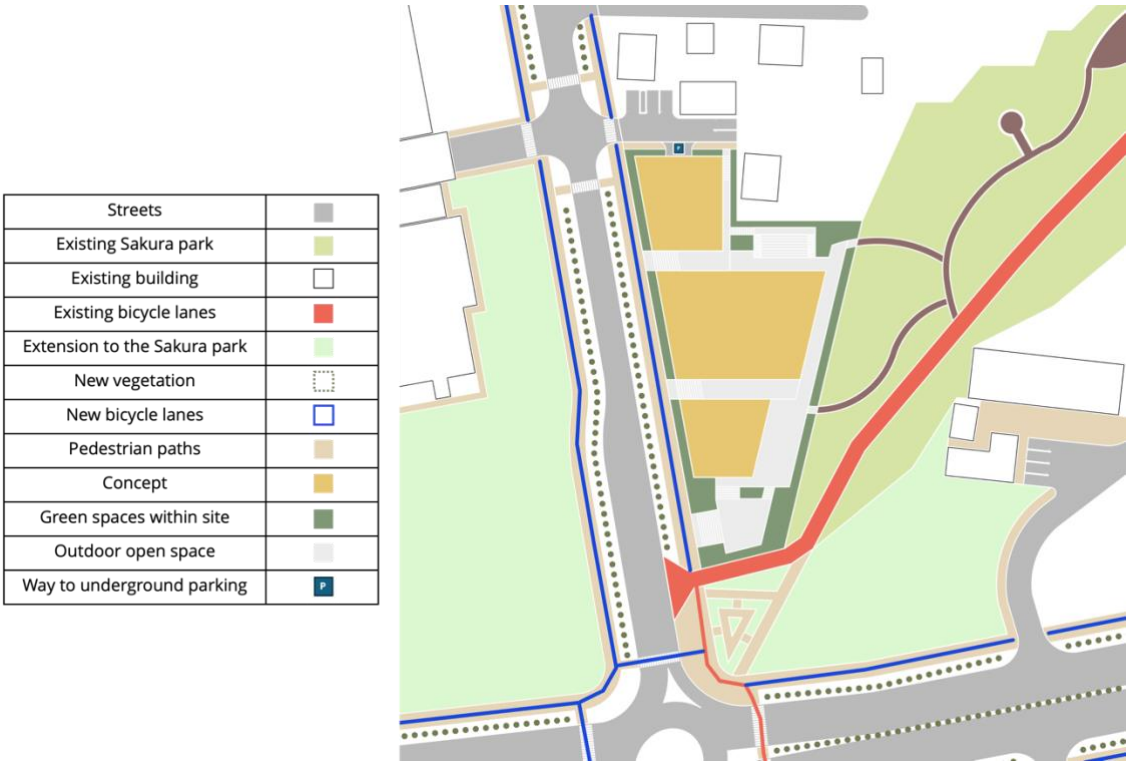


Fig. 48. Alternative 2 scheme of the arrangement of library building by the author.

The concept of alternative spatial arrangements suggests a design with three unique buildings above ground level, each with a different height, as well as a shared lower level. This concept envisages a plan with one subterranean level located 4.5 meters below the reference point of level 0, and three blocks built above ground. This layout has three blocks: A1, A2, and B. Block A1 has two stories, Block A2 has three, and Block B has four. Each block has a distinct purpose or accommodates several functions within the broader framework.

One of the primary aspects of this option is the concentrated public area at ground-level zero. This space is a focal point, with primary entrances to the blocks, and presumably serves as a meeting center or hub for social interaction. Visitors can use it for a variety of purposes, such as hosting events, setting up seating areas, and creating a visually pleasing environment. At level negative 4.5 meters, another public area connects directly to Sakura Park. This underground public place most likely has a distinct mood and setting, providing an alternate location for relaxation, leisure activities, and maybe even cultural events. Its link to the park above implies a seamless integration with external green areas, which improves the overall user experience and fosters a sense of continuity between interior and outdoor spaces.

Overall, this alternative spatial design appears to promote efficient space utilization, functional segregation of various activities or tasks within the structure, and integration with neighboring landscapes or facilities, such as Sakura Park.

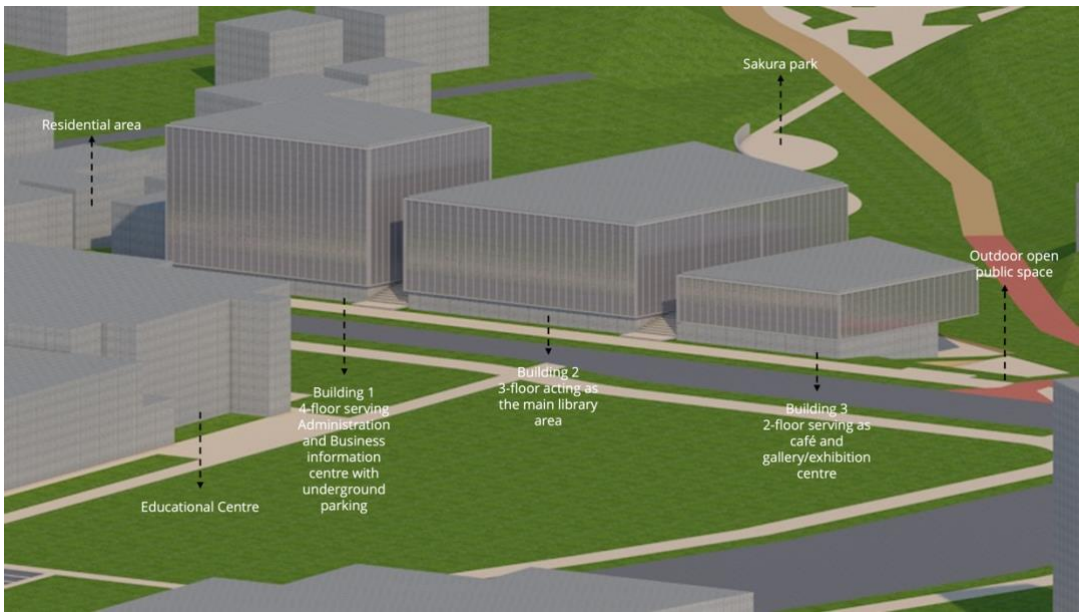


Fig. 49. Volume functional representation of alternative 2 by the author.

This alternative describes a careful approach to architectural design, notably the harmonious integration of a structure with its environment.

- **Smaller Volumes:** The plot layout stresses the use of smaller volumes rather than a single massive building. This architectural option tries to effortlessly integrate the structure into its surroundings. By avoiding a large bulk, to keep the structure from dominating the landscape and perhaps making visitors uncomfortable or overwhelmed.
- **Height Consideration:** When developing separate structures on land, the height is carefully examined. This guarantees that the buildings do not interfere with the skyline of the neighboring structures. The new structure may complement rather than overpower the current architectural setting by preserving a balance in height.
- **Building's façade:** This is strategically positioned toward Sakura Park. This strategic positioning gives residents a greener outlook, connecting them with nature and improving their entire experience in the area. Orienting towards the park also adds aesthetic value by providing a visually appealing focal point for both the building and the park.
- **Interior Space Configuration:** The building's arrangement is intended to optimize views of the park from within. This means that inhabitants may enjoy uninterrupted views of the greenery, generating a sense of calm and connection with nature even when within. Such design considerations not only improve the interior's visual appeal but also add to the building's occupants' well-being and comfort.

This alternative organizes the zones into three unique structures:

- **Library Services**: The building houses the library's facilities and public services. It is the primary hub for library-related activities such as borrowing books, accessing digital resources, and conducting research or study.
- **Gallery Space Structure:** The second building houses the café and gallery space. This area is designated for cultural and social activities such as art exhibitions, community events, and informal meetings over refreshments.
- **Administration and Business Information Structure:** The third structure contains the administration offices and business information services. This includes space for staff offices, meetings, administrative tasks, as well as business and entrepreneurial tools.

Importantly, these three structures are interrelated, which means they share paths or linkages. This interconnection allows for smooth transitions between zones and encourages visitors to explore other areas of the library experience. It also enables effective cooperation and communication among various departments or services situated inside the library.

2.2.2. Conceptual function of the proposed alternatives

Each of the proposed alternatives for the spatial arrangement of the Tvirtoves g. 14 contains a multifunctional public library space within. Hence the two different functional schemes will be explained below.

1) Alternative 1:

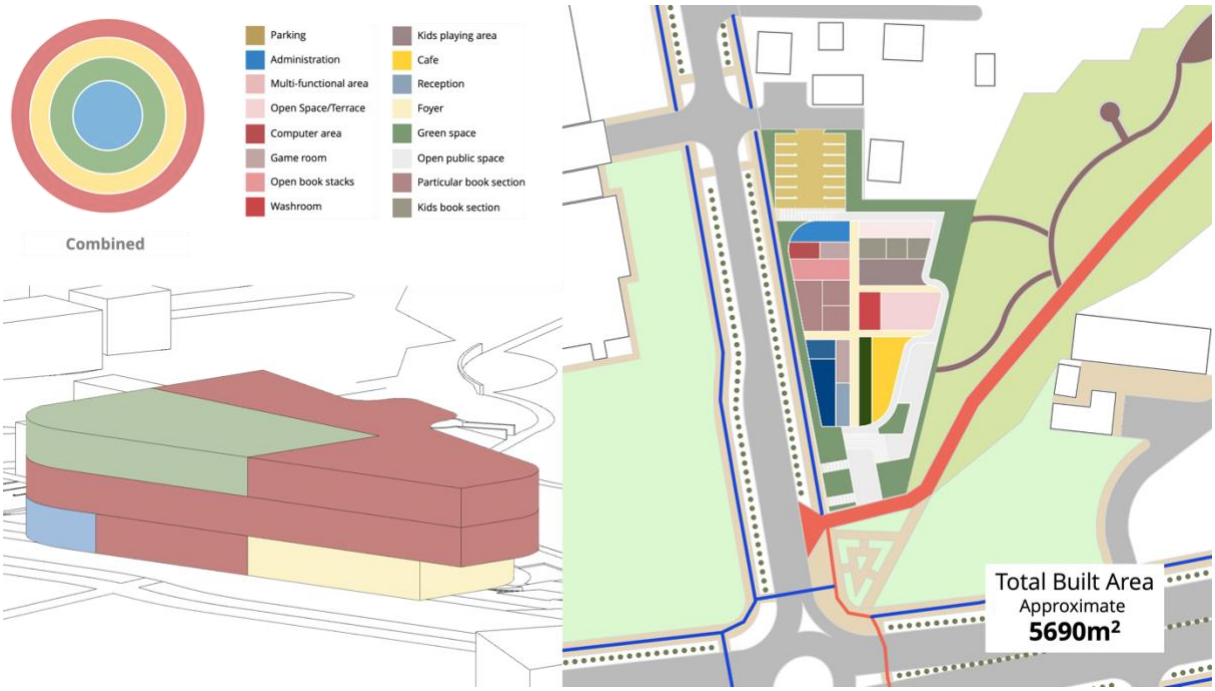


Fig. 50. Concept alternative 1 of the volume functional and ground floor scheme of the multifunctional public library.

Concept 1 for the library design focuses on a core, coherent structure that anchors the site and allows for seamless connection with its surroundings. Its functional layout maximizes both internal movement and exterior views, resulting in a seamless link between the library and its surroundings. Recognizing the potential impediment caused by its large block construction, the design deliberately places functions to maintain sightlines from west to east, thus improving spatial continuity.

The underground floor acts as a focus for administrative activity, along with a café, gallery, and limited library facilities. This level enables a dynamic interaction between operational needs and guest facilities. Moving up to the first level, a complete library service area serves a wide range of age groups and communities, promoting inclusion and accessibility. Ascending further, the second level effortlessly blends business information resources with more library services, demonstrating the space's overall integration of zones. This deliberate mix increases the library's usability while maintaining its interconnected different zones.

2) Alternativ

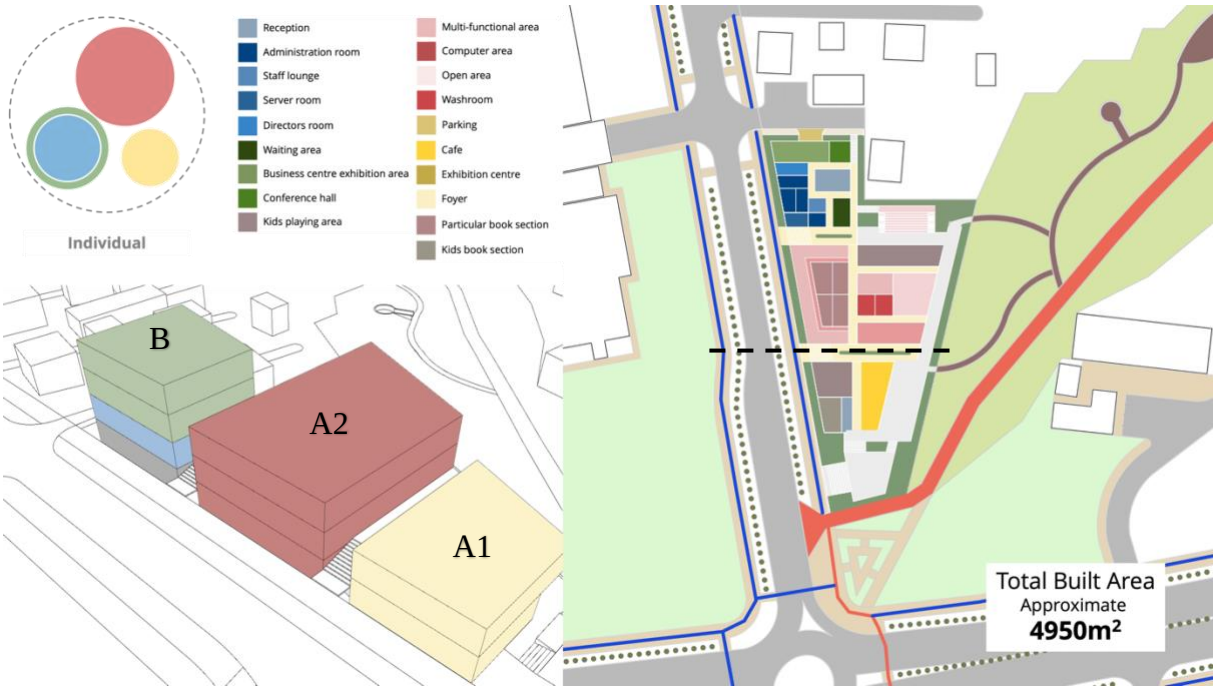


Fig. 51. Concept alternative 2 of the volume functional and ground floor scheme of the multifunctional public library.

