

**NATIONAL LIBRARY OF G20 COUNTRIES: A
COMPARATIVE STUDY WITH THEIR PRESENCE IN
SOCIAL MEDIA PLATFORMS**

Thesis submitted to the Faculty of Arts of Jadavpur University in partial fulfillment of the requirement for the Degree of Doctor of Philosophy in Library and Information Science

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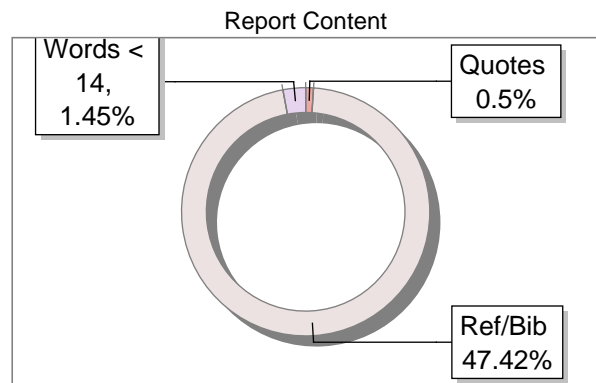
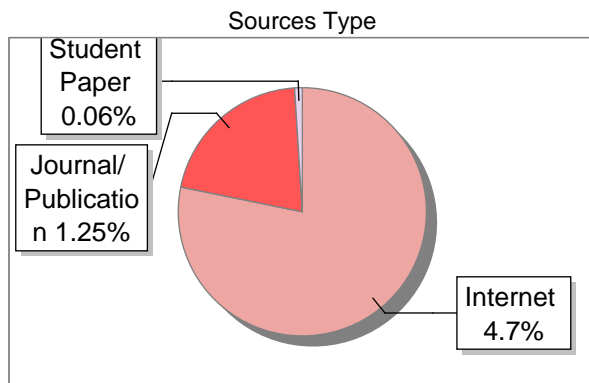
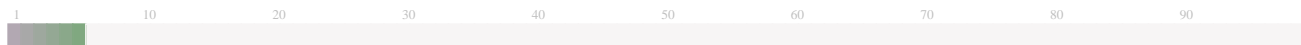
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Chaitali Ghosh

(Signature)

Date:

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List of Abbreviation

G20	Group of 20
TOPSIS	Technique for Order of Preference by Similarity to Ideal Solution
MCDM	Multi-criteria Decision Making Model
CENL	Conference of European National Librarians
ISO	International Organization for Standardization
IFLA	International Federation of Library Associations and Institutions
LOC	Library of Congress
USA	United States of America
UK	United Kingdom

Preface

In the digital era, libraries serve not only as repositories of knowledge but also as dynamic institution adapting to digital landscape. National Library is a custodian of cultural heritage, helping instrument of educational advancement, reflection of nation's intellectual and social priorities. With the evolution of technology and widespread adoption of social media, these institutions are now navigating new paths to remain accessible, relevant and engaging in virtual world.

This study titles "*National Library of G20 Countries: A Comparative Study with their presence in social media platforms*" is an effort to bridge the understanding between traditional library performance metrics and modern digital engagement. It evaluates and ranks the National Libraries of G20 countries using TOPSIS method, based on ISO 11620:2023, ISO 2789:2022, and ISO 21248:2019 prioritizing by IFLA Global Vision and Strategy Outline.

However, this research extends beyond conventional benchmarks. It explores how these National Libraries performing on social media named Facebook, twitter (X), Instagram and Youtube and investigates the relationship between online presence, traditional activities and user satisfaction.

The G20 countries represent both developed and developing countries, chosen as per economic diversity. This study aims to highlight disparities, trends, and best practices that can inform future strategies for National Libraries across G20 countries.

The study is intended to contribute to the ongoing discourse on the transformation of National Libraries in 21st century. It aims to guide library professional, policy maker, researchers, students and users to understand the challenges and opportunities. This research highlights the importance of traditional library service with innovative digital strategies.

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Abstract

NATIONAL LIBRARY OF G20 COUNTRIES: A COMPARATIVE STUDY WITH THEIR PRESENCE IN SOCIAL MEDIA PLATFORMS

Chaitali Ghosh

This study is a comparison of National Library of G20 countries. The main objectives of the study are to know the status of National Library of G20 countries and their presence in social media platforms and the comparison of performance of National Libraries of economic developed and developing countries by Technique for Order of Preference by Similarity to Ideal Solution and social media performance and activeness. Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method is used for analyzing taking 5 parameters mentioned in CENL Report presented in the Conference on European National Library based on ISO11620-2023, ISO 2789-2022 and ISO21248-2019 parameters and prioritizing on the basis of IFLA Global Vision and Strategy Outline. On other hand, the activeness of National Library in social media is also presented in this study. Engagement, followers count, posting frequency of National Library in each social media platform, platform specific comparison, cross-regional comparison and comparison on economic developed and developing country are also analyzed here. Data are collected from their own website, social media, literature review, tripadvisor, google review and through different tool i.e. socialInsider. Data have been analysed by multicriteria decision making model, correlation and different graphical representation. The analysis using the TOPSIS method makes rank the Library of Congress, The British Library, and Bibliothèque Nationale de France as the top three national libraries based on performance indicators like collection size, budget, staff, time and space. User satisfaction rankings

reveals discrepancies, indicating that traditional metrics does not always align with user satisfaction, as seen in the low satisfaction for Bibliothèque Nationale de France despite 3rd in TOPSIS rank. Social media analysis shows that Facebook has strong correlations between engagement and follower count, YouTube is the only platform where post frequency and engagement are positively correlated. Instagram of National Libraries is more engaged platform and Twitter is more used platform. North American libraries lead in higher user engagement as well as higher TOPSIS (Pi) scores implies more digital outreach with institutional quality. National Libraries of economic developed countries average Pi score, average engagement and average followers count are higher than the economic developing countries but National Libraries of economic developing countries posted more than National Library of economic developed countries. User satisfaction range is wider for National Library of developed country than the developing countries. It indicates that activeness in social media and higher satisfaction rate of users proves that National Library of developing countries is trying to make users satisfy with their minimal capacity.

Keywords: National Libraries, Social Media Performance, User Engagement, TOPSIS analysis, User Satisfaction, Economic Developed and Developing Countries

Chapter 1: Introduction

1.1 Introduction

"Library" means "storehouse of knowledge" or "a collection of books for study, research, reference and recreation". It is probably derived from a Latin word 'liber' which means 'a book'. The definition of the library has changed functions over time with the change in its features and functions. A dictionary abc-clio defines "A collection or group of collections of books and/or other print or non-print materials organized and maintained for use (reading, consultation, study, research, etc.)". The Oxford Dictionary defines library as "a building or room containing collections of books, periodicals, and sometimes films and recorded music for using or borrowing by the public or the members of an institution". The Merriam-Webster's Dictionary defines it as "a place in which literary, musical, artistic, or reference materials (as books, manuscripts, recordings, or films) are kept for use but not for sale". The Oxford Companion to the English Language says that the "library is a collection of books, periodicals and/or other materials, primarily written and printed".

The National Library is a custodian of culture and knowledge. It works as a repository of knowledge, preserving and providing access of wider resources, including books, manuscripts, periodicals, maps, photographs, and digital materials. The National Library holds a special place in society, embodying the collective memory and intellectual heritage of a nation. The primary role of a national library is to acquire, organize, and preserve the nation's literature, including books, manuscripts, periodicals, newspapers, government publications, maps, audiovisual materials, and digital resources. It focuses on

materials produced within the country, but it may also collect important resources from other countries that are relevant to the nation's history and culture. National libraries play an important role in preserving and safeguarding the intellectual heritage of a country for future generations. They ensure the longevity and accessibility of important works, making it available to researchers, scholars, students, and the general public. National libraries have extensive cataloging and archiving systems in place to ensure proper organization and retrieval of materials. Additionally, preservation and access, national libraries provide numerous services to support research, education, and cultural development. These services include reference services, interlibrary loan services, digital libraries, online databases, exhibitions and public outreach initiatives. National libraries also engage in digitization projects to make rare and valuable materials available online, expanding access beyond the library space. National libraries serve as national institutions, supported by government funding and governed by legislation or a dedicated governing body. They may share resources, promote research, and preserve the national heritage collectively with other libraries, museums, archives, and cultural institutions. The importance of a national library goes expands world-wide. It acts as a cultural symbol and source of national pride, reflecting a country's commitment to intellectual development, education, and the preservation of its cultural identity. By safeguarding and promoting access to knowledge, a national library plays an important role in fostering a well-informed and engaged society.

G20 is a group of 20 countries based on world major economies and countries has financial stability. Countries include United Kingdom (UK), United States, Australia, France, Argentina, Brazil, Canada, China, India, Germany, Japan, Italy, Mexico,

Indonesia, Russia, South Korea, Turkey, Saudi Arabia, and South Africa. National Libraries of Group of 20 Countries is famous as well. The study has been analysed the condition of national libraries of group of 20 countries taking parameters given by Conference of European National Library (CENL) and make ranking only taking 5 quantitative parameters. The national library is national heritage of country. The G20 group consists of the world's major economies, representing a significant portion of global economic activity, technological advancements, and cultural richness. The National Libraries supports preservation and dissemination. However, with the development of digital technologies and the growing effect of social media, the traditional functions of National Libraries have evolved. Libraries use social media platforms to enhance user engagement, increase accessibility, and disseminate information beyond physical spaces. The assessment of their performance on social media is, therefore, an important aspect of their overall effectiveness in the modern digital landscape.

The condition of national library indicates the present condition of nations. National library contributes for society, for country. Many of members are visited national libraries for educational, cultural and informational needs. The top ranking libraries affects the users visit or not, top ranking libraries contributions in social platforms and user engagement rate have been analyzed in this study. Correlation of user engagement rate in social media platform and users visit directly in the library has been discovered.

The aim of this study compares the national libraries of the G20 nations. Finding out about the G20 countries' National Library status and social media presence is the study's

primary goal. The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is a technique, is employed for decision making. This study employs the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method to analyze the status of National Libraries based on five key parameters. These parameters have been gathered from the Conference of European National Librarians (CENL) Report, depend on the ISO 11620:2023, ISO 2789:2022, and ISO 21248:2019 prioritizing by IFLA Global Vision and Strategy Outline and ranked the National Libraries of G20 countries based on these established metrics and assessed their overall standing in terms of traditional library performance indicators.

In addition to analyzing traditional library metrics, this study also examines the social media presence of National Libraries. The activeness of libraries on social media platforms, engagement levels, followers count, and platform-specific performances have been assessed. Furthermore, cross-regional comparisons, comparison of developed and developing countries are made to understand how different National Libraries utilize social media for user interaction and digital outreach. The study evaluates the correlation between TOPSIS ranking (based on traditional metrics) and user satisfaction ranking, revealing a slight positive correlation. Additionally, the relationship between TOPSIS ranking and user engagement on social media shows a moderate correlation, while user satisfaction and social media engagement exhibit nearly zero correlation. These findings suggest that traditional library metrics influence user engagement and satisfaction to some extent, user satisfaction does not indicate higher engagement on social media. The result of the study explores that Youtube is the only platform having strong relationship between post per day and engagement per post and followers. In total, Users are more

engaged in Instagram than others social media platforms of National Libraries. Post frequency is high in twitter.

The study ends with conclusions that the role of traditional library metrics in determining user engagement and satisfaction. It highlights the evolving role of National Libraries in social media. The study also compares the condition of National Libraries in economic developed and developing countries. This research aims to contribute to the broader discourse on the transformation of National Libraries and their relevance in an increasingly digital world.

1.2 Background of the Study

The National Library acts as a cultural hub and represents a nation. This study deals with the National Library of G20 countries. It is a permanent repository body of all countries. The study represents the status of national library and their activeness in social media and popularity in social media with satisfaction of original readers of national library. It develops comparative study of cross-regional status of National Libraries on traditional metrics, user satisfaction rate, social media activeness and engagement. It also explores the comparative study of economic developed and developing countries in respect of traditional metrics, social media analytics.

1.3 Statement of the Problem

Comparative Study of National Libraries of G20 Countries and their performance in social media platform.

1.4 Research Objectives

The study involves in measuring the National Libraries performance of G20 countries and making analysis of all. The objectives of study are evaluated the status of National Libraries in G20 countries. The objectives of study are as follows-

Traditional Rank and User Satisfaction metrics

- To evaluate the traditional rank of national libraries using TOPSIS analysis and compare it with user satisfaction rankings, identifying whether traditional performance metrics correlates with user satisfaction.

Platform-Specific Comparison:

- To analyze platform-specific engagement by identifying which social media platform (Facebook, Twitter, Instagram, or YouTube) shows the strongest correlation between post frequency, engagement per post, and follower count, and to identify the most engaging and widely used platforms.

Engagement Specific Comparison:

- To assess the relationship between social media engagement and traditional performance indicators, user satisfaction, and posting frequency, determining which national libraries rank highest in engagement.

Performance of National Library in Social Media

- To identify the posting behavior of national libraries, evaluating whether higher traditional performance (Pi) correlates with increased posting frequency and identifying libraries with the highest activity.

Cross Region Analysis

- To investigate regional differences in social media engagement and posting trends among national libraries, highlighting variations in strategy and effectiveness across geographic areas.

Comparison of Economic Developed and Developing Country

- To compare economic developed and developing countries with their national libraries' performance index (Pi), average social media post frequency, engagement levels, follower counts identifying disparities and trends.

1.5 Scope and Coverage of Research

This research focuses evaluating National Libraries of G20 countries. Parameters are set on the basis of a paper presented in the Conference on European National Library. TOPSIS method are used to rank the National Library 5 quantitative parameters selected by IFLA global vision and strategy outline. The TOPSIS ranking here is referred to as traditional metrics in the study because it evaluates national libraries based on well-established parameters based on ISO11620-2023, ISO 2789-2022 and ISO21248-2019. It also analysed their engagement in the social media platform.

1.6 Limitation

Some parameters on CENL report are not being able to consider because of non-availability of data. Facebook, X, Instagram and Youtube, these four important social medias have been taken for this study. National Library of China does not use any social media. They use their own social media and that is totally restricted. So only traditional metrics is done on the available data from the website of National Library of China. There are more than one National Library having national importance for National Library of Italy and National Library of European Union. So National Library of Italy and National Library of European Union are not considered for the study.

1.7 Research Questions

Traditional Rank and User Satisfaction metrics

- What is the rank of National Library of G20 Countries on the basis of TOPSIS (traditional metrics)?
- What is user satisfaction rank of these National Libraries?
- Is there a significant correlation between traditional metrics and user satisfaction rank?
- Which National Library ranks highest as per traditional metrics?
- Which National Library ranked highest as per user satisfaction rate?

Platform-Specific Comparison:

- Which social media platform (Facebook, Twitter, Instagram, YouTube) shows strongest relationship between post per day and engagement per post?
- Which social media platform shows strongest relationship between engagement per post and followers?

- Which social media used for more engagement?
- Which social media are used more?
- Which social media is used for more post or frequently used??

Engagement Specific Comparison:

- Which National Library's engagement rank is high?
- Whether social media engagement correlates with traditional metrics?
- Whether social media engagement correlates with user satisfaction rank?
- Whether social media engagement correlates with posting frequency?

Performance of National Library in social media

- Whether high Pi leads National Library to high posting frequency?
- Which National Library's post frequency is high?
- Does the frequency of posting impact engagement rates across different platforms?
- Which social media are used more by post?

Cross Region Analysis

- What is the differences show in Pi score of different region?
- What are the regional differences of engagement per day in social media?
- What is the regional trend of post per day?
- Which library is more active and more engaged in social media?

Comparison of Economic Developed and Developing Country

- What is the difference identified on Pi for economic developed and developing countries?
- What is the difference identified on average post frequency, engagement and follower's count?
- Where is the difference identified on user satisfaction perspective of National Library of G20 countries?

1.8 Research Methodology

Five parameters are taken up for ranking based on IFLA Global Vision and Strategy outline. All National Libraries in world follows same standard and giving same services followed by International Standard of National Library. Services are being assessed by taking user satisfaction rate. 5 quantitative important parameters based on mentioned in ISO11620-2023, ISO 2789-2022 and ISO21248-2019 available in website of National Libraries. Rank is done based on Pi score of TOPSIS. These parameters are being considered for the study mentioned below:

Parameter	Type	Method Used
Working Hours	Operational Parameter	TOPSIS Analysis
Collection	Resource Parameter	
Budget	Financial Parameter	
Staff	Human Resource Parameter	
Library Space	Infrastructure Parameter	

Then TOPSIS method has been applied on these criteria. TOPSIS is a multi-criteria decision-making (MCDM) method used to rank and select from a set of alternatives based on their closeness to an ideal solution. Developed by Hwang and Yoon in 1981, TOPSIS is grounded in the principle that the chosen alternative should have the shortest distance from the ideal solution and the farthest distance from the negative ideal solution (Hwang & Yoon, 1981).

Service is an important factor to assess the quality of the library. National Library is not an exception. To assess the quality, the user-satisfaction rate has been taken up. Percentage of positive review has been considered for the ranking.

In addition to traditional performance metrics and assessment of user satisfaction rate, the study also examines social media of National Library by analyzing followers count, engagement and posting frequency on social medias like facebook, twitter, Instagram, Youtube. The following methods are used:

Category	Method Used
Post, Like, Share, Comment	Social Insider
Engagement	Like+Comment+Share

To identify relationship between various performance indicators and social media engagement, correlation like Spearman and Pearson correlation methods have been used.

The following correlations are examined:

Category	Tool/ Method Used
TOPSIS Rank with User Satisfaction Rank	Correlation (Spearman Rank Correlation)
User Engagement Per Post with TOPSIS Rank	Correlation (Spearman Rank Correlation)
User Engagement Per Post and TOPSIS Rank	Correlation (Spearman Rank Correlation)
Social Media Post Per Day and Engagement Per Post	Correlation (Spearman Correlation)
TOPSIS with Post Per Day	Correlation (Spearman Rank Correlation)
Platform Specific Correlation	Correlation (Pearson)
For Correlation	Python in Google Colab

Chapters of the study

Chapter 1 – Introduction: This chapter sets the outline for entire research study. It introduces the topic, states the problem or research questions, explains the significance of the research and sets objectives. It may also provide the overview of study.

Chapter 2 -Literature Review: This chapter reviews existing research, theories, and publications relevant to the study. It provides context by summarizing already known

knowledge, identifying gaps in knowledge and justifying need for the current research. It helps to build research methodology and foundation of study.

Chapter 3 –National Libraries of G20 Countries: This chapter describes the National Libraries of G20 countries. It may cover their history, functions, organizational structure, services, digital contribution and history.

Chapter 4- Research Methodology: This chapter explains how the research is conducted. It describes the research design, methods of data collection, tools used and analysis procedures.

Chapter 5-Data Analysis and Interpretation: The Chapter presents the collected data and analyzes it to answer the questions. It includes statistical or qualitative analysis, charts, tables and graphs.

Chapter 6 – Findings, Conclusions, and Suggestions: This final chapter summarizes the key findings from the data analysis and discusses their implications. It also provides important practical suggestions for future research.

1.9 Significance

G20 countries (Group of 20 Countries) composed of economically developed and developing countries. Financial stability indicates overall development of countries. So only G20 countries' national libraries have been taken for this research. Comparison of National Library has been done taking the set-up parameters discussed in a European conference. This study may be helping students, researchers to find out the situation of national libraries of developing countries and the engagement of users in social media.

The study evaluates the role of National Libraries by analyzing both traditional library performance metrics and modern digital engagement strategies. While traditional performance indicators influence user engagement to some extent, the study finds that user satisfaction does not necessarily translate into higher social media engagement. This research highlights the need for National Libraries to make a balance between maintaining high-quality traditional services and also enhancing their digital outreach strategies to remain relevant in the digital era. It also highlights the diversities of traditional and digital performances of National Libraries of economic developed and developing countries.

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Chapter 2: Literature Review

2.1 Introduction

Literature review is a critical analysis of literatures on specific topic which are already exists. It helps to identify the gaps of existing literature. It is a state of art report. Review of Literature serves as several purpose within academic and research contexts like contextualization, identification of gap, critical evaluation, and synthesis of information. It is a common component of article, academic papers, dissertation and theses. It requires systematic approach of searching, selecting and evaluating sources of information on a particular topic and presenting it in organized manner. Primary and secondary publications both print and electronic are referred to as literature published in a variety of formats, including books, journal articles, conference and seminar proceedings, encyclopedias, theses and dissertations, and full-text and abstracted bibliographic databases, websites, etc. A critical synthesis of the current state of knowledge on a particular topic or issue, as well as a critical study of data and literature on a topic or subject presented in its broader format, are also referred to as reviews. A survey of all the writing that has been done on a specific subject or in opposition to a theory or research issue is called a literature review. It may serve as the foundation for larger-scale research in the future. A well-written literature review can combine data from several documents in continuous way.