Concept 2 for library design takes a strategic approach, having various volumes with a special emphasis on an underground level to successfully maximize space consumption. The design automatically assigns functions to the primary zones based on their demands and use, resulting in a unified and efficient architecture.

A large parking lot is located at the center of the underground level, addressing the issue of parking spaces. Furthermore, the underground area has an important feature—a tunnel that connects the library site to the nearby new park, increasing the accessibility and relevance of Sakura Park in the neighborhood. This underground tube not only allows for easy travel between the park and the library but also promotes a symbiotic relationship between these two urban spaces. Aside from parking and connection, the underground level has additional facilities required for a community hub. The library's storage facility and Cafes provide locations for leisure and social interaction. Furthermore, simple entry connections from the basement level to the upper levels allow accessibility for all users.

Three unique blocks, A1, A2, and B, divide the library complex above ground, each serving a specialized role to meet users' various demands. Library services and gallery spaces occupy Blocks A1 and A2, embodying the institution's fundamental goal of spreading knowledge and promoting cultural engagement. The function of these blocks accommodates a variety of media, reading rooms, and exhibition spaces, catering to the diverse interests of guests. In contrast, Block B serves as an administrative and business hub, containing co-working spaces and amenities required for the library.

2.2.3. Evaluation of the proposed concepts spatial arrangement in Tvirtoves g 14.

A multipurpose public library is essential for each city, providing a wide range of materials and services. It promotes lifelong learning with literature, internet access, and educational programs. Additionally, it fosters community relationships through events, workshops, and discussion forums, which enrich cultural experiences and promote social cohesiveness among residents. Based on that two evaluation criteria were developed connected with a conceptual model and the 4 main criteria derived from the research and based on principles and rules on how a library can be more multifunctional and usable

1) Based on the conceptual Model and the 4 main criteria derived from the research:

The library's main aim and vision include inspiring a diverse community through knowledge and study, as well as creating a vibrant hub for people of all ages with integrated spaces and cutting-edge technology. This includes creating versatile places that cater to a variety of activities, ensuring responsiveness to community expectations, and stressing user-centric design by collaborating with users to modify services accordingly. The library is envisioned as a community center with a variety of spaces, including comfortable reading nooks, collaboration zones, and specialized sections for children, all set in a welcoming environment enhanced by friendly personnel, accessible design, and natural light. Initiatives collaborating with local communities and schools, interactive displays, and a feedback mechanism foster active participation. Facilities are created with accessibility, sensory concerns, and zoning in mind to provide inclusiveness and ease of access for all people. Components such as green areas, renewable energy, and sustainable materials weave sustainability into the library's fabric. At the same time, an emphasis on education, outreach, and behavioral changes encourages eco-friendly activities in the community.

Table 6. Evaluation based on the conceptual model and 4 main criteria.

Criteria		Alternative 1	Alternative 2
Mission and Vision	Integrated spaces	Yes	Yes
	Adaptability	Yes	Yes
	User-centric design	Yes	Yes
	Technology		Yes
Community Hub	Diverse spaces	No	Yes
	Atmosphere	No	Yes
	Engagement		
Facilities	Accessibility	Yes	Yes
	Sensory considerations	Yes	Yes
	Zoaning	No	Yes
Sustainable Spaces	Elements		
	Availability	Yes	Yes
	Behavioral changes		Yes

2) Based on principles and rules on how a library can be more multifunctional and usable:

The multipurpose public library symbolizes community participation and intellectual nutrition, distinguished by its physical environment, functional design, social characteristics, and environmental efforts. Its architectural design, whether modern minimalism or classical grandeur, supports a culture of creativity and learning. Functionality reigns supreme, with adaptable spaces that respond to a wide range of demands, from quiet reading nooks to exuberant collaboration areas. The library's social features give it energy, serving as a gathering place for individuals from all walks of

life and inspiring conversations and relationships. Furthermore, its sustainability initiatives, such as energy-efficient systems, eco-friendly materials, and green areas, decrease environmental effects and function as instructional tools, motivating tourists to practice ecological stewardship. These aspects work together harmoniously to create a multipurpose public library that extends beyond its physical bounds, enriching lives and building communities for future generations.

Table 7. Evaluation based on principles and rules on how a library can be more multifunctional and usable.

Alternative 01.

Principles		Rating(1-5)	Total (38)	Percentage %
Built in environment	Architecture and design	3	13	34 %
	Location	5		
	Accessibility	5		
Function	Library services	3	6	16 %
	Community services	3		
Social attributes	Community engagement	5	14	37 %
	Inclusivity	4		
	Educational support	5		
Sustainability	Energy efficiency	3	5	13%
	Green Spaces	2		

Alternative 02.

Principles		Rating(1-5)	Total (47)	Percentage %
Built in environment	Architecture and design	4	14	30 %
	Location	5		
	Accessibility	5		
Function	Library services	5	10	21 %
	Community services	5		
Social attributes	Community engagement	5	15	32 %
	Inclusivity	5		
	Educational support	5		
Sustainability	Energy efficiency	4	8	17 %
	Green Spaces	4		

2.2.4. Selected concept of the multifunctional public library

The concept alternative 2 with separate volumes and different functional zones was selected for further development. It was chosen as it creates different spaces, has the potential to offer more function, and fits better with the surroundings. In addition, it provides more functions and views than Alternative 1. Finally, based on the evaluation criteria and the information gathered during the research phase, alternative 2 has more potential to meet the needs of the neighborhood and community.

2.3. Elaboration of the conceptual idea and the final design

During the design development phase, the selected concept will be further refined. This phase will include site planning, floor functionality, building elevation, structural concerns, and the incorporation of green infrastructure. As this is the final stage of the design, comprehensive drawings such as site plans, floor plans, elevations, and sections will be created.

2.3.1. The spatial arrangement and the future vision

Before delving deeper into the design of the multifunctional public library in Virtoves g. 14, we developed a more detailed spatial arrangement and scheme to better understand the experiment's vision. Some changes were made to the volume, and detailed functions were executed, which were discussed in the previous chapter.

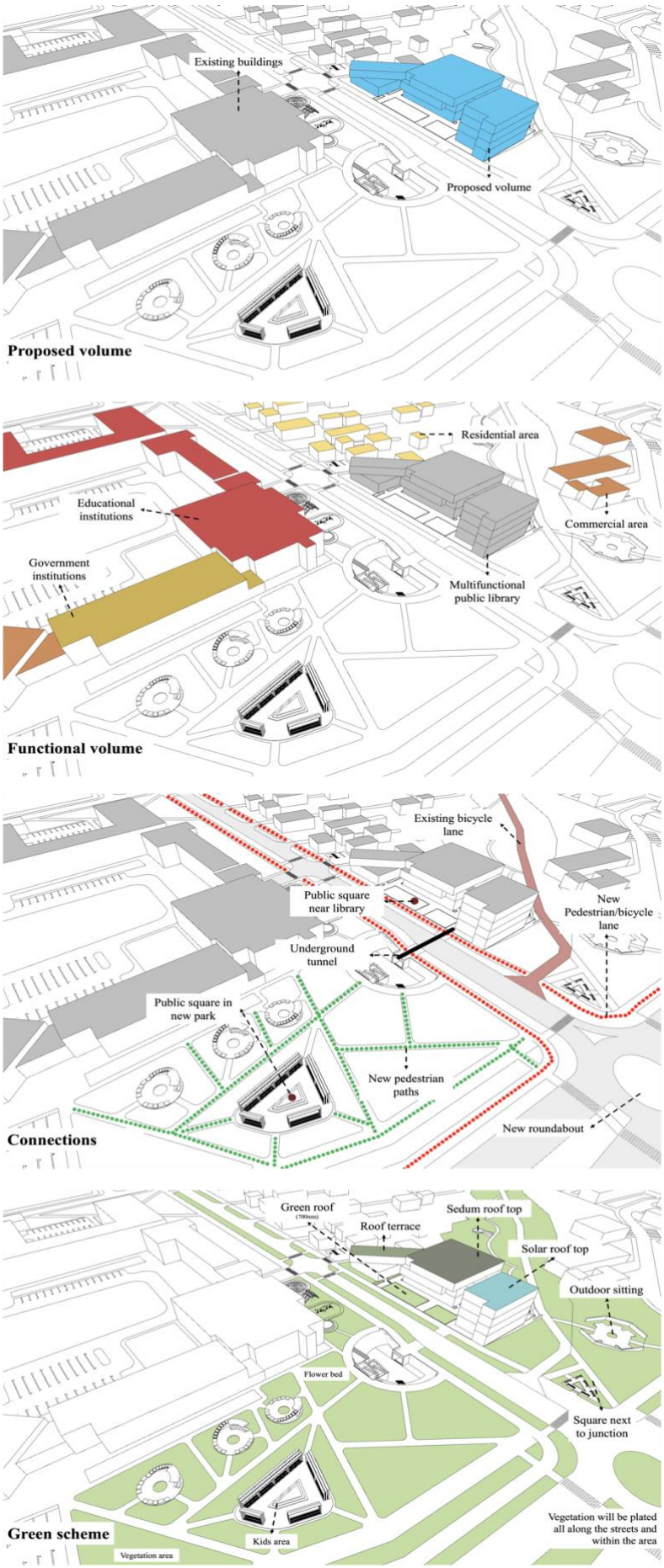
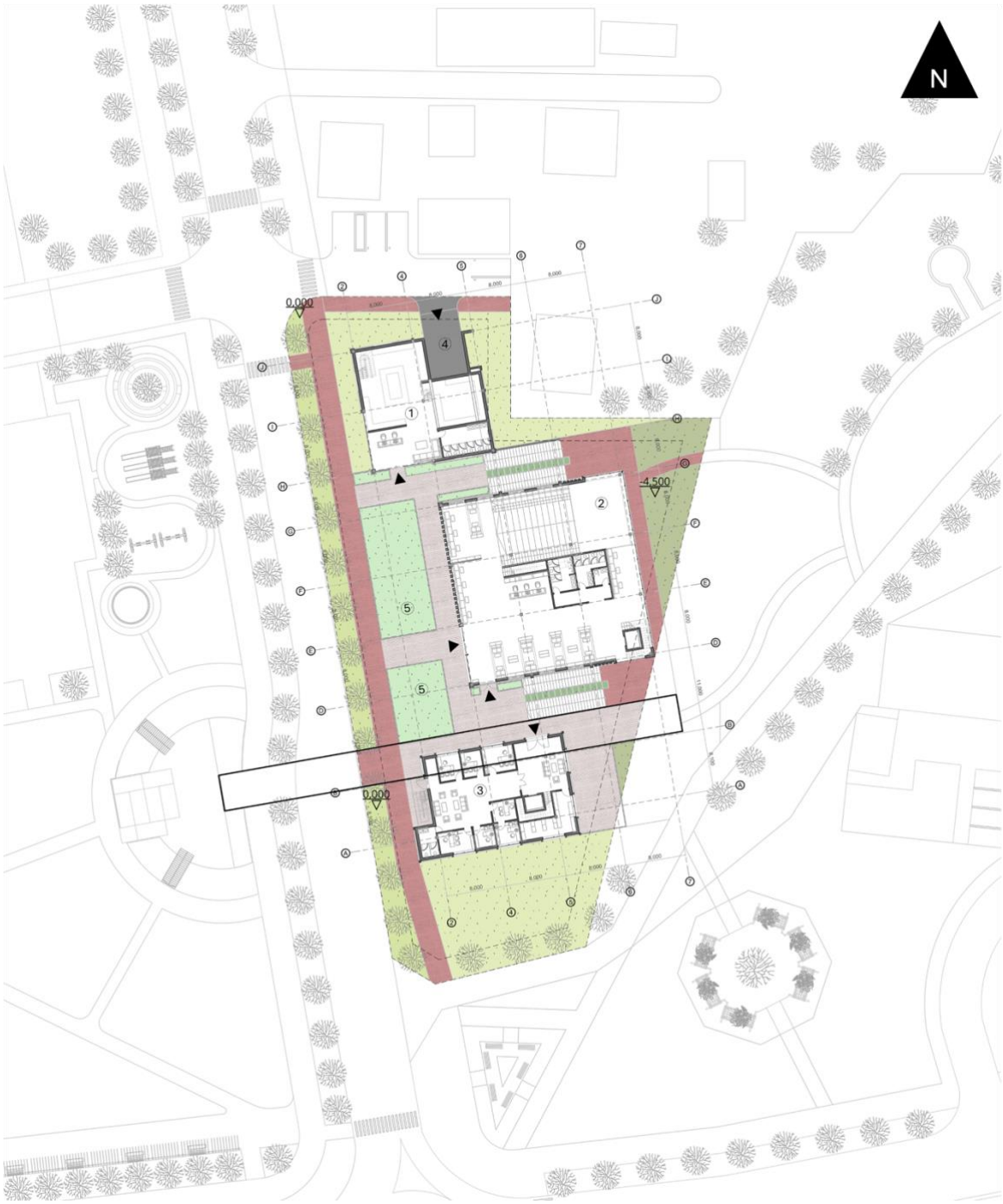


Fig. 52. Spatial arrangement of the new structure, functions, connection, and green development.

2.3.2. Site arrangement and site plan



Site Plan calculator	
Plot area	2931m²
Underground Parking area	1236m²
Building area	1206m²
Total build area	5312m²
Density	40.14%
Intensity	181.23%

Site Plan Description	
Plot Boundary	
Building boundary (3m)	
Underground tunnel boundary	
Level marking	
Grass (flat surface)	
Grass (flat surface (-4.500))	
Grass (slope surface)	
Grass (planter boxes)	
Permeable pavements	
Tiles	
Entrance	

Site Explication	
Block A1	1
Block A2	2
Block B	3
Way to underground parking	4
(700 mm) raised green bed	5

Fig. 53. The multifunctional public library site plan (not in scale) by the author.

On the north side of the plot, there is one entrance for underground vehicle parking, which connects directly with the parking spaces. Three blocks, A1, A2, and B, divide the buildings (see Figure 56). The main entrances to the building are facing the west side of the plot, with an open public space above the underground space. Moreover, two pathways connect the bottom-level public space to the floor beneath the zero level, facilitating a smooth pedestrian flow. The building placement is within 3.0 m of the boundary and 6 meters from the street readline. However, there are slight changes in the volume of block A1 on the second floor, which directly connects to block A2.