2.2 Review of Literature

- National Library
- Social Media Performance

- Social Media Engagement
- TOPSIS analysis

National Library

Uraon, Amit & Sinha, Manoj (2019) presented in their paper National Library as an apex body of India, reflected the society's economy, education, policy, religion and others. National Library is a reflection of society. ICT (Information Communication Technology) is used extensively for the users of National Library in India. Though the growth of National Library is upward rising,

Hebbeln (1971) said during his work on Library of Congress, National Libraries of Scandanavia, Kungliga Biblioteket in Stockholm, National Library of Sweden and Det Kongelige Bibliotek i.e. National Library of Denmark that development of all libraries in Scandanavia had been slower than the National Libraries of United States. He also mentioned that National Agriculture Library, National Library of medicine and Library of Congress bears national importance of United States. Again Chowdhury (2021) researched on comparative study of National Libraries. She had mainly taken the developing countries National libraries. Chowdhury (2021) studied on national libraries of Brazil, Russia, India, China and South Africa taking parameters of web 2.0, applicability, virtual reference services, website covering language, visitors service, number of Institutional repository and software used. She concluded that National Library of Brazil, Russia and India are more progressive than the National Library of China and South Africa. Not only the ICT, the website is also important for making the National Library famous. Pisanski, J., & Žumer, M. (2005) analysed websites of national

libraries in Europe. He found that economically developed countries' national libraries websites were better than the underdeveloped countries' national libraries. As per the study, he pointed out National Libraries of Southern and Eastern European Countries are slightly worse. Negi, D. S. (2022) studied on web impact factors. He analysed web impact factor of 3 National Libraries which are Library of Congress, British Library, and National Library of India. The research paper analysed many parameters of web impact factors like domain of websites, domain age, external links, and internal links. The study concluded that Library of Congress had more links, more webpages, and web impact factors than others. Library of Congress ranked highest. Onyancha, O. B. (2012) in his study said that National Libraries of Africa had no own website. But most of the National Libraries used Alexa and AltaVista search engine. Khan, D. N. M., & Shehzad, F. (2017) evaluated 5 national libraries which are Bangladesh, India, Iran, Pakistan and Srilanka. 35 parameters were taken mentioned by IFLA for his study. He concluded that National Library of Singapore ranked 1st whereas Bangladesh ranked last. Hassanzadeh, E., Osareh, F., & Khosravi, F. (2022) tried to establish performance indicators for national libraries worldwide, drawing from leading institutions and expert opinions via the Fuzzy Delphi Method (FDM). It utilized both qualitative and quantitative methods, gathering data from prominent national libraries. A comprehensive checklist covering 192 indicators across 11 dimensions was validated by experts, resulting in the identification of 32 pivotal indicators. These findings enable effective performance assessment, resource allocation, strategic planning, and upholding of library standards. Embracing these indicators could be optimized operations and drive sustainable growth for national libraries. National Library had assessed by many ways and many parameters. But main

point of National Library is that National Library is a custodian of knowledge. Kim, S., & Cha, M. (2021) said that the National Library of Korea had the responsibility of gathering and safeguarding the country's knowledge, data, and cultural legacy. He also studied to create performance indicators as a logical tool for better management of the National Library of Korea in order to support the institution's ongoing expansion. The Balanced Scorecard (BSC) made by him serving as the foundation for the performance indicators, which were helpful in connecting the organization's strategies to changes in the library environment with performance measurement.

Social Media Engagement

In this digital era, social media is important factors for digital outreach. Users of National Library can get aware by a post in social media. Posting leads audience active. Beng (2020) worked on social media. He said that social media sites like Facebook, Twitter, Instagram had become popular tools making relationship between company and customers. Company made analysis their audience by like, comments, share, retweets. This study analysed the ultimate engagement rate impacts their purchase behaviour or not. The findings explored that there was a significant effect on customer online engagement. User engagement is very important not only for the Company, for any Institution also. Now in India, Ministry of Culture also emphasized on the social media post to aware the users about any information and it helps to enhance community service. Dolan (2016) in his study found that a low engagement among the users in facebook pages might affect the sales. He took Facebook Insight tool for analysis. This paper highlighted the needs of understanding social media strategy and customer engagement characteristic.

Social Media Performance

Posting frequency is also important for social media to make engage users. Rahman, Z., Suberamanian, K., Zanuddin, H., Moghavvemi, S., & Nasir, M. H. N. M. (2016) said in their study that social media was a communication tool connects world by one click. Marketing scheme of corporate house was to manage engagement rate by increasing post frequency. They analyzed on 1834 post from 17 brands of Electrical Companies for the period of 9 months. They used Cross Sectional Data Analysis by Least Square Method. Moro, S., Rita, P., & Vala, B. (2016) modeled performance metrics of social media and developed life time consumer model by different features like category, total likes, month, hour, weekday, paid.

TOPSIS Analysis

TOPSIS is multicriteria decision making model. It is used when there are multiple riterias but no perfect solution. It a decision making model. One can choose one ideal solution using multiple criterias. Deng, H, Yeh, CH& Willis, R.J(2000) studied on inter-company comparison process using multi-criteria analysis model, TOPSIS for solving the problem. The modified TOPSIS indicated that the performance difference between companies on each financial ratio. As a result, the comparison process was conducted on a commonly accepted basis and was independent of subjective preferences of various stakeholders. Lastly, it helped to choose best one. Lai, Y. J., Liu, T. Y., & Hwang, C. L. (1994) in their study used TOPSIS to solve a multiple objective decision making problem. The principle of compromise (of TOPSIS) for multiple criteria decision making is that the chosen solution should have the shortest distance from the positive ideal

solution as well as the longest distance from the negative ideal solution. TOPSIS helped to take positive solution from different opportunity. Yong, D. (2006) selected a new TOPSIS approach for selecting plant location under linguistic environments was presented, where the ratings of various alternative locations under various criteria, and the weights of various criteria were assessed in linguistic terms represented by fuzzy numbers. To avoid complicated fuzzy arithmetic operations, the linguistic variables, which were represented by triangular fuzzy numbers, were transformed into crisp numbers based on graded mean representation. The canonical representation of multiplication operations on triangular fuzzy numbers was used to obtain the “positive ideal solution” and the “negative ideal solution”. The closeness efficient was defined to determine the ranking order of all alternatives by calculating the distance to both the “positive-ideal solution” and the “negative-ideal solution” simultaneously. Compared with existing fuzzy TOPSIS methods, the proposed method could deal with group decision-making problems in a more efficient manner. A numerical example of plant location selection was used to illustrate the efficiency of the proposed method. This TOPSIS method was used in Library by Hsieh, L., Chin, J. and Wu, M. in the year 2006. Hsieh, L., Chin, J. and Wu, M. (2006) evaluated 6 libraries’ performance in Taiwan. The Delphi method was used here for summarizing opinion of experts in completing construction of performance evaluation indicators for e-library. Analytic Hierarchy Process was used to illustrate the problem and combine the two to establish the hierarchy structure for performance evaluation of research. The indicator’s weight was combined for Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to find out the multi criteria evaluation method for ranking and making decision.

2.3 Conclusions

National Library is a cultural heritage and as library it is also followed Ranganathan's 5th law i.e. Library is a growing organism. National library grows as well. Development of National Library does not only depend on physical parameters. Digital parameters, web impact factors, ICT is very important tool as per literature review. Currently, social media performance is also important factor to assess a growing library.

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*Chapter 3: National Libraries of G20
Countries*

3.1 Introduction

The National Libraries of the G20 countries play a vital role as custodians of knowledge, culture, and heritage, representing largest and most influential repositories of information. Each national library functions as the legal deposit institution of its country, tasked with collecting, preserving, and providing access to all published works, including books, manuscripts, maps, government documents, and increasingly, digital resources. While their origins differ, situated in different years, they all serve as pillars of national identity and scholarship. Collectively, these libraries safeguard rare and ancient manuscripts, cultural archives, and modern research materials, ensuring the continuity of knowledge for future generations. In the modern era, many G20 national libraries have embraced digitization, global partnerships, and community outreach programmes, extending their role beyond preservation to promoting literacy, lifelong learning, and cultural exchange on an international scale. Together, they form a connection of knowledge networks that not only serve their citizens but also contribute to global education, research, and cultural diplomacy.

The below mentioned libraries are taken for the studies

National Library	Country
Library of Congress	United States
The British Library	United Kingdom
Biblioteca Nacional Mariano Moreno	Argentina
National Library of Australia	Australia
National Library of Brazil	Brazil

National Library of Canada	Canada
National Library of South Korea	South Korea
Bibliothèque Nationale de France	France
National Library of Mexico	Mexico
National Library of Russia	Russia
National Library of Turkey	Turkey
National Library of China	China
German National Library	Germany
National Diet Library	Japan
King Fahd National Library	Saudi Arabia
National Library of India	India
National Library of Indonesia	Indonesia
National Library of South Africa	South Africa

3.2 About National Libraries

Library of Congress (LOC)

The Library of Congress was established in 1800, is the national library of the United States and recognized as the largest library in the world. Established to provide research support to the U.S. Congress, it has developed into a premier institution of global knowledge, cultural preservation, and scholarly resources. Early collection of LOC was destroyed at the time of War of 1812 when British troops set fire to Washington, D.C., but in 1815 President Thomas Jefferson's personal library of 6,487 volumes helped to rebuild the library and also broadened its scope. Jefferson's collection, which spanned philosophy, history, science, literature, and law, gave the

library its mission of maintaining a universal and comprehensive collection. Its holdings include books, journals, newspapers, manuscripts, maps, photographs, prints, rare documents, sound recordings, films, and digital archives. Among its most prized treasures are the Gutenberg Bible, one of only a few complete copies in existence, drafts of the Declaration of Independence and the U.S. Constitution, and Abraham Lincoln's handwritten Gettysburg Address.

Beyond its collection, the LOC plays a crucial functional role. It serves as the research institution of Congress through the Congressional Research Service (CRS), which provides lawmakers with authoritative, nonpartisan policy and legal analysis. The Law Library of Congress, the largest in the world, contains millions of legal resources covering nearly every jurisdiction. The LOC is also a pioneer in digitization and preservation, making millions of materials available online for global access. Public programmes include exhibitions, lectures, concerts, and educational initiatives aimed at promoting literacy and cultural appreciation.

Architecturally, the LOC is notable for its three main buildings in Washington, D.C.: the Thomas Jefferson Building (1897), famous for its murals and elaborate Beaux-Arts design; the John Adams Building (1939); and the James Madison Memorial Building (1980). Collectively, these buildings house reading rooms, research facilities, and exhibition spaces, serving both lawmakers and the general public.

As both a national research institution and an international cultural hub, the Library of Congress holds a unique position. It safeguards America's intellectual and historical legacy while also collaborating with libraries and institutions worldwide to promote access to knowledge, preservation of cultural heritage, and giving scholarship.

History of Library of Congress

The LOC was established on April 24, 1800, when President John Adams signed a contract that moved the U.S. government from Philadelphia to Washington, D.C. The legislation included a \$5,000 appropriation to purchase books which may necessary for Congress, making the creation of the national library. The collection was originally housed in the U.S. Capitol and consisted of just a few hundred volumes.

In 1814, during the War of 1812, British forces invaded Washington, D.C., and set fire to the Capitol, destroying the entire library. To rebuild, Thomas Jefferson wanted to sell his personal library of 6,487 books, which Congress purchased in 1815. Jefferson's collection covers philosophy, science, literature, law, and more, were helping to define the Library's mission of universality rather than a narrow political focus. This purchase marked a turning point in the Library's growth and intellectual scope.

Throughout the 19th century, the Library expanded steadily, acquiring collections and serving both lawmakers and scholars. By the mid 1800s, its growing importance led larger facilities. In 1897, the Thomas Jefferson Building was completed as the Library's first separate structure, a stunning Beaux-Arts architectural masterpiece that symbolized knowledge, art, and national pride.

During the 20th century, the Library of Congress became not only the research arm of Congress but also a repository of American and world culture. The John Adams Building (1939) and the James Madison Memorial Building (1980) were added to accommodate its rapidly expanding collections. At the same time, it established major departments like the Congressional Research Service (CRS) and the Law Library of Congress, both of which continue to play crucial roles in legislative research and global legal studies.

In the digital age, the LOC has taken the lead in preservation and access initiatives. American Memory Project, launched in the 1990s, was one of the earliest large-scale digital archives, making historical documents, maps, recordings, and images available online. Today, the LOC provides millions of digital items accessible worldwide, while continuing to safeguard rare and fragile materials in its physical archives.

Currently, the Library of Congress holds over 170+ million items over 470 languages, making it the largest library in the world. Its collections include books, manuscripts, photographs, maps, films, and rare artifacts such as the Gutenberg Bible, Abraham Lincoln's Gettysburg Address, and original drafts of the U.S. Constitution.

The British Library

The British Library (BL) was established in 1973 through the British Library Act, is the national library of the United Kingdom and one of the largest libraries in the world. It was formed by bringing together several major collections, most notably the library of the British Museum, whose origins date back to 1753. In 1997, the BL's main building at St Pancras, London, was opened by Queen Elizabeth II, making it one of the most significant public buildings of the 20th century in the UK. The library covers more than 170 million items including books, manuscripts, maps, newspapers, sound recordings, and digital resources, representing virtually every language and culture. Among its most treasured holdings are the Magna Carta (1215), Shakespeare's First Folio, the original Beowulf manuscript, Leonardo Da Vinci's notebooks, and handwritten lyrics by the Beatles.

As the UK's legal deposit library, the British Library receives a copy of every book and periodical published in the UK and Ireland, ensuring the preservation of the

nation's intellectual heritage. It serves as a global research hub, offering access to scholars, students, and the public, both onsite and through its extensive digital platforms. Beyond preservation and access, the BL organizes exhibitions, lectures, and cultural events to engage wider audiences. With its main site in London and a storage and document supply center in Boston Spa, West Yorkshire, the British Library stands as a world-leading institution, preserving the past while supporting innovation, research, and cultural exchange in the present.

History of British Library

The British Library, the national library of the United Kingdom, was formally established in 1973 through the British Library Act of 1972, but its roots go back much earlier to the British Museum Library, which was founded in 1753. The museum's library was built upon the collections of notable figures such as Sir Hans Sloane, whose vast holdings of books, manuscripts, and natural history specimens formed the core, as well as the Cottonian and Harleian manuscript collections, which included treasures like the Magna Carta. For more than two centuries, the British Museum Library served as one of the world's great research collections, but by the mid-20th century, the scale and specialization of its holdings led to calls for the creation of a dedicated national library. In 1973, the British Library was established officially, uniting the British Museum Library with the National Central Library and the National Lending Library for Science and Technology. Initially, much of its collection remained housed in the British Museum's famous Round Reading Room, but the growing size of the library required new facilities. This need culminated in the construction of the St Pancras Building in London, which was opened by Queen Elizabeth II in 1997 and remains one of the UK's most significant modern public buildings. Today, with additional facilities in Boston Spa, West Yorkshire, the British

Library holds above 170 million items, making it one of the biggest libraries in the world. It serves as both the legal deposit library, UK and a global research hub, preserving priceless treasures like Magna Carta, Shakespeare's First Folio, the Beowulf manuscript, and Leonardo da Vinci's notebooks, while also pioneering digital preservation and access in the modern era.

Bibliotheca Nacional Mariano Moreno (Argentina)

The Biblioteca Nacional Mariano Moreno, located in Buenos Aires, is the national library of Argentina and the largest library in the country. It was officially founded in 1810, during the May Revolution, with Mariano Moreno, a lawyer, journalist, and one of the leaders of the independence movement, because of that the library now bears his name. As one of the oldest national libraries in the Americas, it has played a crucial role in preserving Argentina's documentary and cultural heritage. Its collections include millions of items such as books, newspapers, periodicals, manuscripts, maps, photographs, and sound recordings, with particular strength in materials related to Argentine history, politics, and literature. The library safeguards works and personal papers of national icons like Domingo Faustino Sarmiento and Jorge Luis Borges, the later of whom also served as its director from 1955 to 1973. The library's striking modernist building, inaugurated in 1992 in the Recoleta neighborhood, was designed by architect Clorindo Testa and is considered a landmark of Brutalist architecture in Argentina. Today, the Biblioteca Nacional Mariano Moreno functions not only as a research and archival centre but also as a vibrant cultural institution, hosting exhibitions, conferences, and public programs that highlight

Argentina's intellectual and literary traditions while ensuring access to knowledge for scholars and the wider public.

History of the Biblioteca Nacional Mariano Moreno

Argentina's national library, is one of the oldest and most important cultural institutions in Latin America. It was officially created on September 13, 1810, during the May Revolution, just months after the Primera Junta had assumed power following the collapse of Spanish colonial authority. The library was founded through a decree proposed by Mariano Moreno, a lawyer, journalist, and revolutionary leader, who became its first director. Initially, its collection was formed by the confiscation of books belonging to religious orders that had been dissolved, particularly the Jesuits, as well as private donations.

During the 19th century, the library expanded significantly, becoming a repository of Argentina's intellectual and political history. Important figures such as Domingo Faustino Sarmiento, a writer, educator, and future president of Argentina, were closely associated with the library, strengthening its reputation as a centre of culture and education.

In the 20th century, the library reached new prominence under the directorship of Jorge Luis Borges (1955–1973), one of Argentina's greatest literary figures. Borges' tenure gave the institution global recognition, even though, ironically, he was blind for most of his directorship and unable to read the books himself.

For much of its existence, the library was located in the former residence of President Sarmiento, but by the mid-20th century, for the need for a larger, modern facility. In 1961, construction began on a new building designed by architect Clorindo Testa and

others, in the Brutalist style. After decades of delays, this striking modernist structure was inaugurated in 1992 in the Recoleta neighborhood of Buenos Aires.

Now, the Biblioteca Nacional Mariano Moreno houses millions of volumes, including books, manuscripts, newspapers, periodicals, maps, photographs, sound archives, and personal papers of many Argentine writers and leaders. It continues to serve not only as a national research library but also as a cultural hub, hosting exhibitions, conferences, lectures, and public events that celebrate Argentina's intellectual and literary heritage.

National Library of Australia

The National Library of Australia, located in Canberra, is the largest reference library in the country and the nation's premier research library. It traces its origins back to the Commonwealth Parliamentary Library, founded in 1901, the same year as Australia's Federation. Initially serving members of Parliament, it gradually developed a broader national role in preserving Australia's documentary heritage. In 1960, the National Library Act formally established it as the National Library of Australia, giving it responsibility for maintaining a comprehensive collection of material relating to the nation and its people.

The library's collections are more than 10 million items spanning books, journals, manuscripts, newspapers, maps, photographs, music, oral histories, and digital resources. It is especially renowned for its Trove service, a world-leading digital platform that provides open access to millions of digitized Australian newspapers, government documents, photographs, and cultural materials, widely used by researchers, students, and the public. The NLA also houses important literary and historical archives, including papers of significant Australian writers, politicians, and

Indigenous collections that preserve Aboriginal and Torres Strait Islander cultural heritage.

The library's striking building on the shores of Lake Burley Griffin in Canberra was opened in 1968, designed in a neoclassical style inspired by Greek architecture. It includes reading rooms, exhibition spaces, and galleries that host public programs, exhibitions, and cultural events.

Today, National Library of Australia functions as the country's most important repository of knowledge, supporting research and scholarship, preserving the nation's cultural memory, and ensuring free access for all Australians. Through its growth of digital initiatives, international partnerships, and commitment to preservation, it plays a central role in safeguarding and sharing Australia's intellectual and cultural heritage.

History of National Library of Australia

The National Library of Australia (NLA) traces its origins to the Commonwealth Parliamentary Library, founded in 1901, the year of Australia's Federation, to serve the newly formed Federal Parliament. From its earliest years, however, the library began collecting materials of wider national importance, gradually evolving into a repository of Australia's documentary heritage. When the Parliament moved from Melbourne to Canberra in 1927, the library relocated as well, continuing its dual role as both a parliamentary and national institution. Its independent identity was formally recognized with the National Library Act of 1960, which separated the functions of the Parliamentary Library from the newly established National Library of Australia. To accommodate its expanding collections, a permanent home was built on the shores of Lake Burley Griffin in Canberra, officially opened in 1968 by Prime Minister John Gorton. Since then, the NLA has grown into the country's largest reference library,

holding more than 10 million items, including books, manuscripts, newspapers, photographs, maps, music, and oral histories. In 2009, it launched Trove, a groundbreaking digital service that provides free online access to millions of items from libraries, museums, and archives across Australia, making it one of the world's leading platforms for digital heritage. Today, the National Library of Australia stands as the nation's premier research library and cultural institution, preserving Indigenous and national collections while providing global access to Australia's intellectual and cultural legacy.

National Library of Brazil

The National Library of Brazil (*Biblioteca Nacional do Brasil*), located in Rio de Janeiro, is the largest library in Latin America. It was officially established in 1810, when the Portuguese Royal Family transferred its court to Brazil after fleeing Napoleon's invasion of Portugal, bringing with them the Royal Library collection of around 60,000 volumes. This collection formed the foundation of the institution, which became the Royal Library of Rio de Janeiro before evolving into the National Library. Over the centuries, it expanded into a comprehensive repository of Brazil's intellectual and cultural heritage, holding millions of items covering books, manuscripts, maps, photographs, newspapers, prints, and rare works. Its current headquarters, an impressive neoclassical building in downtown Rio de Janeiro, was inaugurated in 1910 and remains a landmark of Brazilian culture. Beyond preservation, it plays a central role in research, scholarship, and cultural promotion, hosting exhibitions, conferences, and programs that highlight Brazil's literary and historical traditions and works as depository library.