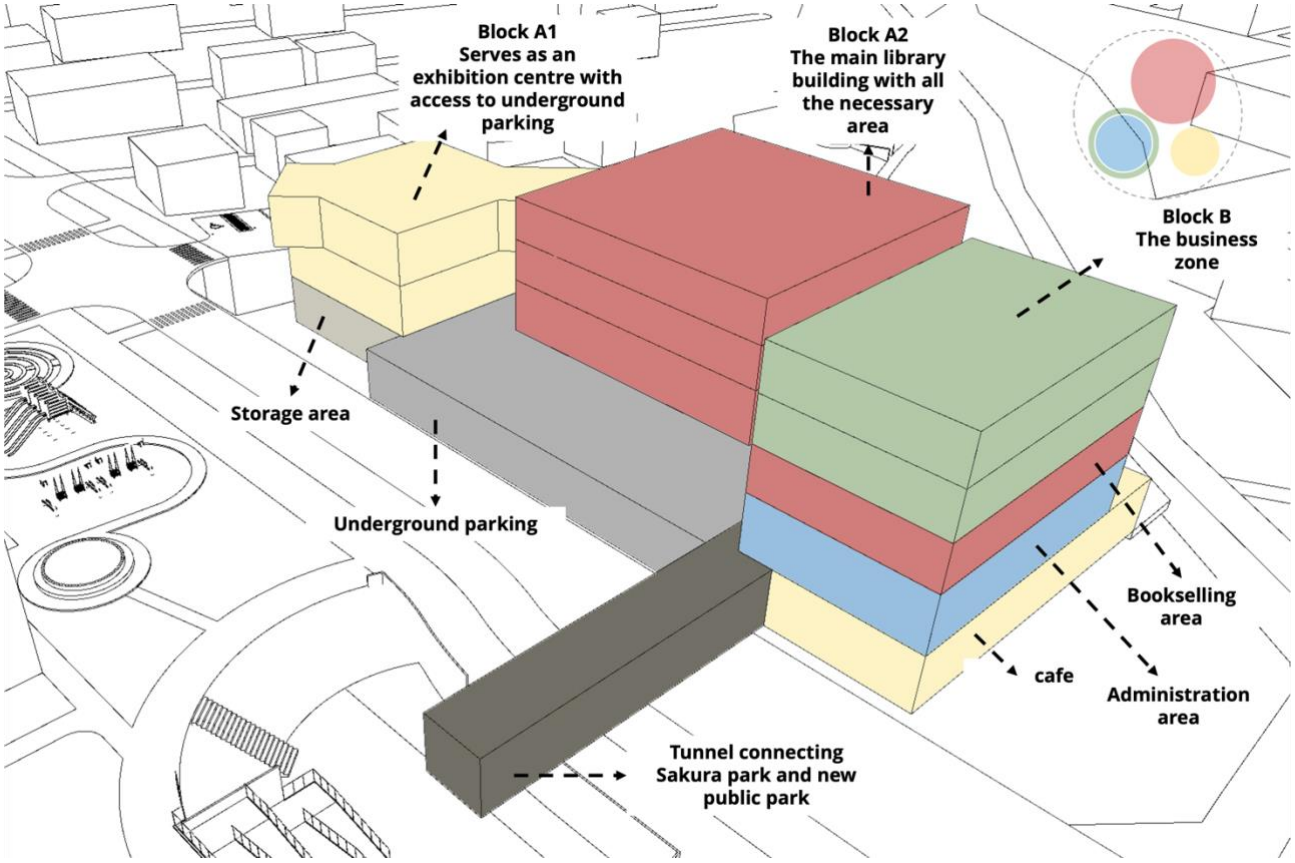


Fig. 54. The detailed function of each block of the multifunctional public library space.

Furthermore, an underground tunnel connecting the Sakura park and the new public park was made (see Figure 54.). This helps to ensure a smooth interconnection between the public spaces without disturbing the traffic above. The blocks above it are connected by elevators and stairs, while the parking spaces and cafes on its side are connected.

Additionally, the two public spaces in the area help to create a circular flow within the site, making it more attractive. Because the green spaces are on different levels, they create a different environment, allowing people to choose what they want.

The deserted location saw a substantial metamorphosis as a result of the deliberate cultivation of trees and bushes. The newly introduced vegetation consisted of plants from the Rosaceae family and the indigenous Lithuanian flora, including the Stelmužė Oak and Grossulariaceae. These species were selected for their capacity to thrive in the local environment. The trees and plants were strategically positioned along the roadways, pedestrian routes, and around ancient buildings to offer shade, establishing a pleasant and cooler atmosphere for tourists. In addition, the recently created public park is predominantly adorned with cherry blossoms, which heightens its visual

attractiveness and emphasizes the cultural significance of the surrounding Sakura Park. This considerate landscaping not only rejuvenates the environment but also promotes a harmonic integration of natural and urban life.

2.3.3. Building function and the floor plans of the multi-functional public library

For the final design floor plan plans, there will be one underfloor floor and one first-floor plan. However, the upper-floor plans are divided and will be explained separately.

1) Underground floor plan:

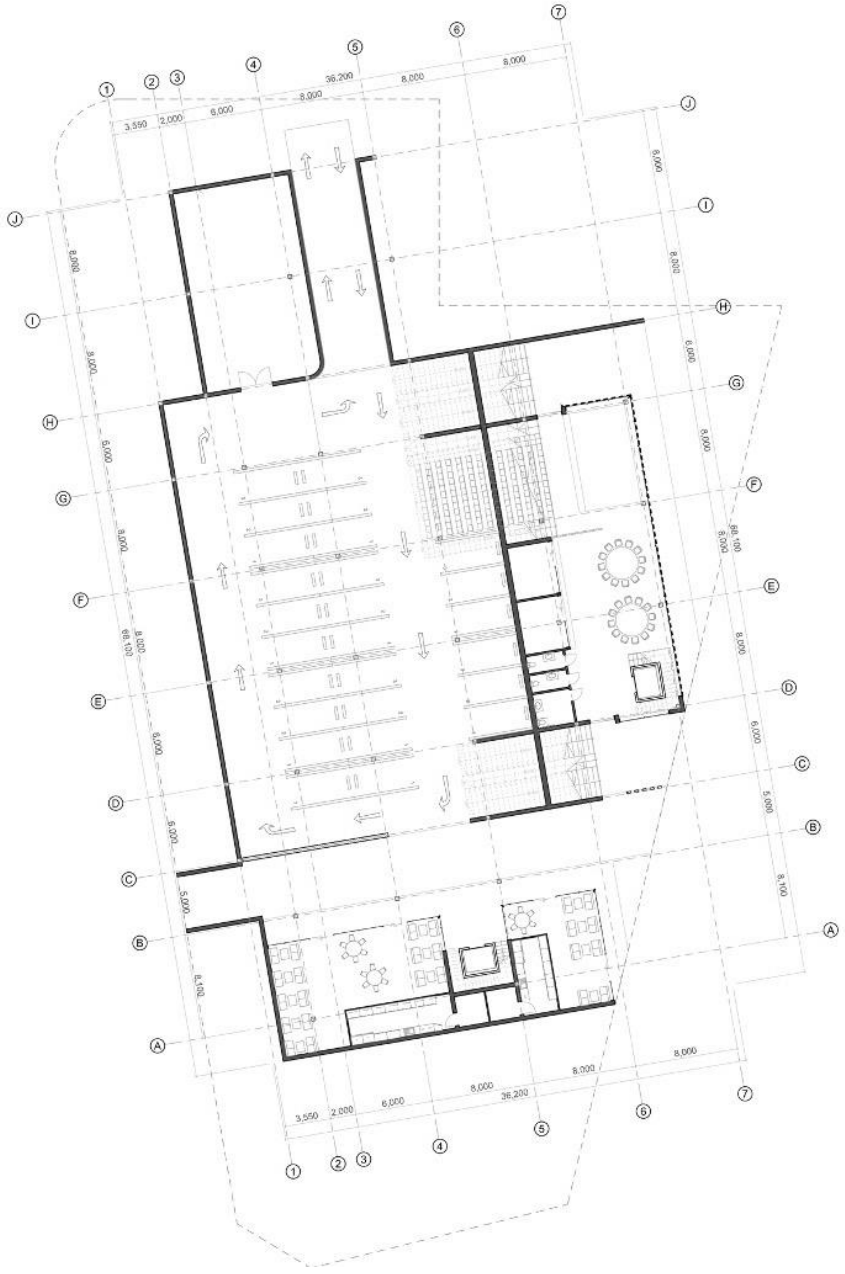


Fig. 55. Underground floor plan of the multifunctional public library (not in scale) by the author.

The underground floor primarily houses the parking spaces, accommodating 31 cars and 10 bicycles for easy parking. The main entrance to the parking lot is from the north side, hiding from public eyes with a ramp slope of 7 degrees, and each car parking space is 2.5*5.0 m in dimension with 5.0 m of wide space for the cars to move around. The library stores all its miscellaneous items in a storage area

measuring 9.0*15.8m next to the ramp. The cafes occupy the space on the south side, illuminating the underground tunnel connecting Sakura Park and the new public park, preventing darkness and creating a black spot. In between the cafes, there is an elevator, and stairs connect to block B. On the east side, there are two entrances for block A2. Block A2's basement level features an amphitheater space that connects to the first floor. Pods, adjacent to the amphitheater, serve as spaces for small group studies and meeting rooms, with washrooms next to them. Additionally, elevators and stairs connect the upper floors of A2. Sakura Park and the green public space next to it connect all the different spaces on the underground floor.

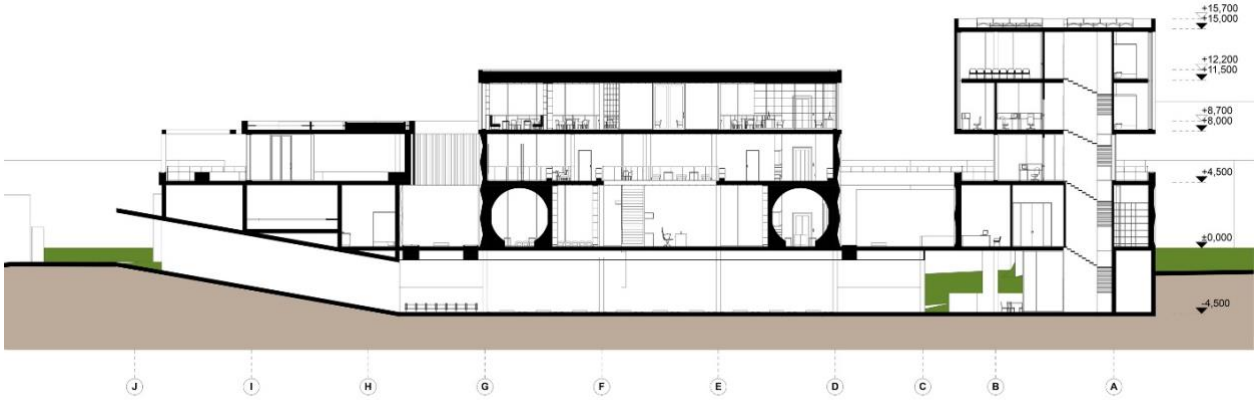


Fig. 56. Underground floor section.

2) First floor plan:

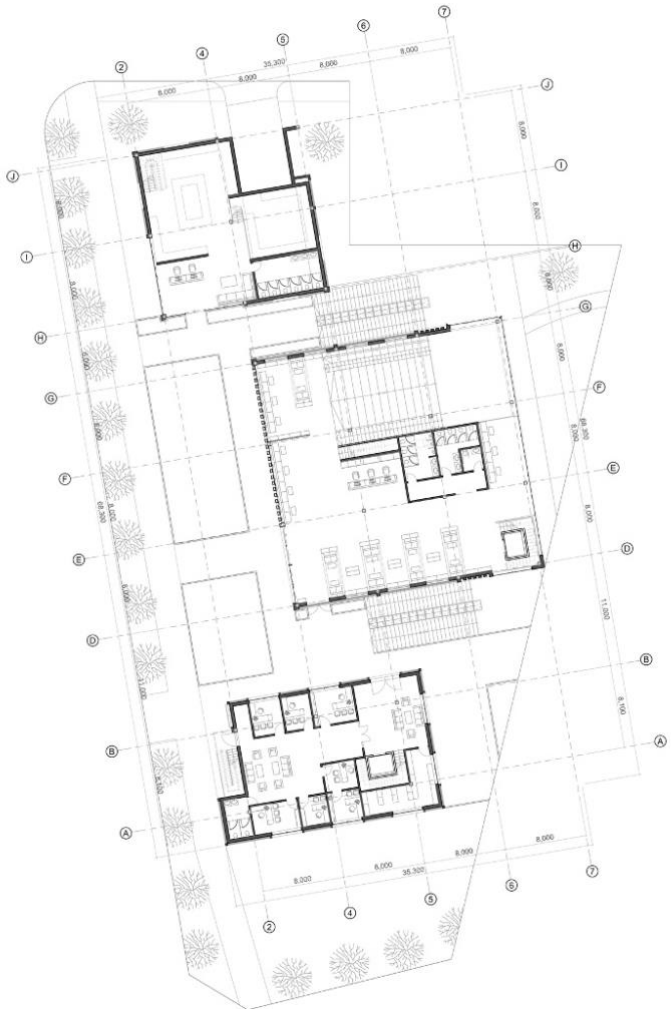


Fig. 57. First-floor plan of the multifunctional public library (not in scale) by the author.

On the first floor plan, all the blocks are located in the centralized, semi-divided green public space, a green roof above the parking lot good for planting small shrubs and trees. To begin from the north, there is block A1, which consists of a multifunctional space for different events, with the main purpose of being an exhibition gallery space. At the entrance of the building which faces the south side, there is a reception area with couches for people to sit on and wait for their turn, attached to a washroom for guests. To maximize its utilization, the building divides the gallery space into two parts, with one part on ground level and the second part sitting on the roof of the parking ramp at a height of 1.2 m from ground level. Additionally, there are staircases with stairlifts, which makes it easy for disabled people to access the upper floor. The total area is 208 m2.

Block A2 is the core hub and focal point of the overall library building, housing all necessary operations and services. Strategically located, its entrance faces west, inviting guests from the green public area that serves as the block's principal entryway. Upon entering, the layout follows an open-plan approach, creating a sense of spaciousness and accessibility. The strategically positioned reception area welcomes visitors and offers guidance, information, and support. For visitor convenience and comfort, washrooms and locker rooms are located adjacent to the reception area.

As visitors progress around the block, they will come across zones intended for a variety of functions. Waiting areas provide opportunities for leisure or small stops, while stairs lead to the amphitheater and upper floor, allowing for easy transit between levels of the structure. One significant aspect of Block A2 is the inclusion of semi-private pods, which provide quiet areas for individuals to engage in reading or studying, creating an environment conducive to concentration and attention.

Furthermore, carefully placed bookcases decorate the surroundings, displaying a broad assortment of literature from all genres and disciplines. This smart layout provides accessibility and encourages research, allowing guests to find and pursue their interests across genres and themes.

Finally, block B on the south side of the site accommodates the administration area. The administration area is accessed from the north and leads to the waiting hall, which is equipped with an elevator and stairs leading to the upper floors. The administration area has cabins for all authorities, starting with the director, deputy director, librarians, and administration staff, as well as a staff lounge. A storage and processing room connects to the server area on the floor.

3) Second-floor plan:

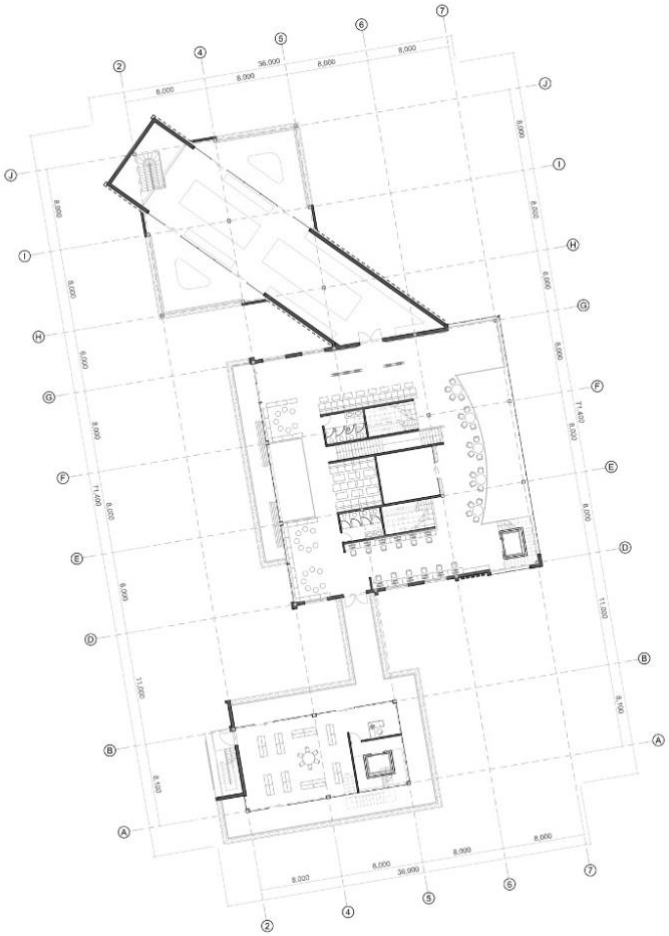


Fig. 58. Second-floor plan of the multifunctional public library (not in scale) by the author.

The second floor consists of three independent blocks joined by bridges or expanded volumes from other blocks.Block A1 consists of two semi-covered terraces separated by a diagonal volume. These terraces include planter boxes that serve as rails for visitor safety. A diagonal volume connects Block A1 to Block A2. It has a versatile space that allows for furnishings to be adjusted according to events or purposes.

Block A2 has a specific place for children and teenagers, which caters to their diverse requirements. Ascending the steps, guests will find a curving resting space with chairs and a table allowing a lovely view of Sakura Park, ideal for reading. A game room is adjacent to the seating area, where children can play freely. Stairs on each side of the game area connect to upper levels with varied heights that provide seats for readers. In front of the elevator is a computer workstation for children and teens, separated into two zones with ground seats to accommodate various sorts of reading materials. Men's and women's restrooms sit below the stairs, interspersed with a comfortable area where teens can work or read their favorite novels. Near the entrance to the multifunctional space, there are spots to display artwork and creative boards, as well as a covered balcony overlooking the park to inspire visitors.

Block B is for book fans who can explore and purchase books on the level. A balcony with outdoor seats surrounds the selling area and encourages guests to spend their time reading. Planter boxes on the balcony add a touch of greenery to the room, improving the atmosphere.

4) Third-floor plan block A1 and A2:

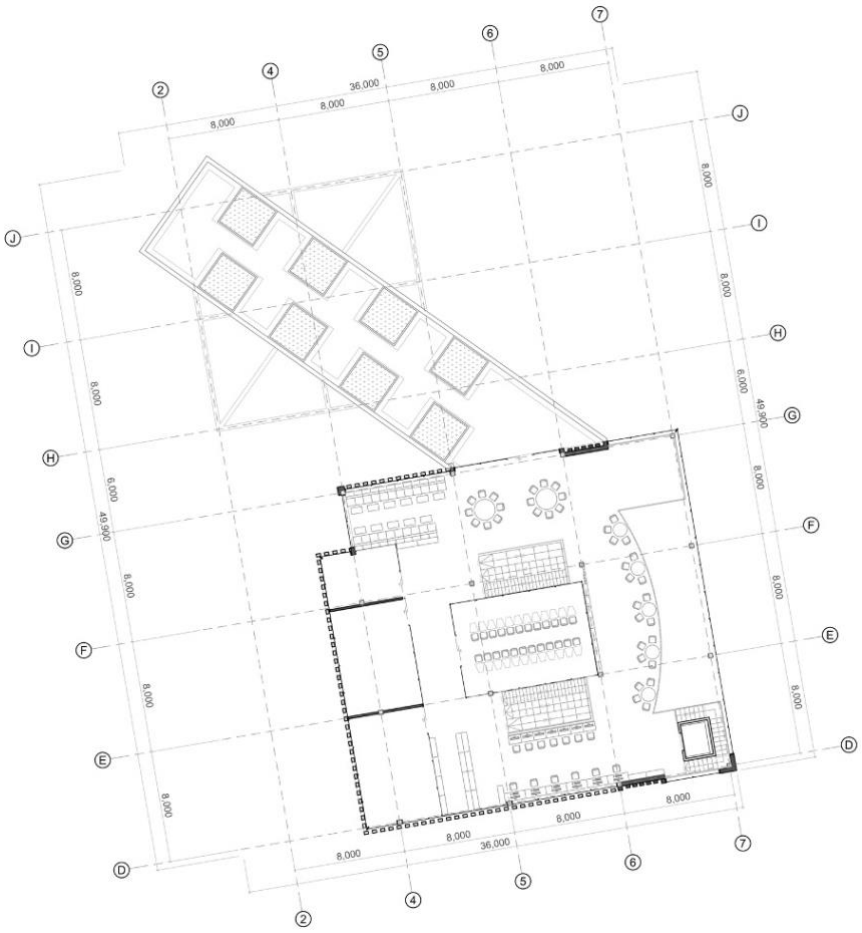


Fig. 59. Third-floor plan of blocks A1 and A2 of the multifunctional public library (not in scale) by the author.

Blocks A1 and A2 meticulously construct themselves on the third level to offer visitors a variety of experiences. Block A1 welcomes nature with its green roof, resulting in a quiet outdoor terrace where people can relax while reading their favorite books or participating in outdoor events. This green roof not only provides a refreshing getaway but also creates a connection with nature, broadening the library experience beyond the constraints of indoor settings.

The technology aspects of the library experience are the focus of Block A2, located on the same floor. Guests can access the world of digital resources and cutting-edge technology. This block meets the demands of the digital age by providing computerized workplaces, access to online publications, and specialized areas for technology-related reading. VR and AR experience zones provide immersive adventures, while flexible conference spaces equipped with technology enable collaboration and learning. The multimedia rooms meet a variety of media demands, while the maker spaces foster creativity and invention, all against a panoramic view of the park, flawlessly combining technology with the natural surroundings for a truly immersive and dynamic library experience.

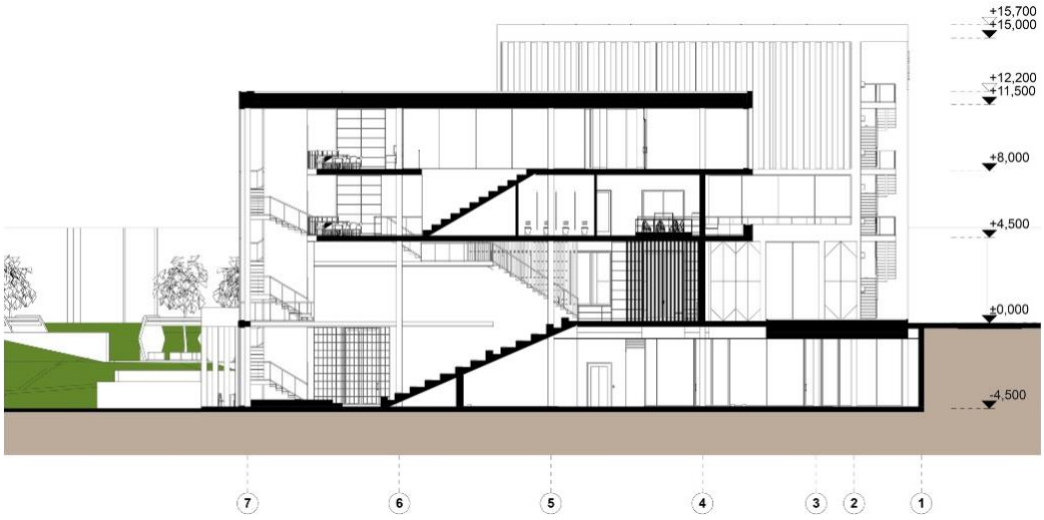


Fig. 60. Block A2 section (not in scale).

5) Third and fourth-floor plan of block B:

Fig. 61. Third and fourth-floor plan of block B of the multifunctional public library (not in scale) by the author.

Block B's third and fourth zones provide a flexible mix of work areas. The third level houses a contemporary corporate information center that promotes cooperation and production through a big co-working area suitable for 32 people. Within this zone, eight-person pods provide comfortable yet effective workstations for concentrated work or group conversations. A semicovered terrace extends from this floor, providing an outside space for a refreshing change from the inside setting.

Ascending to the fourth story, the arrangement easily transforms to satisfy corporate demands, with specific areas for business conventions and meetings. With two unique locations available for hire, businesses may choose the place that best meets their needs, whether it's a small team gathering or a large-scale conference. Furthermore, each section has its semi-covered terrace, which allows guests to network or simply get some fresh air in between busy sessions. Together, these zones on Block B's third and fourth floors offer a setting suitable for both work and collaboration, delivering a well-rounded experience for both inhabitants and guests.

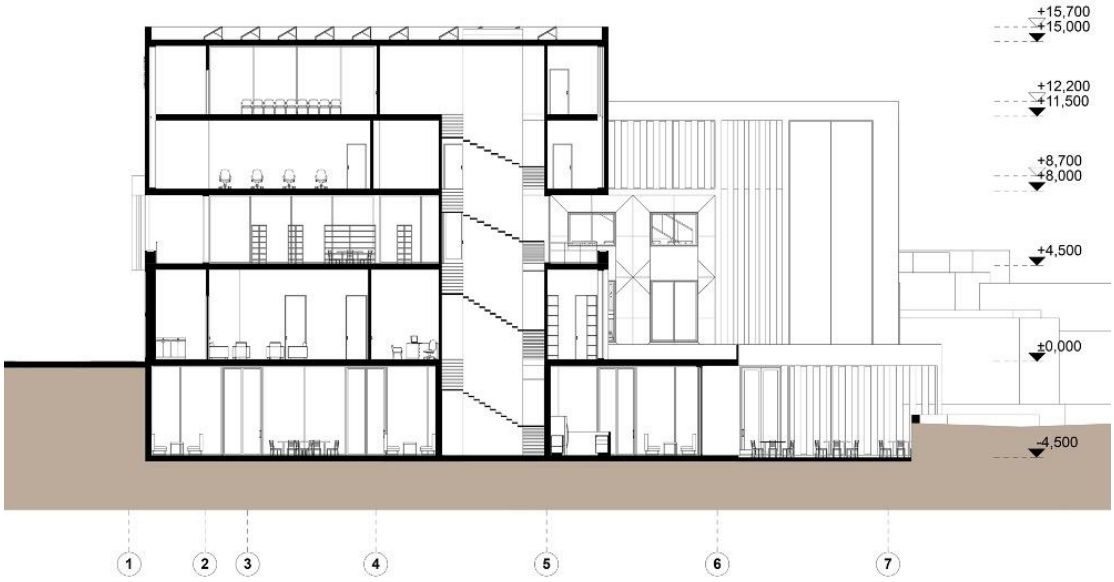


Fig. 62. Block B section (not in scale).

2.3.4. Elevation and visual aspect of the multi-functional public library

The design idea for the building focused on attaining a cohesive and aesthetically pleasing appearance by integrating natural features and textures. To do this, the three blocks were designed with commonalities in their visual aesthetics, which enhances the overall coherence of their appearance. However, to add a hint of natural liveliness, green hanging plants were purposely integrated.

When it comes to the color palette, the main factors taken into account were simplicity and harmony. The primary utilization of two primary shades, white and light brown, was meant to create a feeling of calm and elegance. The selection of these colors was based on their capacity to harmonize with each other, creating a timeless and refined atmosphere. The facade incorporated wood and stucco as the main elements to create a visually appealing and textured appearance.