History of National Library of Brazil

The National Library of Brazil (*Biblioteca Nacional do Brasil*), located in Rio de Janeiro, was officially founded in 1810 with the arrival of the Portuguese Royal Family, who had fled Lisbon during Napoleon's invasion and brought with them the Royal Library of around 60,000 volumes. This collection became the foundation of the institution, which initially served as the Royal Library of Rio de Janeiro and, after Brazil's independence in 1822, was renamed the Imperial and Public Library of the Court. Throughout the 19th century, its holdings expanded rapidly through acquisitions, donations, and the establishment of legal deposit laws, positioning it as a leading center of culture and scholarship in Latin America. To accommodate its growing collection, a new neoclassical headquarters was constructed and inaugurated in 1910 in downtown Rio, where it remains a landmark of Brazilian heritage. During the 20th century, the library modernized its services, developing specialized collections of manuscripts, rare books, maps, photographs, and prints, while continuing to function as Brazil's legal deposit library. Today, with a collection of more than 9 million items, the National Library of Brazil is recognized by UNESCO as one of the ten largest libraries in the world, serving as a guardian of Brazil's cultural and intellectual memory while embracing digitization to ensure global access to its treasures.

National Library of Canada

The National Library of Canada, established in 1953, was created to collect, preserve, and provide access to the nation's published heritage and to serve as a central resource for libraries across the country. Located in Ottawa, the library played a vital role in ensuring that Canadian books, periodicals, and cultural materials were systematically preserved through its legal deposit program, which required publishers to provide copies of all works issued in Canada. Its mission extended beyond preservation, as it

also aimed to foster national identity by making Canada's literary and historical legacy accessible to scholars, students, and the public. In 2004, the National Library of Canada merged with the National Archives of Canada to form Library and Archives Canada (LAC), a unified institution that continues the dual mission of safeguarding Canada's documentary heritage and providing access to millions of items, including books, manuscripts, government records, photographs, maps, and digital resources. Today, Library and Archives Canada is recognized as one of the world's most comprehensive national institutions, reflecting the diverse voices and histories that shape Canada.

History of National Library of Canada

The National Library of Canada was established in 1953 by an Act of Parliament to serve as the nation's central institution for collecting, preserving, and providing access to Canadian publications. It was started safeguarding national published heritage, which was scattered across various government departments and universities. The library's establishment introduced the legal deposit program, requiring publishers to submit copies of their works, ensuring that Canada's literary and cultural output was systematically preserved. Under the leadership of its first National Librarian, Dr. W. Kaye Lamb, the library grew into a cornerstone of Canadian scholarship and identity, developing vast collections in both English and French and fostering national bibliographic services. Throughout the latter half of the 20th century, it expanded its role to include supporting libraries nationwide, curating special collections, and embracing digital catalogues to enhance accessibility. In 2004, the National Library merged with the National Archives of Canada uniting the preservation of both published works and documentary records under one institution. Today, LAC safeguards millions of items, including books, government records, photographs,

maps, music, and digital resources, making it one of the world's leading institutions for preserving a country's documentary and cultural memory.

National Library of South Korea

The National Library of Korea, located in Seoul, is the country's largest and most comprehensive library, serving as the central repository of its intellectual and cultural heritage. Established in 1945, shortly after Korea's independence from Japanese colonial rule, the library was created to collect, preserve, and provide access to the nation's publications and documentary resources. It operates under a legal deposit system, ensuring that all works published in South Korea are deposited for future generations. The library houses a huge collection of over 12 million items, including books, manuscripts, government documents, maps, audiovisual materials, and a growing body of digital resources. In addition to its main facility, the National Library of Korea oversees specialized branches, such as the National Library for Children and Young Adults and the National Library for the Disabled, highlighting its commitment to lifelong learning. With advanced digital services and international exchange programs, the library not only preserves Korea's past but also supports research, education, and innovation in the present, positioning itself as a key cultural and knowledge hub in Asia.

History of National Library of South Korea

The National Library of Korea was founded in 1945 after liberation from Japanese colonial rule, with the goal of building a central institution to preserve and provide access to the nation's documentary and cultural heritage. Initially established in Seoul, the library started with a modest collection but quickly expanded its holdings through donations, purchases, and the implementation of a legal deposit system in 1965,

which ensured that every work published in South Korea would be archived. In 1988, to accommodate its rapidly growing collections, the library relocated to a larger and more modern building in Seocho-gu, Seoul, which remains its main facility today. Over the decades, it developed specialized branches, including the National Library for Children and Young Adults (2006) and the National Library for the Disabled (2012), reflecting a broader mission of inclusivity and lifelong learning. With the rise of technology, the library has embraced digitization projects, creating vast online databases and digital archives that make its resources accessible to researchers worldwide. Today, the National Library of Korea holds over 12 million items and functions as both a guardian of Korea's historical memory and a modern research hub that supports education, culture, and international knowledge exchange.

Bibliothèque Nationale De France (BnF)

The Bibliothèque nationale de France (BnF), located in Paris, is the national library of France and most important cultural institutions in the world. It was founded by Charles V in 1368, which gradually expanded under successive French monarchs and became a cornerstone of the nation's intellectual heritage. Today, the BnF is a Institution for collecting, preserving, and providing access to all works published in France through a legal deposit system and safeguarding rare manuscripts, maps, photographs, music, and digital resources etc. It has huge collections over 40 million items, make it one of the largest libraries globally, encompassing treasures such as medieval manuscripts, Renaissance prints, and modern digital archives. The library operates across several sites, with its historic Richelieu Library serving as a cultural landmark, and its modern François-Mitterrand site, inaugurated in 1996, symbolizing France's commitment to knowledge in the digital age. As both a guardian of the

nation's memory and a hub for research and culture, the BnF plays a central role in preserving French heritage while fostering global intellectual exchange.

History of Bibliothèque Nationale de France

BnF traces its origins to 1368, when King Charles V established the royal library in the Louvre Palace with manuscripts that formed the foundation of what would later become France's national library. Over the centuries, the collection expanded dramatically, especially during the reign of Francis I, who in 1537 introduced the legal deposit system, requiring publishers to provide a copy of every work printed in France. This law ensured a continuous growth of the library's holdings and positioned it as a guardian of French intellectual and cultural life. During the French Revolution, the library's collections grew further with the confiscation of books and manuscripts from the Church and the aristocracy, transforming it into a true national institution open to the public. In the 19th century, the library was relocated to the Richelieu site, where it became one of the world's largest and most prestigious libraries. To meet modern needs, a major expansion was undertaken under President François Mitterrand, leading to the construction of the François-Mitterrand site, inaugurated in 1996, which houses millions of volumes in its iconic four glass towers. Today, the BnF holds more than 40 million documents, including manuscripts, maps, prints, audiovisual materials, and digital archives, making it one of the largest and most significant libraries in the world. It continues to serve as both a guardian of France's cultural memory and a global hub for research and knowledge exchange.

National Library of Mexico

The National Library of Mexico (Biblioteca Nacional de México), located in Mexico City, is the country's principal repository of printed heritage and one of the most

significant cultural institutions in Latin America. Officially founded in 1867 by decree of President Benito Juárez, it was established to safeguard Mexico's bibliographic memory and to provide access to knowledge for scholars and the public. The library functions under a legal deposit system, which requires publishers to submit copies of their works, ensuring that the nation's intellectual output is preserved for future generations. Since 1929, it has been administered by the National Autonomous University of Mexico (UNAM), linking it closely with academic research and education. Its extensive collections include millions of books, newspapers, magazines, manuscripts, maps, and rare documents that trace Mexico's history from the pre-Hispanic era to the present. The library is also responsible for producing the Mexican National Bibliography and coordinating the National Catalog of Holdings, which supports libraries across the country. In addition to its role as a guardian of heritage, the National Library of Mexico serves as a vibrant research hub, contributing to the preservation, dissemination, and promotion of Mexican culture and knowledge at both national and international levels.

History of National Librray of Mexico

The National Library of Mexico was officially founded in 1867, during the presidency of Benito Juárez, as part of the country's broader efforts to strengthen education and preserve national heritage following years of political turmoil. Its origin was 1850s, when the Mexican state expropriated church properties. These collections, rich in colonial manuscripts, rare books, and theological works, formed the foundation of the new national library. Initially housed in the former Temple of San Agustín in Mexico City, the library became a central institution for safeguarding the intellectual and cultural output of the nation. In 1929, its administration was transferred to the National Autonomous University of Mexico (UNAM), which gave it a stronger

academic role and integrated it into the university's research and teaching missions. Over the 20th century, the library expanded its holdings through the legal deposit law, acquisitions, and donations, eventually containing important collections in Latin America. Today, it preserves millions of items, from pre-Hispanic codices and colonial manuscripts to modern publications and digital archives, making it both a guardian of Mexico's documentary memory and a vital research hub for scholars around the world.

National Library of Russia

The National Library of Russia was established in 1795 in St. Petersburg by order of Catherine the Great, making it the country's first public library. Its foundation was rooted in the Enlightenment ideals of providing universal access to knowledge, and it was initially known as the Imperial Public Library. The first collections came from the purchase of the Zaluski Library of Warsaw, one of the largest libraries in Europe at the time, which had been seized during the partitions of Poland. The library officially opened to the public in 1814, offering free access to books and manuscripts, which was a progressive step for its era. Throughout the 19th century, it expanded rapidly, acquiring rare manuscripts, maps, and works in foreign languages, cementing its role as Russia's leading research institution. During Russian Revolution of 1917, the library was nationalized and renamed the Russian Public Library, and later the State Public Library, reflecting its new political role. In 1992, after the dissolution of the Soviet Union, it was renamed the National Library of Russia, symbolizing its enduring role as a custodian of the nation's cultural and intellectual heritage. Today, it preserves over 36 million items, including invaluable Slavic manuscripts, early printed works, and unique archival materials, while also embracing digitization and

modern library services to remain a central hub of scholarship and culture in Russia and beyond.

History of National Library of Russia

The National Library of Russia was founded in 1795 by order of Catherine the Great, making it the country's first state public library and one of the earliest in Europe designed to be accessible to all. Its initial collection was formed from the confiscated Zaluski Library of Warsaw, one of Europe's largest book collections at the time, acquired after the partitions of Poland. Officially opened to the public in 1814, it quickly became a center of scholarship, offering free access to books, manuscripts, and foreign works. Throughout the 19th century, the library expanded significantly, acquiring rare Slavic manuscripts, early printed books, and important scientific works, which helped it develop into Russia's foremost intellectual hub. After the Russian Revolution of 1917, the library was nationalized and renamed the State Public Library, reflecting its new role under Soviet governance. With the collapse of the Soviet Union in 1992, it was officially named as National Library of Russia, affirming its position as a guardian of the nation's cultural memory. Today, with a collection exceeding 36 million items, the library preserves centuries of Russian and world heritage, while also embracing digitization and modern services to continue serving scholars, researchers, and the public.