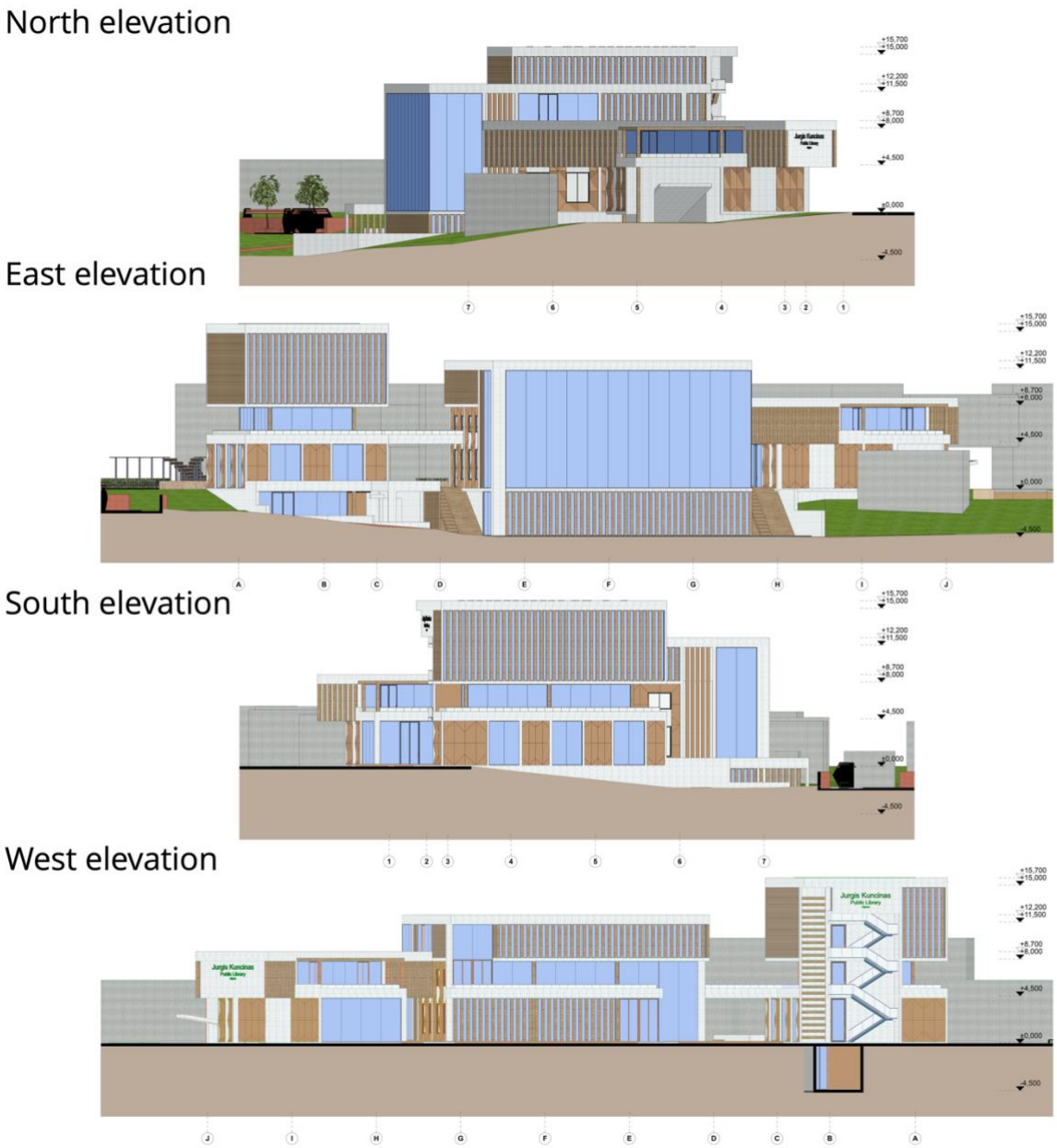


Fig. 63. Elevation of the multifunctional public library (not in scale) by the author.

Intentionally, the first level of each block integrated a simple yet effective design to achieve depth and uniqueness. This architectural feature not only functioned to visually distinguish the lower level of the structure from the upper levels but also contributed to the overall composition by creating a sense of depth.

The upper levels showcase a repeated arrangement of wooden stripes, which served both a practical purpose and enhanced the visual appeal of the facade. The wooden stripes served as shading elements for the windows, producing a dynamic interplay of light and shadow.

Fig. 64. Visualization from the north end by the author.

Curtain walls with iron fasteners were primarily utilized for glazing, imparting a modern aesthetic to the exterior. The creative contrast with the other materials and colors on the exterior was designed to provide visual intrigue and emphasize the contemporary architectural features of the building.

The planned use of different heights and volumes in each section of the structure not only allows for an easy blend with the environment but also ensures unrestricted sunlight access. This design method promotes both environmental harmony and provides the structure with a dynamic rhythm and distinctive character, creating various zones for people to interact with. In addition, the bonsai cherry blossom plants in front of the building not only improve its visual appeal but also enhance its overall presence. They serve as a captivating focal point that effortlessly combines nature with design, enriching the experience of both visitors and passersby.

Fig. 65. Visualization from the sakura park by the author.

The center building block A2 showcases a glass facade from bottom to top towards the view from sakura park, giving the feeling of interior spaces connected with the exterior, such that from inside people can have a clear view of the park. It also helps to create a distinct facade from the rest of the buildings. The design approach generally focused on achieving a harmonious and visually appealing structure that easily blends with its environment. The design balanced aesthetics, utility, and harmony, creating a timeless and engaging appearance.

2.3.5. Building structure

Steel and wood are the main building materials used in the experimental design's main structure. The only elements utilized were the underground-level RCC, the reinforced concrete slab, and the roof. For the underground level, the RCC column foundation rests on the pile foundation, a suitable choice given the soft soil in this area and its ability to support the overhead structure. The pile foundation is 250mm in diameter, while the RCC column above it is 300mm in diameter.

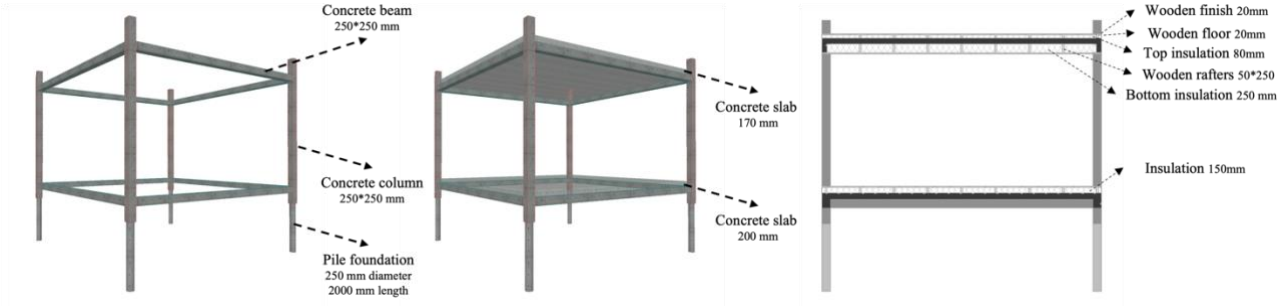


Fig. 66. Underground level section of RCC foundation.

The building's architectural design places a high emphasis on sustainability and structural strength, which is particularly noticeable in the levels located above ground level. Here, a fusion of steel and timber components creates a sturdy structure. Positioned strategically at intervals of 8.0 meters, steel columns measuring 220 mm in diameter offer substantial support. The wooden beams, spaced at 4.0 m and measuring 220 mm, work together with the steel columns to effectively distribute weight throughout the structure. The framework is strengthened by placing rafters, which are 50*220 mm in size, on top of the beams. This additional reinforcement ensures that the foundation has the strength to support the floors and their weight. This deliberate incorporation of materials promotes sustainability and guarantees the structural durability required for the building's long-term usefulness and environmental accountability.

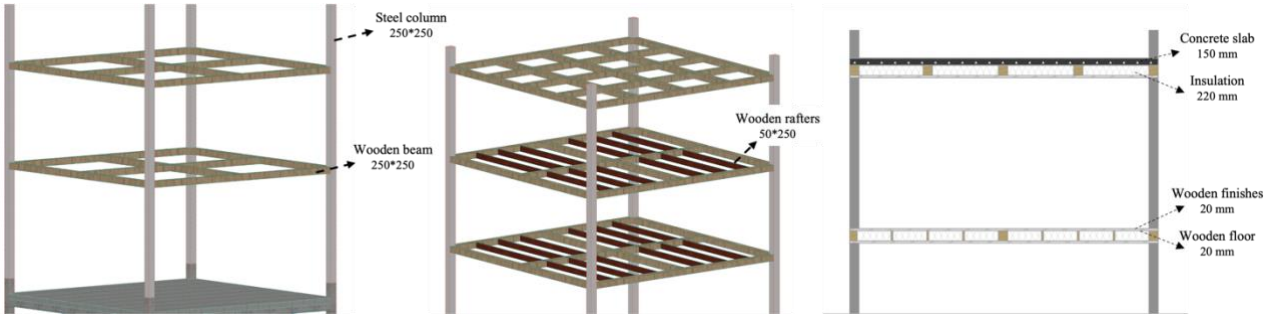


Fig. 67. Steel and wooden foundation with rafters section on upper floors.

During the building process, the combination of wood beams and steel columns required standard connections, which were strengthened with steel connector plates to guarantee the stability and

strength of the structure. The connection plates, utilizing screws and nails, effectively attached the hardwood beams to the steel columns, ensuring stability and support. Furthermore, the rafters were connected to the timber beams using standard connections, ensuring uniformity in the building method. This method not only made the process of putting the parts together easier but also guaranteed that the entire construction would be strong and able to handle many environmental and weight-related problems for a long period.

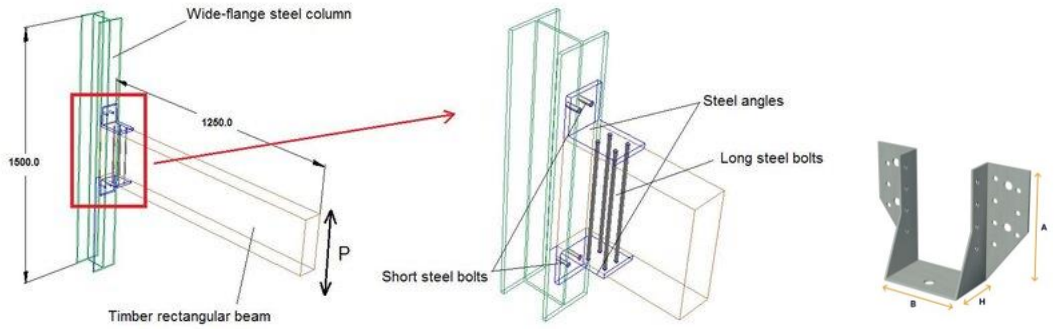


Fig. 68. Standard joints for steel and wooden elements. (Sirumbal-Zapata et al., 2019)

2.3.6. Green infrastructure

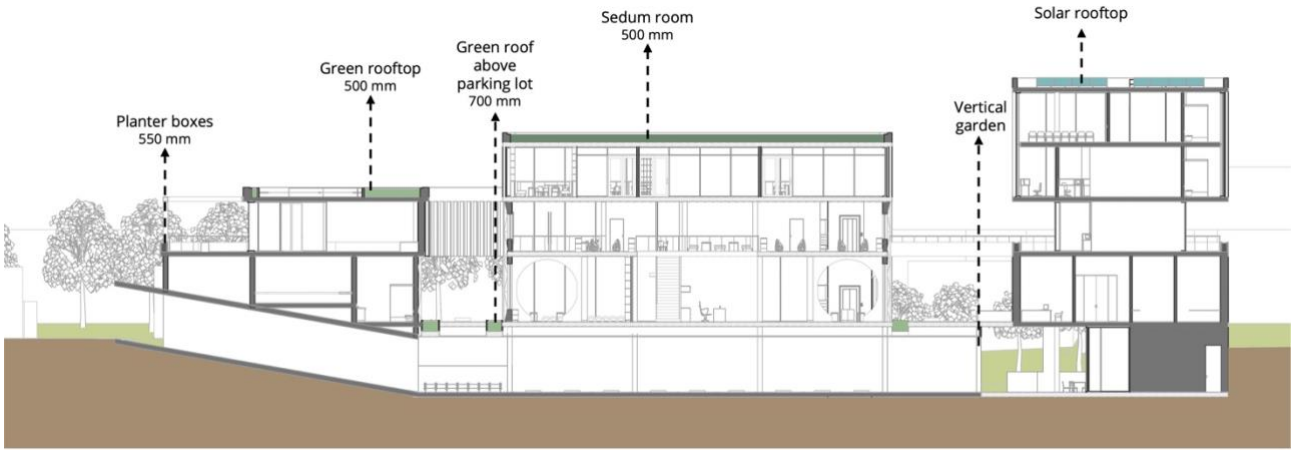


Fig. 69. Section of the building showing the green infrastructure.

The incorporation of green infrastructure on the site is a crucial element of sustainable urban development, and this project effectively employs many ways to improve environmental performance. Green roofs, deliberately implemented in various locations, provide several functions. A substantial 700-mm layer of green roofing is located above the parking lot. This layer serves two functions: promoting plant growth and This helps to alleviate the urban heat island effect. Block A1 features a soil depth of 500 mm, which is perfect for creating an attractive external roof garden that promotes biodiversity. Block A2 boasts a low-maintenance 500-mm sedum roof. This roof not only improves the appearance of the building but also helps with thermal regulation, lowering the amount of energy needed for cooling.

Moreover, the installation of solar panels on top of Block B demonstrates a dedication to integrating renewable energy, in line with objectives for sustainable development. Through the utilization of solar energy, the building can greatly decrease its reliance on traditional energy sources, lowering its dependence on fossil fuels and limiting its impact on the environment by emitting less carbon dioxide.

Fig. 70. The existing open space and the changes made to implement more green infrastructure.

The project has successfully incorporated the nearby open space into its design, improving its use and ease of access. The design concept of the project revolves around the existing trees in this green space. Green infrastructure elements such as permeable pavements, a variety of tree species, and flower beds transform the area into a lively and welcoming outdoor space. This effort not only enhances environmental sustainability by fostering biodiversity and water management through permeable surfaces, but it also establishes a community sanctuary that provides a versatile location for rest, leisure, and social interaction.

2.4. Evaluation of the elaborated experimental design of the multifunctional public library

1) Experimental design based on the research:

Based on the conceptual model and 4 main criteria derived from it.

Table 8. Comparison of what was conceptualized and what is achieved.

Criteria		Alternative 2	Experimental design
Mission and Vision	Integrated spaces	Yes	To achieve it, a circular flow of movement was developed within the building, making it accessible from all directions, which supports the idea of integrated spaces. Adaptability and user-centric design were achieved through the functions and placement of different zones carefully to create a centralized flow within the structure. Block A2's third floor, which houses all technologically equipped elements, satisfies the technology aspect's requirement.
	Adaptability	Yes	
	User-centric design	Yes	
	Technology	Yes	
Community Hub	Diverse spaces	Yes	The creation of diverse areas for all age groups, distinct sections for different genres of books, the incorporation of green elements within the interior space, a large glass facade that provides a clear view of the outdoor environment, a multifunctional room, and VR/AR rooms all contribute to the creation of diverse spaces, an attractive atmosphere, and the development of public engagement.
	Atmosphere	Yes	
	Engagement		
Facilities	Accessibility	Yes	Stairlifts, elevators, disabled washrooms, doors connecting different spaces, implementing technological sensory fixtures throughout the building, sensory lighting, and creating different zones all help to fulfill the criteria.
	Sensory considerations	Yes	
	Zoaning	Yes	
Sustainable Spaces	Elements		Sustainable building materials, green infrastructure incorporation, large windows bringing natural sunlight, and window shades reduce the dependency on artificial lights. Connecting indoor and outdoor spaces facilitates behavioral changes in the space. The availability of solar panels again helps reduce dependency on natural resources and reduces carbon footprints.
	Availability	Yes	
	Behavioral changes	Yes	

Based on principles and rules on how a library can be more multifunctional and usable

Table 9. Comparing principles and rules from the concept to experimental design.

Alternative 02.

Principles		Rating(1-5)	Total (47)	Percentage %
Built in environment	Architecture and design	4	14	30 %
	Location	5		
	Accessibility	5		
Function	Library services	5	10	21 %
	Community services	5		
Social attributes	Community engagement	5	15	32 %
	Inclusivity	5		
	Educational support	5		
Sustainability	Energy efficiency	4	8	17 %
	Green Spaces	4		

Experimental design

Principles		Implimentations
Built in environment	Architecture and design	Vibrant, contemporary, modern
	Location	Surrounded by public buildings, sakura park
	Accessibility	New connections, bicycle lanes, circular flow
Function	Library services	Developing 5 zones catering to different services
	Community services	Information services, events and programs, technology access, exhibitions, multifunctional spaces
Social attributes	Community engagement	
	Inclusivity	Physical accessibility, diverse collection, multilingual services, safe and inclusive environment, affordable access.
	Educational support	
Sustainability	Energy efficiency	Green roofs, sedum roof, local material, solar pannels, access to sunlight.
	Green Spaces	

While moving from the initial idea to the experimental design in the physical environment, several important variables, such as utility, social integration, and sustainability, play a crucial role in leading the transition into the design phase. The design adopts a minimalist and modern approach to maximize spatial use, intelligently allocating functional zones according to their demands and usability. This planned organization promotes inclusiveness by guaranteeing that library services are accessible to various age groups and communities, fostering participation in communal activities and events. By incorporating sustainable features into its construction, the design not only meets energy needs but also promotes environmentally friendly infrastructure, supporting larger environmental goals.

Essentially, this experimental design highlights the significant sociological influence of libraries as centers for community involvement and educational assistance. Through the availability of information and resources, the library plays a crucial role in promoting social cohesiveness and empowering individuals. By strategically using design concepts and sustainability measures, the planned library not only fulfills the current requirements of its users but also establishes a strong community.

2) Experimental design based on SDG's:

Fig. 71. SDG's goals are implemented in the experimental design.

As discussed during the research, achieving these six Sustainable Development Goals (SDGs) is crucial for developing a multifunctional public library. Therefore, during the experimental design, the goals were considered in terms of zoning and allocating the functions within the building.

- **Goal 3:** This goal talks about health and well-being, connecting it with the library, which hosts workshops, seminars, events focused on health education, access to a health care database, and so on. To accommodate this design, it includes specific sections, gathering spots, separate rooms, and so on.
- **Goal 4:** The whole idea of the experiment is to motivate people to come to the library which helps individuals to connect with the community and attend events that connect to good education. Libraries encourage children, young people, and adults to read and learn lifelong.
- **Goal 10:** Being a public library, it allows all people to access its free services that are available to all. The interconnected, simple, and open floor plan helps to make the available resources more accessible, which helps to remove the obstacles for the people.
- **Goals 11 and 13:** As both the goals talk about sustainability and climate action, the design incorporates green infrastructure with locally sourced materials, solar rooftops, access to natural sunlight, a green roof, etc.
- **Goal 12:** This goal focuses on consumption, and libraries are considered pioneers in it. Creating co-working spaces, multifunctional spaces, computerized spaces, and rented business conference rooms contribute to the creation of a circular economy, thereby reducing the need for separate consumption.

General conclusions

1) According to the research, libraries have a rich and diverse history, evolving from private to public collections through the years. Over time, libraries have transformed into different categories depending on the area and the requirements. Libraries have also transformed into vibrant community hubs that integrate all the necessities of today. Furthermore, libraries have begun incorporating technology into various services, such as e-books, which has led to digital transformation.

2) Public libraries have evolved into community hubs that promote sustainable development, in line with the United Nations' Sustainable Development Goals. They advocate for diversity, accessibility, and social, economic, and environmental sustainability. Libraries provide adaptable places for a wide range of community needs, including information on climate change, renewable energy, and ethical consumption. Because of their emphasis on sustainability and environmental concerns, they are proponents of responsible living and environmental stewardship.

3) Public libraries are a vital part of the community, providing a platform for learning and community engagement. These institutions demonstrate a strong commitment to sustainability and provide improved spaces for the community. A better space for the community. They offer a range of services, including programs, resources, and technologies, catering to the unique needs of their communities. These libraries not only serve as book repositories, but they also promote the importance of sustainability in the community through event organization.

4) It influences the spatial development of the multifunctional public library, according to the theoretical analysis. Allows the smooth flow of development in terms of how the site should be included in terms of volumes, what functions and zones should be implemented to make the place more accessible, and how it should fit within the environment.

5) The experimental design proved that it could bring a change in the neighborhood by the development of this design.

- Helps to create a smooth flow within the neighborhood connecting different spaces without disturbing the existing movements.
- Extending the Sakura Park on the opposite side of the allocated plot helps to increase the existing park and its importance, creating more outdoor and public space where the neighborhood can relax and enjoy. This extension also contributes to enhancing public mobility and ensuring the neighborhood remains safe from insecurity.
- Implementing locally sourced materials and integrating green infrastructure helps the community understand the importance of sustainability, proving Hypothesis 3.
- An increase in neighborhood accessibility by developing more bicycle lanes, underground tunnels, new paths connecting different buildings, and lastly, constructing a roundabout near the crossing helps to decrease traffic and make vehicular movement fast.
- Social considerations play a crucial role in organizing and creating different environments that serve several functions to enhance people's choices and opportunities for social interaction.
- and development incorporates recreational space to fulfill the needs of the local population and enhance the architectural concept.

List of references

1) Allplan. (n.d.). The 10 Most Popular Green Building Certifications. Retrieved October 18, 2023, from https://blog.allplan.com/en/the-10-most-popular-green-building-certifications

2) Bennett, S., & Council on Library and Information Resources (Eds.). (2005). Library as place: Rethinking roles, rethinking space [Electronic resource]. Council on Library and Information Resources. http://www.clir.org/pubs/abstract/pub129abst.html

3) Carmona, M. (2019). Principles for public space design, planning to do better. URBAN DESIGN International, 24(1), 47–59. https://doi.org/10.1057/s41289-018-0070-3

4) Coromandel Community Centre. (n.d.). Retrieved October 24, 2023, from https://coroalive.org.au/galleries/community-centre-activities

5) Designing libraries, Gemma. (2016). https://www.studocu.com/in/document/mahatma-gandhi-university/library-science/designing-libraries/66442890

6) Dobie (Director). (2021, April 15). IMPACT OF DIGITAL TRANSFORMATION ON THE FUTURE OF LIBRARY WORK. https://www.youtube.com/watch?v=EOHKoHuthMg

7) Edwards, B. W. (2011). Sustainability as a Driving Force in Contemporary Library Design. Library Trends, 60(1), 190–214. https://doi.org/10.1353/lib.2011.0030

8) Eric s. Anderson. (2018). Sustainability and the Modern Library by ericsobek—Issuu. https://issuu.com/ericsobek/docs/e._anderson_honorsthesis_sheets

9) EveryLibrary. (2021, August 19). Libraries Can Help in Times of Stress, Uncertainty, and Burnout. EveryLibrary. https://medium.com/everylibrary/libraries-can-help-in-times-of-stress-uncertainty-and-burnout-2acc0824e744

10) Fagbola, O., Uzoigwe, C., & Ajegbomogun, V. O. (n.d.). Libraries Driving Access to Knowledge in the 21st Century in Developing Countries: An Overview.

11) Flexible Urban Public Spaces and their Designing Principles. J. Civil Eng. Urban., 8 (4): 39-43. Www.ojceu.ir; (2018).

12) Gupta, S. (2020). Green Library: A Strategic Approach to Environmental Sustainability [SSRN Scholarly Paper]. https://papers.ssrn.com/abstract=3851100

13) Hickerson, E. H. T. (2022). Designing Libraries for the 21st Century.

14) History of the Library. (n.d.). Vrublevskių Biblioteka. Retrieved September 18, 2023, from http://www.mab.lt/en/about-the-library/history-of-the-library/

15) Home—McArthur Public Library. (n.d.). Retrieved October 24, 2023, from https://www.mcarthurpubliclibrary.org/

16) Homepage—Eilat Municipal Library. (n.d.). Retrieved October 24, 2023, from https://eilat.library.org.il/

17) How public libraries help build healthy communities. (2017). Brookings. https://www.brookings.edu/articles/how-public-libraries-help-build-healthy-communities/

18) I-1240 Law on Construction. (2007). https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.312477?jfwid=bkaxmm6x

19) Igarashia, T., Koizumib, M., & Wakec, N. (2022, October 15). The impact and concept of public libraries in the twenty-first century [Text]. University of Borås. https://doi.org/10.47989/colis2225

20) Koen, D., Lesneski, T. E., Koen, D., & Lesneski, T. E. (2018). Library Design for the 21st Century: Collaborative Strategies to Ensure Success (1st ed.). De Gruyter Saur. https://www.perlego.com/book/886626/library-design-for-the-21st-century-collaborative-strategies-to-ensure-success-pdf?queryID=9df15cbb3c6bcef0edebc68a5a04401c&index=prod_BOOKS&gridPosition=7

21) Kumbhar, B. (n.d.). Digital Library Architecture: An overview.

22) Kurbanoğlu, S., & Boustany, J. (2014). From Green Libraries to Green Information Literacy. In Communications in Computer and Information Science (Vol. 492, p. 58). https://doi.org/10.1007/978-3-319-14136-7_6

23) La Conner Swinomish Library—A place for discovery, connection, and inspiration. (n.d.). La Conner Swinomish Library. Retrieved October 24, 2023, from https://www.laconnerswinomishlibrary.org

24) Library | Definition, History, Types, & Facts | Britannica. (2023). https://www.britannica.com/topic/library

25) Lynch, K. (2008). The image of the city (33. print). M.I.T. Press.

26) Mainka, A., & Khveshchanka, S. (2012). Digital Libraries as Knowledge Hubs in Informational Cities.

27) Pierce, D. (n.d.). New Library Design: Spaces That Connect, Cultivate, and Transform Communities. Library Journal. Retrieved October 29, 2023, from https://www.libraryjournal.com/story/new-library-design-spaces-that-connect-cultivate-and-transform-communities

28) Rezaallah, A., Bolognesi, C., & Afghani Khoraskani, R. (2012). LEED and BREEAM; Comparison between policies, assessment criteria and calculation methods.

29) Rumilets, T. (n.d.). MEDIA LIBRARY AS A PROGRESSIVE MULTIFUNCTIONAL SPACE.

30) Sahavirta, H. (2022). Advocating Public Libraries by the SDGs.

31) Savić, D. (Dobie). (2021, May 11). Impact of Digital Transformation on the Future of Library Work. https://www.institutefordigitaltransformation.org/impact-of-digital-transformation-on-the-future-of-library-work/

32) Shaffer, G. L. (2018). Creating the Sustainable Public Library: The Triple Bottom Line Approach (1st ed.). Libraries Unlimited. https://www.perlego.com/book/4164560/creating-the-sustainable-public-library-the-triple-bottom-line-approach-pdf

33) Stanley A. Milner (Downtown). (n.d.). Retrieved October 24, 2023, from https://www.epl.ca/locations/EPLMNA

34) State Library of New South Wales. (2019). Library as community place. State Library of NSW. https://www.sl.nsw.gov.au/public-library-services/people-places/library-community-place

35) Team, P. (2021). The evolution of libraries to the 21st century (Infographic). https://blog.pressreader.com/libraries-institutions/21st-century-library-evolution-timeline

36) TEDx Talks (Director). (2016, October 10). The library is not a place, it's a concept. | Bill Ptacek | TEDxCalgary. https://www.youtube.com/watch?v=ES0zGUvZj5s

37) The Europe Challenge. (n.d.). The Europe Challenge. Retrieved October 10, 2023, from https://theeuropechallenge.eu/

38) The four spaces of the public library | IFLA Public Libraries Section Blog. (2016, March 29). https://blogs.ifla.org/public-libraries/2016/03/29/the-four-spaces-of-the-public-library/

39) The Word – National Centre for the Written Word / FaulknerBrowns Architects. (2017, January 9). ArchDaily. https://www.archdaily.com/801550/the-word-nil-national-centre-for-the-written-word-faulknerbrowns-architects

40) Types of Libraries and their functions. (2019). https://www.slideshare.net/jasvinderkaur46/types-of-libraries-and-their-functions

41) GoogleForms: Online Form Creator | Google Workspace. (n.d.). Retrieved January 6, 2024, from https://www.facebook.com/GoogleDocs/

42) Kioupi, V., & Voulvoulis, N. (2022). Education for Sustainable Development as the Catalyst for Local Transitions Toward the Sustainable Development Goals. Frontiers in Sustainability, 3. https://www.frontiersin.org/articles/10.3389/frsus.2022.889904

43) https://www.researchgate.net/publication/315368761_Sustainable_Steel timber_Joints_for_Framed_Structures#fullTextFileContent

44) https://www.mdpi.com/2075-5309/14/2/524

45) https://wittswood.co.uk/blog/32-7-reasons-why-wood-is-good-for-interior-design-all-about-wooden-decor

46) https://www.researchgate.net/publication/335789926_Experimental_assessment_and_damage_modelling_of_hybrid_timber_beam-to-steel_column_connections_under_cyclic_loads/figures?lo=1

Appendix

Appendix 1: Sociological survey form

Jurgis Kuncinas Public Library in Alytus - To create a contemporary library - open to the public, with innovative, developing traditional and nowadays facilities.
Welcome to the survey on how community involvement can help develop a better library that satisfies the needs and demands of society. I am Yash Devendra Khandelwal, a master's student of architecture at Kaunas University of Technology. I'm undergoing this survey for my final research project. Please fill out this survey. It will help me better understand the needs and demands of the community and the people living in Alytus. which will play a key role in designing the city's public library.