National Library of Turkey

The National Library of Turkey (Milli Kütüphane), located in Ankara, is the country's largest and most important library, serving as the central institution for preserving Turkey's written and printed cultural heritage. Officially opened in 1946, it was founded to collect, safeguard, and provide access to all works published in Turkey,

and has significant international materials. The library operates under the legal deposit system, ensuring that copies of every publication produced in the country are preserved for future generations. Its collections include books, manuscripts, newspapers, journals, maps, photographs, and audiovisual materials and other resource for researchers, academics and public. One of its notable strengths is its collection of Ottoman-era manuscripts, rare works in Arabic, Persian, and Turkish, and documents related to the history of the Republic of Turkey. In addition, the library has embraced modernization through digitization projects and advanced information services, enabling greater access to resources both nationally and internationally. As a cultural hub, the National Library of Turkey not only preserves the nation's intellectual output but also fosters education, cultural exchange on a global scale.

History of National Library of Turkey

National Library of Turkey was established in 1946, when it was formally established in Ankara to serve as the country's principal repository of knowledge and cultural heritage. Its creation was closely tied to the Republic's modernization reforms, which emphasized education, science, and culture as essential elements of national progress. The library began with modest collections, but its growth was secured by the introduction of the legal deposit law, which required that copies of every book and publication printed in Turkey be sent to the National Library. This legal framework ensured the preservation of the nation's intellectual output and gradually transformed the institution into a comprehensive research hub. In addition to printed works, the library actively collected Ottoman-era manuscripts, rare books, and archival documents in Turkish, Arabic, and Persian, thereby safeguarding centuries of cultural history. As the collections grew, a new purpose-built facility was constructed and inaugurated in 1983, providing modern infrastructure and expanded space for its

holdings. Since then, the National Library of Turkey has continued to evolve, embracing digitization, electronic catalogues, and international collaborations for scholars and the public. Today, it stands as both a guardian of Turkey's past and a cornerstone of its intellectual and cultural future.

National Library of China

The National Library of China (NLC), is the largest library in Asia and one of the largest in the world, located in Beijing, serving as the foremost repository of China's literary and cultural heritage. It was established in 1909 as the Imperial Library of Peking during the late Qing Dynasty, it was envisioned as a modern national institution to preserve Chinese civilization and foster scholarly research. Today, the library has over 40 million items, including books, manuscripts, journals, maps, audiovisual resources, and an extensive digital collection. Among its treasures are invaluable ancient Chinese manuscripts, oracle bones, Buddhist scriptures, Dunhuang manuscripts, genealogical records, and rare editions that chronicle China's thousands of years of history. It also functions as a legal deposit library, ensuring that every publication produced in China is preserved for future generations. Beyond its historical collections, the NLC has embraced modernization with vast digital resources, online services, and international cooperation, making its holdings accessible worldwide. With its dual role as a research hub and cultural institution, the National Library of China not only safeguards the country's intellectual legacy but also plays an important role in promoting global cultural exchange.

History of National Library of China

The history of the National Library of China (NLC) began in 1909, when it was founded in Beijing as the Imperial Library of Peking under the late Qing Dynasty. It

was part of the government's modernization efforts, inspired by Western-style libraries, and was intended to collect and preserve the cultural and scholarly works of the nation. After the fall of the Qing Dynasty in 1911, the library became the Beijing National Library, opening its doors to the public in 1912. Over the decades, it steadily expanded its collections, focusing not only on modern publications but also on ancient Chinese classics, rare manuscripts, Buddhist sutras, oracle bones, genealogies, and historical archives that are priceless to Chinese civilization. During the 20th century, particularly after the establishment of the People's Republic of China in 1949, the library underwent significant growth, with systematic acquisitions through legal deposit laws and large-scale preservation of cultural heritage. In 1998, it was officially named as the National Library of China, reflecting its status as the central institution of knowledge and cultural preservation for the nation. Today, with huge collection and vast digital resources, the library represents both a guardian of China's past and a modern hub of education, research and cultural exchange.

German National Library

The German National Library (Deutsche Nationalbibliothek, DNB) is the central archival library and national bibliographic center of Germany, responsible for collecting, preserving, and documenting all publications of German since 1913. With its main sites in Leipzig, Frankfurt am Main, and a branch in Berlin, the library serves as the nation's most important hub for cultural and intellectual heritage. Its vast collections include millions of books, journals, newspapers, maps, music scores, digital media, and sound recordings, making it indispensable for research in the humanities, social sciences, and beyond. The DNB is also renowned for its specialized holdings, such as the German Exile Archive 1933–1945, documenting the experiences of Germans who fled during the Nazi era, and the German Music

Archive, which collects and preserves all printed and recorded music published in Germany. In addition to physical collections, the library has embraced digitization and online services, ensuring global accessibility to its resources. As both a guardian of the written word and a modern research institution, the German National Library helps in safeguarding Germany's cultural memory while promoting knowledge exchange on an international scale.

History of German National Library

The history of the German National Library (Deutsche Nationalbibliothek, DNB) began in 1912, when the decision was made to establish a central library to collect and preserve all German-language publications from 1913 onward. The first site was founded in Leipzig, a city historically known for publishing and book fairs, and it became the core of the national collection. After World War II, Germany's division led to a second site being created in Frankfurt am Main in 1947, as West Germany's national library. Meanwhile, Leipzig continued to serve East Germany. Following reunification in 1990, the two institutions were joined into a single national library with a unified mission. In 2006, it officially adopted the name Deutsche Nationalbibliothek (DNB). Over time, its role expanded beyond books to include digital publications, music archives, and exile literature collections, with the establishment of specialized units such as the German Music Archive and the German Exile Archive 1933–1945. Today, with its three locations—Leipzig, Frankfurt, and a branch in Berlin—the DNB functions as both a traditional repository and a modern digital library, ensuring that Germany's intellectual and cultural heritage is preserved and accessible to future generations.

National Diet Library

The National Diet Library (NDL), located in Tokyo and Kyoto, is the country's national library and the sole institution of its kind, serving both as a parliamentary library and as a national repository of knowledge. It was established in 1948 after World War II, the NDL holds millions of items, including books, periodicals, maps, manuscripts, government documents, audiovisual materials, and extensive digital archives. It is especially notable for its collections of Japanese historical materials, such as early printed books, classical manuscripts, and official records, as well as vast holdings of foreign publications to support comparative research. In addition, the NDL manages specialized services such as the Rare Books and Old Materials Collection, the Modern Political and Constitutional History Collection, and large-scale digitization projects that provide online access to millions of resources. By combining its parliamentary role with its function as a research and cultural institution, the NDL plays a central part in both Japan's governance and its scholarly and cultural life.

History of National Diet Library

The history of the National Diet Library (NDL) dates back to 1948, when it was formally established in Tokyo as Japan's postwar national library. Its creation was part of the democratic reforms introduced after World War II, modeled closely on the U.S. Library of Congress, to provide impartial research and information services to the National Diet (Japan's parliament). The NDL merged three pre-existing libraries: the libraries of the House of Peers, the House of Representatives, and the Imperial Library, thereby consolidating Japan's major national collections under one institution. Initially focused on supporting lawmakers with legal, political, and economic information, the NDL quickly expanded its role as a legal deposit library, ensuring the preservation of all Japanese publications. Over the decades, it built

significant collections not only of Japanese works but also of foreign literature, making it a hub for international research. A second major facility was established in Kyoto in 1961, designed to house historical materials and specialized collections, while the Tokyo Main Library remained the central hub for parliamentary services. With the rise of technology, the NDL has also pioneered digitization projects, providing online access to rare books, official documents, and historical archives. Today, it stands as both the guardian of Japan's cultural and intellectual memory and a key resource for democratic governance and global scholarship.

King Fahd National Library

The King Fahd National Library (KFNL), located in Riyadh, Saudi Arabia, is the kingdom's premier cultural and intellectual repository, dedicated to preserving the nation's heritage and supporting scholarly research. Established in 1983 and officially opened in 1996, the library was named in honor of King Fahd bin Abdulaziz Al Saud and was created to serve as the national library of Saudi Arabia. Its mandate includes the legal deposit system, which requires all works published in the country to be submitted to the library, ensuring the preservation of Saudi intellectual and cultural output. The library's vast collections include books, manuscripts, periodicals, rare documents, government publications, and digital resources, covering both Arabic and international works. It is particularly renowned for its manuscript and rare book collections, which highlight the depth of Islamic scholarship and Arabian history. Architecturally, the library is also a landmark in Riyadh, blending modern design with traditional Islamic aesthetics, especially after its major expansion completed in 2013. Beyond preservation, KFNL plays an active role in knowledge dissemination, digital archiving, and cultural exchange, making it a vital institution for education, research, and cultural identity in Saudi Arabia.

History of King Fahd National Library

The history of the King Fahd National Library (KFNL) began in 1983, when it was established by royal decree in Riyadh to provide service as the national library of Saudi Arabia. It was named in honor of King Fahd bin Abdulaziz Al Saud, reflecting his vision to preserve the kingdom's intellectual and cultural heritage while modernizing its research infrastructure. The library officially opened its doors to the public in 1996, becoming the central institution for collecting, organizing, and safeguarding all publications produced in Saudi Arabia under the legal deposit system. Over the years, its collections expanded to include not only Saudi works but also Arabic and international publications, rare manuscripts, government records, and digital resources. In 2013, KFNL underwent a major architectural transformation, with the construction of a striking new building that blended contemporary design with traditional Islamic elements, making it a cultural landmark in Riyadh. Since then, the library has embraced digital technologies, expanding access to online databases, e-resources, and digitized manuscripts. Today, KFNL stands as both a guardian of Saudi Arabia's scholarly and cultural legacy and a modern hub for research, education, and knowledge exchange.

National Library of India

The National Library of India, located in Kolkata (West Bengal), is the biggest library in the country and one of the most significant libraries in Asia, serving as India's premier repository of knowledge and culture. Established in 1948, shortly after independence, it inherited the collections of the Imperial Library, which was formed in 1903 by combining several secretariat libraries during British rule. Today, the library functions as a legal deposit library, responsible for collecting and preserving

every publication produced in India, in addition to housing vast numbers of foreign works. Its holdings exceed 2.2 million books and documents, covering a wide range of subjects in over Indian and foreign languages, including Sanskrit, Persian, Arabic, and European texts. The National Library is particularly highlighted for its rare manuscripts, maps, and archives, which provide deep insight into India's history and cultural evolution. It was housed in the historic Belvedere Estate, a colonial-era mansion, the library combines architectural heritage with modern functions, including digitization and electronic cataloguing. Beyond being a research hub, it plays a vital role in literacy promotion, scholarly activities, and the preservation of India's intellectual and cultural heritage for future generations.