1) What is your gender?*
- Male
- Female
- Prefer not to say
- Other

2) What is your age?*
- 18-24
- 25-34
- 35-44
- 45-54
- 55+

3) If a new multifunctional library were developed how happy you would be? *
- Least 1 2 3 4 5 Most

4) How frequently do you visit a library in a month?*
- Daily
- Once a week
- More than once a week
- Once a month
- More than once a month
- Rarely
- Never

5) What services do you most frequently use in a library? (Select all that applies)*
- Book borrowing
- Study spaces
- Events/Workshops
- Digital resources
- Other:

6) What facilities would you like to see in a library? (Select all that apply)*
- Collaborative workspaces
- Maker spaces (e.g., 3D printing, Audio, and Video capturing)
- Quiet reading areas
- Multimedia rooms
- Other:

7) Please rate these two pictures of a library based on your taste in either traditional architectural design or a more modern open layout. *

Traditional

Modern

- **Traditional:** least 1 2 3 4 5 most
- **Modern:** least 1 2 3 4 5 most

Please give a reason for your rating of these pictures.* (Example - Colour, furniture, style, etc.)

Your answer .

8) Which environmental factors are important to you in a library? (Select all that apply) *

- Natural lighting
- Green spaces
- Noise control
- Accessibility to public transportation
- Other:

9) Do you believe that libraries designed with community input better serve societal needs?*

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Other:

10) Which types of seating arrangements would you prefer in the library? (Select all that apply)*

- Individual desks or study carrels
- Flexible modular seating for customizable arrangements
- Cozy nooks with comfortable chairs
- Long communal tables for group work
- Bean bags or floor seating options
- Other:

11) How does accessibility affect your involvement in the library?*

- Least 1 2 3 4 5 Most

12) Rate how you would like the library in your city to be in terms of its color influence. (on the scale of darkness 1 and vibrancy 5)



- **Image 1:** Dark 1 2 3 4 5 Vibrancy
- **Image 2:** Dark 1 2 3 4 5 Vibrancy
- **Image 3:** Dark 1 2 3 4 5 Vibrancy

13) What type of material would you like to see in the library facade that focuses on sustainability?*

- Concrete
- Wood
- Glass
- Local materials
- Steel
- Recycle material (eg. glass, wood)

14) Rate this picture according to your knowledge based on sustainable design elements that you can observe. (Least 1 to Most 5)



- **Image 1:** least 1 2 3 4 5 most
- **Image 2:** least 1 2 3 4 5 most
- **Image 3:** least 1 2 3 4 5 most

15) What aspect of the community center aims to contribute to sustainability?*

- Material
- Facade
- Accessibility
- Functions
- Technology (eg. Solar panel)
- Other:

Appendix 2: Renders

View from the south point of the site.

View from the 3rd floor (Block A2) window.

View of the amphitheater of the library.

View towards the sakura park from the balcony (Block B).

Bird-eye view of the site.

Jurgis Kunčinas Public Library in Alytus

Student: Yash Devendra Khandelwal
Supervisor: Assoc. Prof. Vidmantas Minkevičius

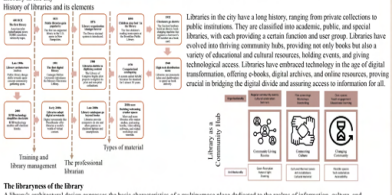
Introduction

What is a library and how do we remember libraries? A library is a collection of typical books, multimedia collections, documents, or digital content. It is a place where people gain knowledge, history, and culture through a wide range of materials such as support learning, intellectual growth, and entertainment. In the modern era where libraries are undergoing digital transformation the traditional way of storing books on the bookshelf and physical copies are being replaced by digital versions or online sources. The main reason for this transformation is to keep up with the advancement in technology and to give users a better experience in the modern world keeping the libraries relevant in the increasingly modern digital world. Additionally, the world is moving towards sustainability, and public buildings, or spaces such as libraries are playing a crucial role in integrating the concept of sustainability as a design element. Eco-friendly designs, efficient waste management systems, local materials, and renewable energy sources are some of the important steps to achieve it.

Analytical Research

Library in the city

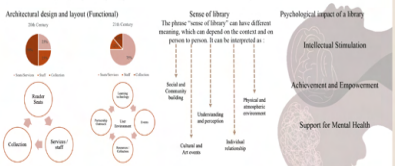
History of libraries and its elements



Libraries in the city have a long history, ranging from private collections to public institutions. They are classified into academic, public, and special libraries, with each providing a certain function and user group. Libraries have evolved into thriving community hubs, providing not only books but also a variety of educational and cultural resources, holding events, and giving technological access. Libraries have embraced technology in the age of digital transformation, offering e-books, digital archives, and online resources, proving crucial in bridging the digital divide and assuring access to information for all.

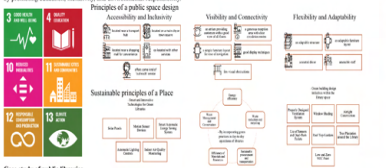
The librarysness of the library

A library's architectural design expresses the basic characteristics of a multipurpose place dedicated to the realms of information, culture, and intellectual research. The library has a great impact on the physical and mental well-being of its clients due to its structural arrangement, functional aspects, and the ambiance of its huge bookshelves covering long, venerable hallways. The library emits an ardent devotion to the quest of knowledge within its architectural limits, promoting a deeper connection with both the individual and society.



Public library embracing sustainable development principles

In the twenty-first century, public libraries are embracing sustainable development ideas, aligning with the United Nations' Sustainable Development Goals (SDGs). They serve as community hubs, promoting information access, social, economic, and environmental sustainability. Libraries provide materials on climate change, renewable energy, and responsible consumerism, enabling informed decision-making. They contribute to the UN's SDGs by promoting education, inclusivity, and environmental responsibility.



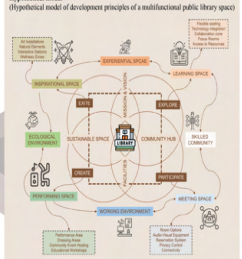
Case study of public libraries

As in previous chapter we discussed all the principle and rules of how a library can be more beneficial for the community, how it will help the people to connect, how it will help to achieve the sustainability. Keeping the above principle and rules an evaluation table was created which will be used to evaluate the public library development projects to case studies to get a better understanding of how the place works.

Aim:
To understand and guide development, the research project aims to analyze factors and theories related to public space development, solve and formulate sustainable principles, and incorporate contemporary and modern elements that will activate and create a vibrant and multifunctional library space (public library).

Tasks:
1) The aim is to investigate the significance of a library in the city by studying its history, typology, role as a center, and the digital revolution in the city.
2) It is important to understand the basic aspects, characteristics, and functions of a public library through its design, presence, influence, and knowledge.
3) To incorporate sustainability into various elements of public libraries by knowing its principles and the methods for better growth.
4) To understand the concepts and answers, undertake a case study on public library development initiatives.

Hypothetical model
(Hypothetical model of development principles of a multifunctional public library space)



Developed upon the information received from the research, principles, and case studies. To systemize the multifunctional public library creation process, a hypothetical model was developed. The hypothetical model starts with the four-factor model for library development where functionality is the key element. Following the criteria of Exite, Explore, Participate, and Create. Leading through the thought process of Mission and vision, Community hub, Facilities, and Sustainable spaces.

Principles		McArthur Public Library	Coromandel Community Library	Eilat Public Library	La Comer Regional Library	Stanley A. Milner Library
Built in environment	Architecture and design	27.5%	22.5%	22.5%	32.5%	33.5%
	Location					
	Accessibility					
Function	Library services	25%	29.5%	22.5%	25%	22.5%
	Community services					
Social attributes	Community engagement	32.5%	30%	37.5%	27.5%	33.5%
	Inclusivity					
	Educational support					
Sustainability	Energy efficiency	15%	20%	22.5%	15%	10.5%
	Green Spaces					

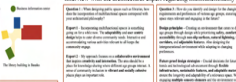
Public libraries are a vital part of the community, providing a platform for learning and community engagement. These institutions are committed to sustainability and to provide. Better space for the community. They offer a range of services, including programs, resources, and technologies, catering to the unique needs of their communities. These libraries not only serve as repositories of books but also promote the importance of sustainability in the community through the events and organisation of events.

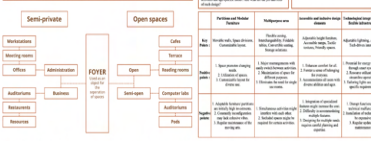
Emparical Research

Integration of multifunctional spaces in a public library can create a community hub and satisfy different age groups.
Integrating multifunctional spaces within the public library serves as a dynamic function, transforming the traditional notion of a library into a community hub. By embracing various functions, from study areas to interactive zones and event spaces, these libraries become inclusive environments catering to diverse age groups. Furthermore, these places frequently provide seminars, presentations, and meetings for adults, fostering lifelong learning and social contact.

Functional analysis

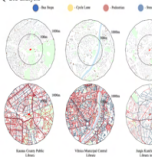
Interview with the architectural expert regarding multifunctionality



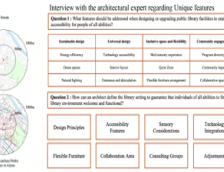


Equipping public libraries with unique features including those with disabilities, can improve accessibility and motivate people to come.
Enhancing the libraries with unique features for all individuals, including those with disabilities, not only improves community engagement but also encourages all types of people to come and get to know each other. Tools such as adjustable furniture, specialized software, and ramps can create an environment that is welcoming for everyone.

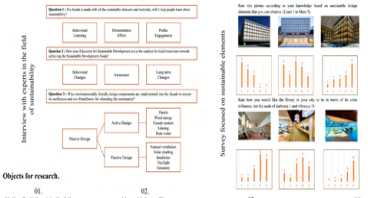
Q-GIS analysis



Interview with the architectural expert regarding Unique features



The sustainable facade of a space will contribute to the development of a sustainable and friendly community centre.
A sustainable facade not only serves as an aesthetic element but is the face of a conscientious design. According to the experts, a crafted facade plays a welcoming atmosphere while showing sustainable elements. The design involves eco-friendly materials and innovative technology reduces environmental impact while enhancing energy efficiency



Objects for research.

01. Les Halles Building Media Library and Multifunctional Spaces
02. Nassuhoburu City Library
03. Library Building in Bauska
04. Kaunas Country Public Library
05. Vilnius Municipal Central Library
06. Jurgis Kančinas Public Library in Alytus

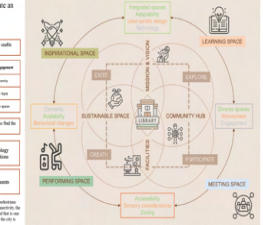
Aim
To understand the feasibility of developing public spaces and determining the public library development structure, an examination of the architectural and urban structure, its social viability, connectedness, and complexity must be carried out.

Task
1) To develop four working hypotheses from the analytical research's hypothetical model.
• Integrating multifunctional spaces in a public library can create a community hub and satisfy different age groups.
• Equipping public libraries with unique features, including those for those with disabilities, can improve accessibility and motivate people to come.
• The sustainable facade of the space will contribute to developing a sustainable and friendly community center.
• Community involvement can help to develop a better library that satisfies the needs and demands of society.
2) Objects and methods are chosen for empirical research to prove the working hypothesis.
3) From the information acquired, design a conceptual model of a public library that is relevant and fits human needs.

Empirical research program

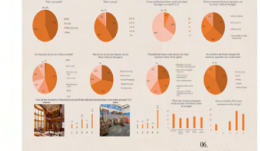
Number	Working Hypothesis	Object	Methods	Tools
01.	Integration of multifunctional spaces in a public library can create a community hub and satisfy different age groups.	Public library projects	Space analysis, Interview Data collection: Types of spaces, usage Qualitative structured survey	Sociotope Sand Art Interview
02.	Equipping public libraries with unique features including those with disabilities, can improve accessibility and motivate people to come.	Public library projects Specialists	Unsystematic observation Accessibility Mapping for Inclusive Interview with experts	Q-GIS Interview
03.	The sustainable facade of a space will contribute to the development of a sustainable and friendly community centre.	Analogs	Interview, Survey Observational thinking, Investigate attitudes, behaviour, and perceptions Visualizing the facade	Interview Survey
04.	Community involvement can help to develop a better library that satisfies the needs and demands of the society.	People leaving in Alytus	Sociological survey Questionnaire data	Survey form

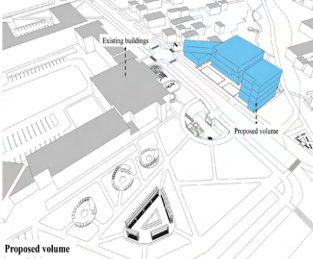
Conceptual model
(Conceptual model of development principles of a multifunctional public library space)

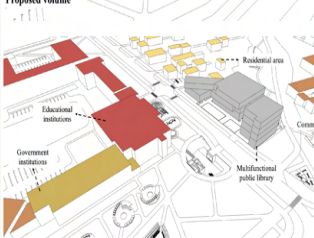


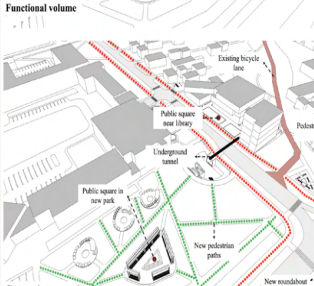
The conceptual model helps to understand the possibility of combining different activities and spaces which helps in the development of a multifunctional public library. However, based on four standards the best of a library is keeping sustainable standards in community hubs and library facilities combining the mission and vision of multifunctional public space.