History of National Library of India

The history of the National Library of India is closely tied to the evolution of libraries during British rule in India. Its origins lie in the Imperial Library, which was founded in 1903 in Calcutta (now Kolkata) by combining several secretariat libraries of the colonial government. The Imperial Library was opened to the public in 1903 and was intended to serve as a reference library for educationist and scholars. After India gained independence in 1947, the Government of India recognized the need for a true national repository that would reflect the country's cultural and intellectual diversity. In 1948, the Imperial Library was renamed the National Library of India, officially designating it as the nation's largest and most authoritative library. It was moved to the Belvedere Estate, a historic mansion that had once served as the residence of British governors-general, giving the institution both symbolic and historical significance. Over time, the library's mandate expanded to include the legal deposit of all publications produced in India, ensuring a comprehensive record of the nation's literary and scholarly output. In recent decades, it has embraced digitization and

modernization, while continuing to safeguard rare manuscripts, archives, and ancient texts that document India's rich heritage. Today, the National Library of India stands as both a guardian of the past and a hub for scholarly research and cultural preservation.

National Library of Indonesia

The National Library of Indonesia (Perpustakaan Nasional Republik Indonesia), located in Jakarta, is the largest library in the country and serves as the central institution for preserving and providing access to Indonesia's documentary heritage. Established in 1980 through the merger of several major library collections, it plays a crucial role in collecting, conserving, and disseminating Indonesia's vast cultural, historical, and literary resources. The library houses millions of items, including manuscripts, rare books, newspapers, government documents, and digital resources, reflecting the nation's diverse cultural heritage. In 2017, it inaugurated a new 27-floor building, which is one of the tallest library structures in the world, symbolizing Indonesia's commitment to knowledge and education. As a national reference and research hub, it not only supports academic and cultural development but also provides modern digital services to meet the needs of contemporary users, strengthening its role as a vital institution for learning and cultural preservation.

History of National Library of Indonesia

The history of the National Library of Indonesia dates back to the early colonial period when Dutch institutions established collections of manuscripts and printed works to document the archipelago's culture and knowledge. The modern foundation of the National Library was laid in 1980, when four major libraries were merged: the Library of the National Museum, the Library of the Ministry of Education and

Culture, the Jakarta Regional Library, and the National Scientific Documentation and Information Centre (PNRI). This unification created a central institution responsible for safeguarding Indonesia's documentary heritage and providing access to knowledge nationwide. Over the years, the library expanded its collections, which include rare ancient manuscripts, colonial-era publications, and modern research works. A significant milestone was achieved in 2017, with the opening of its new 27-story building in Jakarta, one of the tallest library buildings in the world, marking Indonesia's strong commitment to education, culture, and literacy. Today, the National Library of Indonesia stands as both a guardian of history and a modern center for research, learning, and information dissemination.

National Library of South Africa

The National Library of South Africa (NLSA), with campuses in Pretoria and Cape Town, is the official custodian of South Africa's documentary heritage and the largest library in the country. Established in 1999 through the merger of the South African Library (founded in Cape Town in 1818) and the State Library (founded in Pretoria in 1887), it was created to unify the nation's major collections under one institution. The NLSA functions as a legal deposit library, preserving every publication produced in South Africa, as well as acquiring works of international significance. Its collections include millions of books, manuscripts, newspapers, government documents, maps, audiovisual materials, and digital resources, reflecting both South Africa's diverse cultural heritage and global scholarship. A key strength of the library is its rich holdings in Africana and rare manuscripts, which document the history, languages, and traditions of the region. Beyond preservation, the NLSA plays an active role in promoting literacy, fostering a reading culture, supporting researchers, and expanding access through digitization initiatives. With its dual commitment to safeguarding the

past and advancing education, the National Library of South Africa stands as a vital institution for knowledge, cultural identity, and democratic growth in the country.

History of National Library of South Africa

The NLSA, with campuses in Pretoria and Cape Town, is the official custodian of South Africa's documentary heritage and the largest library in the country. It was established in 1999 through the merger of the South African Library (founded in Cape Town in 1818) and the State Library (founded in Pretoria in 1887), it was created to unify the nation's major collections under one institution. The NLSA functions as a legal deposit library, preserving every publication produced in South Africa, as well as acquiring works of international significance. Its collections include millions of books, manuscripts, newspapers, government documents, maps, audiovisual materials, and digital resources, reflecting both South Africa's diverse cultural heritage and global scholarship. A key strength of the library is its rich holdings in Africana and rare manuscripts, which document the history, languages, and traditions of the region. Beyond preservation, the NLSA plays an active role in promoting literacy, fostering a reading culture, supporting researchers, and expanding access through digitization initiatives. With its dual commitment to safeguarding the past and advancing education, the National Library of South Africa stands as a vital institution for knowledge, cultural identity, and democratic growth in the country.

3.3 Conclusion

The National Libraries of G20 countries stand as enduring symbols of knowledge, culture, and identity, each safeguarding the intellectual heritage of its nation while adapting to the challenges of a rapidly changing world. Though diverse in their histories, sizes, and collections, they share a common mission: to preserve the past,

serve the present, and inspire the future. By collecting and conserving invaluable manuscripts, books, and digital resources, these institutions ensure that the voices of different eras and cultures remain accessible for generations to come. In the 21st century, their objectives have expanded beyond preservation to include digitization, global collaboration, literacy promotion, and public engagement, making them more dynamic and inclusive than ever before. Collectively, the national libraries of the G20 not only reflect the cultural and economic richness of the countries but also contribute to a global network of knowledge sharing, reinforcing the idea that libraries are not just repositories, but living institutions of education, innovation, and human progress.

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Chapter 4: Research Methodology

4.1 Introduction

The methodology of this study involves a structured approach to evaluating the traditional performance and social media performance of National Libraries across G20 countries. The study adopts a mixed-methods approach, combining quantitative analysis using TOPSIS and correlation method. The research framework includes data collection, ranking methods, and analytical techniques to derive meaningful insights.

4.2 Research Design

It is comparative analytical research focusing on the three dimensions. The TOPSIS is used to rank National Libraries based on key traditional performance indicators, ensuring an objective evaluation of library operations. User satisfaction is analyzed using percentage of positive reviews over total reviews and used correlation for evaluating how they are correlated. Social Insider tool is used for data retrieval from social media. In that way, Libraries are ranked as per their performance.

4.3 Research Questions

Traditional Rank and User Satisfaction Metrics

- What is the current rank of National Library on the basis of TOPSIS analysis (traditional metrics)?
- What is the user satisfaction rank of these National Libraries?

- Is there a significant correlation between traditional metrics and user satisfaction rank?
- Which National Library ranks highest as per traditional metrics? Which National Library ranked highest as per user satisfaction rate?

Platform-Specific Comparison:

- Which social media platform (Facebook, Twitter, Instagram, YouTube) shows strongest relationship between post per day and engagement per post?
- Which social media platform shows strongest relationship between engagement per post and followers?
- Which social media platform used for more engagement?
- Which social media are used more?
- Which social media is used for more post?

Engagement Specific Comparison:

- Which National Library's engagement rank is high?
- Whether social media engagement correlates with traditional metrics?
- Whether social media engagement correlates with user satisfaction rank?
- Whether social media engagement correlates with posting frequency?

Performance of National Library in social media

- Whether high Pi leads National Library to high posting frequency?
- Which National Library's post frequency is high?

- Does the frequency of posting impact engagement rates across different platforms?
- Which social media are used more by post?

Cross Region Analysis

- What are the differences show in Pi score of different regions?
- What are the regional differences of engagement per day in social media?
- What is the regional trend of post per day?
- Which library is more active and more engaged in social media?

Comparison of Economic Developed and Developing Country

- What is the difference identified on Pi for economic developed and developing countries?
- What is the difference identified on average post frequency, engagement and followers count?
- Where is the difference identified on user satisfaction perspective of National Library of G20 countries?

4.4 Data Collection

- **Literature Review and National Library Websites** – Parameters have been gathered from the Website and through Literature review

- **CENL Report and ISO Standards** – The studies relies on parameters of CENL report based on ISO 11620:2023, ISO 2789:2022, and ISO 21248:2019

CENL report is an annual document submitted by National Libraries to the Conference of European National Libraries. This report provides development, projects, challenges faced by National Libraries. This report can help in policy discussion within the CENL community.

ISO 11620:2023 is an international standard titled Library Performance Indicators which was published in The International Organization for Standardization (ISO), These standards provide a comprehensive framework for evaluating library performance.

ISO 2789:2022 is International Library Statistics developed by ISO in the year 2022. This standard provides guidelines for collection and reporting of library statistics, aiming to ensure consistency and comparability across countries.

ISO 21248:2019 is a quality assessment for National Libraries, international standard developed by ISO, published in March 2019. It provides comprehensive framework of National Libraries through performance measurement and impact assessment. The standard includes 34 performance indicators covering various aspects of National Libraries.

- **IFLA Global Vision and Strategy Outline**- Data have been selected from the CENL report based on the IFLA Global and Vision Strategy outline. It is a global voice of the library and information profession, enabling access to knowledge for all and empowering communities through libraries. It prioritizes staff engagement, reduce digital divide, enhance library service, build up collection,

encourage sustainable practice by removing funding limitation, promote preservation and quick access of cultural heritage.

- **Social Media Platforms** – Data on engagement levels, follower counts, and activity has been obtained using Social Insider Tool for platforms such as Twitter, Facebook, and Instagram and YouTube.
- **User Satisfaction Surveys** – User feedback was gathered from TripAdvisor and Google Reviews to analyze public perceptions of library services.

4.5 Methodology

National Library preserves national heritage. It acts as a custodian of the respective country. It reflects culture of the society and the condition of society. G20 countries are the forum of economic developed and developing country. From this study, the condition (traditional and social media) of National Library of economic developed and developing country to be analyzed and user satisfaction also to be analysed. For traditional analysis, Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method has been used. For Digital analysis ranking method and correlation method has been used.

Step 1: Traditional Metrics

Five quantitative important parameters based on mentioned in ISO11620-2023, ISO 2789-2022 and ISO21248-2019 available in website of National Libraries. Rank was done based on the parameters. These all parameters are also highlighted in CENL conference and selected on the basis of IFLA Global and Vision Strategy Outline.