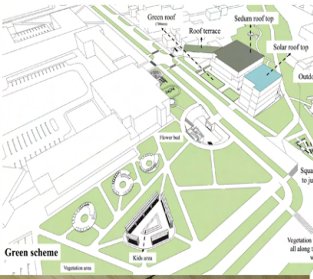
Community involvement can help to develop a better library that satisfies the needs and demands of society.
Sociological survey

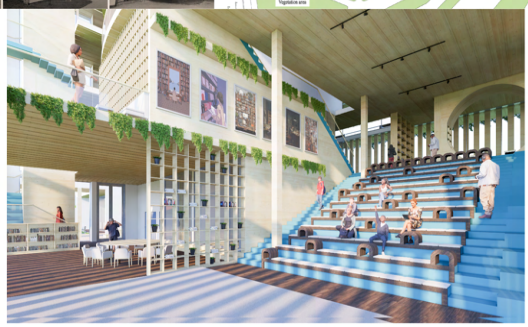












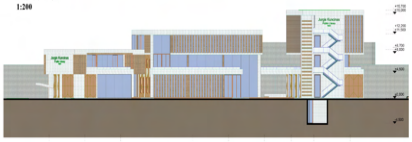
Site Plan calculator	
Plot area	2931m²
Underground Parking area	1236m²
Building area	1206m²
Total build area	5312m²
Density	40.14%
Intensity	181.23%

Site Plan Description	
Plot Boundary	
Building boundary (3m)	
Underground tunnel boundary	
Level marking	
Grass (flat surface)	
Grass (flat surface (-0.500))	
Grass (slope surface)	
Grass (planter boxes)	
Permeable pavements	
Tiles	
Entrance	

Site Explication	
Block A1	1
Block A2	2
Block B	3
Way to underground parking	4
(700 mm) raised green bed	5

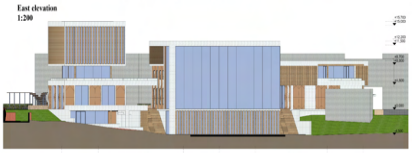
North elevation
1:200

West elevation
1:200



South elevation
1:200

East elevation
1:200

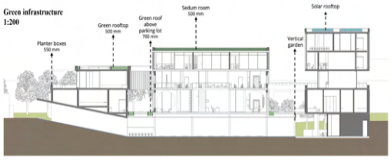


Block B section
1:200

Underground section
1:200

Block A2 section
1:200

Green infrastructure
1:200



Underground floor plan
1:200

Evaluation of the elaborated experimental design of the multifunctional public library

1)Experimental design based on the research:

Based on the conceptual model and 4 main criteria derived from it.

Comparison of what was conceptualized and what is achieved.

Criteria		Alternative 2	Experimental design
Mission and Vision	Integrated spaces	Yes	To achieve it, a circular flow of movement was developed within the building, making it accessible from all directions, which supports the idea of integrated spaces. Adaptability and user-centric design were achieved through the functions and placement of different zones carefully to create a centralized flow within the structure. Block A2's third floor, which houses all technologically equipped elements, satisfies the technology aspect's requirement.
	Adaptability	Yes	
	User-centric design	Yes	
	Technology	Yes	
Community Hub	Diverse spaces	Yes	The creation of diverse areas for all age groups, distinct sections for different genres of books, the incorporation of green elements within the interior space, a large glass facade that provides a clear view of the outdoor environment, a multifunctional room, and VR/AR rooms all contribute to the creation of diverse spaces, an attractive atmosphere, and the development of public engagement.
	Atmosphere	Yes	
	Engagement		
Facilities	Accessibility	Yes	Stairlifts, elevators, disabled washrooms, doors connecting different spaces, implementing technological sensory fixtures throughout the building, sensory lighting, and creating different zones all help to fulfill the criteria.
	Sensory considerations	Yes	
	Zoning	Yes	
Sustainable Spaces	Elements		Sustainable building materials, green infrastructure incorporation, large windows bringing natural sunlight, and window shades reduce the dependency on artificial lights. Connecting indoor and outdoor spaces facilitates behavioural changes in the space. The availability of solar panels again helps reduce dependency on natural resources and reduces carbon footprints.
	Availability	Yes	
	Behavioral changes	Yes	

Based on principles and rules on how a library can be more multifunctional and usable.

Comparing principles and rules from the concept to experimental design.

Alternative 02.

Principles		Rating (1-5)	Total (47)	Percentage %
Built in environment	Architecture and design	4	14	30 %
	Location	5		
	Accessibility	5		
Function	Library services	5	10	21 %
	Community services	5		
Social attributes	Community engagement	5	15	32 %
	Inclusivity	5		
	Educational support	5		
Sustainability	Energy efficiency	4	8	17 %
	Green Spaces	4		

Experimental Design

Principles		Implementations
Built in environment	Architecture and design	Vibrant, contemporary, modern
	Location	Surrounded by public building, Sakura park
	Accessibility	New connection, Bicycle lanes, Circular flow
Function	Library services	Developing 5 zones catering to different services
	Community services	Information services, Events and programs, Technology access, Exhibitions, Multifunctional spaces
Social attributes	Community engagement	
	Inclusivity	Physical accessibility, Diverse collection, Multilingual services, Safe and inclusive environment, Affordable access
	Educational support	
Sustainability	Energy efficiency	Green roofs, Sedum roof, Local material, Solar panels, Access to sunlight
	Green Spaces	

While moving from the initial idea to the experimental design in the physical environment, several important variables, such as utility, social integration, and sustainability, play a crucial role in leading the transition into the design phase. The design adopts a minimalist and modern approach to maximize spatial use, intelligently allocating functional zones according to their demands and usability. This planned organization promotes inclusiveness by guaranteeing that library services are accessible to various age groups and communities, fostering participation in communal activities and events. By incorporating sustainable features into its construction, the design not only meets energy needs but also promotes environmentally friendly infrastructure, supporting larger environmental goals.

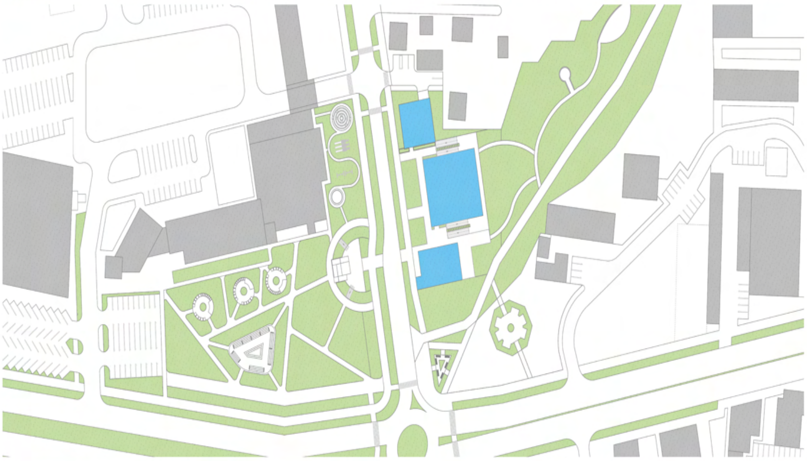
Essentially, this experimental design highlights the significant sociological influence of libraries as centers for community involvement and educational assistance. Through the availability of information and resources, the library plays a crucial role in promoting social cohesiveness and empowering individuals. By strategically using design concepts and sustainability measures, the planned library not only fulfills the current requirements of its users but also establishes a strong community.

As discussed during the research, achieving these six Sustainable Development Goals (SDGs) is crucial for developing a multifunctional public library. Therefore, during the experimental design, the goals were considered in terms of zoning and allocating the functions within the building.

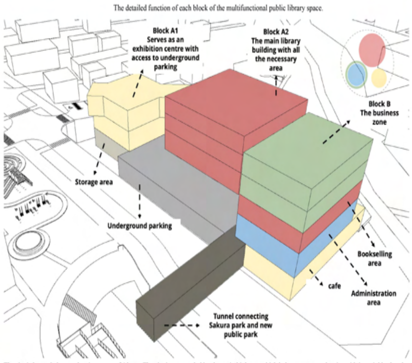
- **Goal 3:** This goal talks about health and well-being, connecting it with the library, which hosts workshops, seminars, events focused on health education, access to a health care database, and so on. To accommodate this design, it includes specific sections, gathering spots, separate rooms, and so on.
- **Goal 4:** The whole idea of the experiment is to motivate people to come to the library which helps individuals to connect with the community and attend events that connect to good education. Libraries encourage children, young people, and adults to read and learn lifelong.
- **Goal 10:** Being a public library, it allows all people to access its free services that are available to all. The interconnected, simple, and open floor plan helps to make the available resources more accessible, which helps to remove the obstacles for the people.
- **Goals 11 and 13:** As both the goals talk about sustainability and climate action, the design incorporates green infrastructure with locally sourced materials, solar rooftops, access to natural sunlight, a green roof, etc.
- **Goal 12:** This goal focuses on consumption, and libraries are considered pioneers in it. Creating co-working spaces, multifunctional spaces, computerized spaces, and rented business conference rooms contribute to the creation of a circular economy, thereby reducing the need for separate consumption.

The experimental design proved that it could bring a change in the neighborhood by the development of this design.

- Helps to create a smooth flow within the neighborhood connecting different spaces without disturbing the existing movements.
- Extending the Sakura Park on the opposite side of the allocated plot helps to increase the existing park and its importance, creating more outdoor and public space where the neighborhood can relax and enjoy. This extension also contributes to enhancing public mobility and ensuring the neighborhood remains safe from insecurity.
- Implementing locally sourced materials and integrating green infrastructure helps the community understand the importance of sustainability, proving Hypothesis 3.
- An increase in neighborhood accessibility by developing more bicycle lanes, underground tunnels, new paths connecting different buildings, and lastly, constructing a roundabout near the crossing helps to decrease traffic and make vehicular movement fast.
- Social considerations play a crucial role in organizing and creating different environments that serve several functions to enhance people's choices and opportunities for social interaction.
- and development incorporates recreational space to fulfill the needs of the local population and enhance the architectural concept.



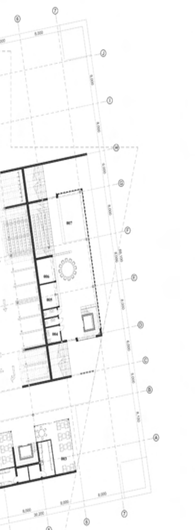
The detailed function of each block of the multifunctional public library space.



The site is located close to the city center of Alytus. The site is surrounded by the main highway which helps to connect the city with its neighborhood, gymnasiums, schools, etc. Also, the site is situated close to the famous Sakura Park which is one of the most attractive sites in the Alytus.

Furthermore, the surrounding area is quite developed and needs to be recognized and reorganized to increase its efficiency. The allocated site is an existing parking lot area that has the possibility of extension towards Tvirtoves g. 12 and g. 8. The extension will serve the purpose of this experimental design, which will be beneficial for the surroundings and the cityscape. This extension has increased the total plot area from 320 m2 to 2931 m2.

According to the Alytus master plan, the territory is designated for the development of a public structure. Additionally, the development area is limited to a maximum height of 15 meters within the regulations, and 12 meters within the surrounding buildings to ensure compliance.



Underground floor area

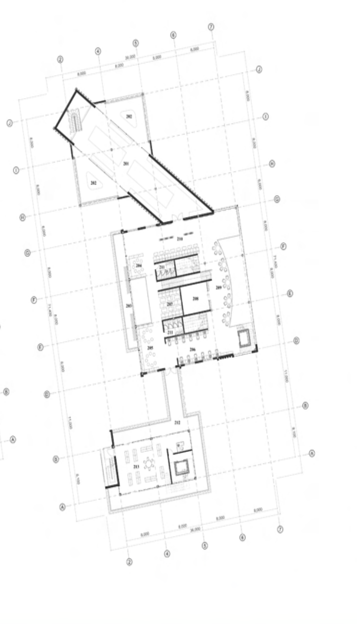
	Title	Area
001	Storage	141.7 m²
002	Cafe 1	120.4 m²
003	Cafe 2	16.3 m²
004	WC	14.5 m²
005	Pod 1	102.3 m²
006	Pod 2	49.5 m²
007	Amphitheater	158.6 m²
Total parking space		938.8 m²
Total Corridores		326.3 m²

First floor area (A1,A2.B)

	Title	Area
101	Gallery	136.7 m²
102	Reception	45.4 m²
103	WC	23.5 m²
104	Reception	29.6 m²
105	Reading zone 1	65.5 m²
106	Reading zone 2	49.5 m²
107	Amphitheater	158.6 m²
108	WC	48.8 m²
109	Sitting zone	24.8 m²
110	Office 1	13.9 m²
111	Office 2	9.2 m²
112	Office 3	10.4 m²
113	Staff sitting	18.5 m²
114	WC	9.0 m²
115	Office 3	12.8 m²
116	Office 4	7.3 m²
117	Office 5	8.8 m²
118	Office 6	8.2 m²
119	Service zone	28.4 m²
120	Lounge	44.0 m²
Total outdoor space		664.2 m²
Total Corridores		246.4 m²

First floor plan
1:200

Second floor plan
1:200



Second floor area (A1,A2,B)

	Title	Area
201	Gallery	230.2 m²
202	Terrace A1	101.1 m²
203	Terrace A2	38.8 m²
204	Kids reading 1	13.2 m²
205	Kids reading 2	26.6 m²
206	Computer area	43.4 m²
207	Teen reading	21.6 m²
208	Game room	27.0 m²
209	Sitting	52.7 m²
210	Display zone	71.5 m²
211	WC	22.4 m²
212	Terrace B	126.3 m²
213	Selling area	99.3 m²
Total Corridores		138.8 m²

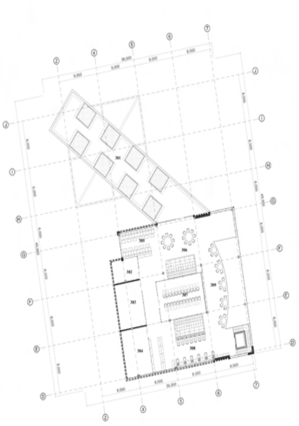
Third floor plan (Block B)

	Title	Area
310	Co-working space	140.8 m²
311	Cabin	48.2 m²
312	WC	20.0 m²
313	Terrace	14.2 m²
Total Corridores		22.4 m²

Fourth floor plan (Block B)

	Title	Area
401	Conference room 1	56.6 m²
402	Conference room 2	110.3 m²
403	Terrace 1	9.2 m²
404	Terrace 2	14.2 m²
405	WC	20.0 m²
Total Corridores		32.4 m²

Third floor plan (Block A1,A2)
1:200



Third floor area (A1,A2)

	Title	Area
301	Roof garden	230.2 m²
302	Digital area	20.2 m²
303	AR/VR	40.8 m²
304	Workspace	40.8 m²
305	Reading zone 1	31.6 m²
306	Reading zone 2	24.5 m²
307	Multifunctional zone	64.6 m²
308	Computer area	39.0 m²
309	Sitting	52.7 m²
Total Corridores		88.8 m²

Third floor plan (Block B)
1:200

Fourth floor plan (Block B)
1:200