Parameter	Type	Method Used
Working Hours	Operational Parameter	TOPSIS analysis
Collection	Resource Parameter	
Budget	Financial Parameter	
Staff	Human Resource Parameter	
Library Space	Infrastructure Parameter	

Then the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method has been applied on these criteria. TOPSIS is a multi-criteria decision-making (MCDM) method used to rank and select from a set of alternatives based on their closeness to an ideal solution. It is developed by Hwang and Yoon in 1981, TOPSIS is grounded in the principle that the chosen alternative should have the shortest distance from the ideal solution and the farthest distance from the negative ideal solution (Hwang & Yoon, 1995). The method involves several key steps and that can be analyses here

Methods of TOPSIS

A. **Step (i)** :Create an evaluation matrix consisting of n criteria

Five criteria had been considered for analysis i.e.

B. **Step (ii)** : Calculating criteria weights

All criteria are equally important and weightage are considered same $1/5= 0.2$

C. **Step (iii)** Calculation of normalized matrix

To find out the normalized matrix, the calculation is as follows

$$\overline{X}_{ij} = \frac{X_{ij}}{\sqrt{\sum_{j=1}^n X_{ij}^2}}$$

D. **Step (iv)** Determine the weightage normalized matrix

The calculation has been done by multiplication of normalized matrix with weightage.

$$V_{ij} = \overline{X}_{ij} \times W_j$$

E. **Step (v)** Determine the best and worst alternative

The highest collection, highest library staff, highest budget, maximum working hours and maximum division of library were considered the best alternative. So from step 5, highest value was taken as V^+ and worst alternative was taken as V^-

F. **Step (vi)** Then best and worst alternatives are deducted from the weightage normalized matrix

$$s_i^+ = \left[\sum_{j=1}^m (V_{ij} - V_j^+)^2 \right]^{0.5}$$

$$s_i^- = \left[\sum_{j=1}^m (V_{ij} - V_j^-)^2 \right]^{0.5}$$

Then calculate the performance evaluation and ranking on the basis of highest performance.

$$P_i = \frac{s_i^-}{s_i^+ + s_i^-}$$

G. Step (vii) Ranking was done on performance indicator

Method can also applied by python

```
import pandas as pd
```

```
import numpy as np
```

```
# Load the data
```

```
data = {
```

```
    'Library': [
```

```
        'The British Library', 'Library of Congress', 'Bibliotheca Nacional Mariano Moreno  
(Argentina)',
```

```
        'National Library of Australia', 'National Library of Brazil', 'National Library of Canada',
```

```
        'National Library of South Korea', 'Bibliotheque Nationale De France', 'National Library of  
Mexico',
```

```
        'National Library of Russia', 'National Library of Turkey', 'National Library of China',
```

```
        'German National Library', 'National Diet Library', 'King Fahd National Library',
```

```
        'National Library of Indonesia', 'National Library of India', 'National Library of South Africa'
```

```
    ],
```

```
    'Total Minutes': [510, 510, 720, 720, 600, 660, 540, 600, 480, 360, 480, 480, 780, 570, 840,  
480, 480, 480],
```

```

'Collection': [200, 175, 1, 7.72, 9, 47, 10, 42, 1.3, 40, 4, 43.27, 49, 44.1, 2.4, 8.66, 2.5, 5.5],

'Budget': [14215064000, 68789800000, 208430659, 4631000000, 1108800000, 13596000000,
8364000000, 22860000000,

            8036000000, 1918800000, 60000000, 6490000000, 4950000000, 116580000,
6328539866, 3266736373,

            740000000, 45000000],

'Staff': [1977, 3172, 38, 225, 570, 853, 600, 2300, 300, 1850, 650, 1365, 617, 895, 350, 1121,
450, 200],

'Library Space': [9300, 186000, 22000, 47000, 400, 35000, 38013.4, 57970, 38000, 63000,
28000, 9300, 72900,

                9290, 62000, 50445, 62000, 33000]

}

```

```
df = pd.DataFrame(data)
```

```
# Step 1: Extract criteria and weights
```

```
criteria = df.iloc[:, 1:6].values.astype(float)
```

```
weights = np.array([0.2, 0.2, 0.2, 0.2, 0.2])
```

```
# Step 2: Normalize the criteria
```

```
norms = np.linalg.norm(criteria, axis=0)
```

```
normalized = criteria / norms

# Step 3: Apply weights

weighted = normalized * weights

# Step 4: Determine ideal and negative-ideal solutions (all criteria are benefit-type)

ideal = np.max(weighted, axis=0)

negative_ideal = np.min(weighted, axis=0)

# Step 5: Calculate separation measures

d_positive = np.linalg.norm(weighted - ideal, axis=1)

d_negative = np.linalg.norm(weighted - negative_ideal, axis=1)

# Step 6: Calculate the TOPSIS score

topsis_score = d_negative / (d_positive + d_negative)

# Step 7: Add scores and rankings to the dataframe

df['TOPSIS Score'] = topsis_score

df['Rank'] = df['TOPSIS Score'].rank(ascending=False).astype(int)

# Step 8: Sort by rank

df_sorted = df.sort_values(by='Rank')

# Display results
```

```
print(df_sorted[['Rank', 'Library', 'TOPSIS Score']])
```

Step 2: User Satisfaction Rank

Service is an important factor to assess the quality of the library. National Library is not an exception. To assess the quality, the satisfaction rate has been measured on the basis of the rating of Trip Adviser and Google review. Only Positive review has been taken. Percentage of positive review has been considered for the ranking.

Trip Adviser is global travel guidance platform that helps users plan, book and review trips. It provides detailed information, user generated content and booking tools. It contains almost 1 billion reviews and opinion from real travelers and also travelers can share their real experience in this site.

Google review is a user generated ratings and written feedback about business, places or services on Google. This review appears on Google search results, Google maps, Google business profiles.

Step 3: Social Media Rank

In addition to traditional performance metrics, the study also examines National Libraries' social media presence by evaluating followers count, engagement and posting frequency on social media platforms like facebook, twitter, Instagram, Youtube. The following methods were used:

Category	Tool/Method Used
-----------------	-------------------------

Post, Like, Share, Comment	Social Insider
For calculating “Engagement”	Like+Comment+Share

Social Insider: Social Insider is multi-channel digital media analytics tool designed for brands, agencies and marketers. It offers dashboard to track performance across platforms like facebook, Instagram, Tiktok, X, LinkedIn and Youtube. It is cloud based social media analytics and reporting tool that helps track, benchmark and report on social performance across multiple platforms. Official website of Social Insider is <https://www.socialinsider.io>.

Step 4: Correlation

To identify relationship between various factors, Spearman and Pearson correlation methods have been used. The following correlations were examined:

Category	Tool/ Method Used
TOPSIS Rank with User Satisfaction Rank	Correlation (Spearman Rank Correlation)
User Engagement Per Post with TOPSIS Rank	Correlation (Spearman Rank Correlation)
User Engagement Per Post and User Satisfaction Rank	Correlation (Spearman Rank Correlation)
Social Media Post Per Day and Engagement Per Post	Correlation (Spearman Correlation)
TOPSIS with Post Per Day	Correlation (Spearman Rank Correlation)
Platform Specific Correlation	Correlation (Pearson)

For Correlation	Python in Google Colab
------------------------	------------------------

Spearman's Rank Correlation coefficient is a non-parametric measure of statistical dependence between two variables. It finds out how well relationship between two variables, whether one variable increases other tends to increase or decrease consistently or not. Generally, when data is ordinal, this correlation is used.

Pearson Correlation is a statistical measure that calculates strength and direction of a linear relationship between two continuous and normally distributed variables.

Google Colabis a free and cloud-based platform that allows writing and run python code directly in browser. It provides interactive environment. Website is: <https://colab.research.google.com/>

Step 5: Graphical Representation

Only graphical representation is shown for the analysis and that has been made by python.

4.6 Limitation of the Study

National Library of China does not use any social media. They use their own social media and that is totally restricted. So only traditional metrics is done on the available data from the website of National Library of China. There are more than one National Library i.e. National Library of Italy and National Library of European Union. So, these libraries are excluded from the study.

4.7 Conclusion

This research methodology provides a structural approach of evaluating National Libraries, integrating both traditional and social media metrics with statistical analysis. By employing the TOPSIS ranking system and correlation, this study contributes to a deeper understanding of how National Libraries adapt to the digital landscape while maintaining their core services.

*Chapter 5: Data Analysis
and Interpretation*

5.1 Introduction

In the digital era, national libraries are increasingly leveraging social media platforms to expand their outreach, engage with diverse audiences, and promote access to knowledge and cultural heritage. This study conducts a comprehensive data analysis of the social media performance of national libraries from G20 countries, focusing on four major platforms: Facebook, Twitter, Instagram, and YouTube. The analysis explores multiple dimensions including posting frequency, user engagement, platform preference, and cross-platform effectiveness by data driven approach. Additionally, the study examines the relationship between traditional library performance metrics (such as TOPSIS rankings), user satisfaction, and social media engagement.

5.2 Data Analysis and Interpretation

The performance and effectiveness of national libraries can be evaluated using multiple quantitative and qualitative parameters that reflect their operational, financial, and infrastructural capacities. In this study, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is applied to assess and compare the performance of G20 national libraries. For consistency and balanced evaluation, five key criteria are selected, each given an equal weightage of 0.2.

Table 1: Showing TOPSIS Criteria for National Libraries

Weightage	0.2	0.2	0.2	0.2	0.2
National Library	Total Minutes	Collection (in millions)	Budget (INR)	Staff	Library Space (sq mtr)
The British Library	510	200	14,215,064,000	1977	9300
Library of Congress	510	175	68,789,800,000	3172	186000
Bibliotheca Nacional Mariano Moreno (Argentina)	720	1	208,430,659	38	22000
National Library of Australia	720	7.72	4,631,000,000	225	47000
National Library of Brazil	600	9	1,108,800,000	570	400
National Library of Canada	660	47	13,596,000,000	853	35000
National Library of South Korea	540	10	8,364,000,000	600	38013.4
Bibliothèque Nationale De France	600	42	22,860,000,000	2300	57970
National Library of Mexico	480	1.3	8,036,000,000	300	38000
National Library of Russia	360	40	1,918,800,000	1850	63000
National Library of Turkey	480	4	60,000,000	650	28000
National Library of China	480	43.27	6,490,000,000	1365	9300
German National Library	780	49	4,950,000,000	617	72900
National Diet Library	570	44.1	116,580,000	895	9290
King Fahd National Library	840	2.4	6,328,539,866	350	62000
National Library of Indonesia	480	8.66	3,266,736,373	1121	50445
National Library of India	540	2.5	740,000,000	450	62000
National Library of South Africa	480	5.5	45,000,000	200	33000

Above table represented the criteria for matrix. Upper row of the table represented the weightage.

The normalized matrix is a key step in TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution), where values are transformed to a comparable scale between 0 and 1. Below is a step-by-step analysis of the data has been provided. Though each criterion of library has carried same importance and value, so same weightage is considered same for each criterion i.e. $1/5=0.2$

To find out the normalized matrix, put the formula on Table: 2

$$\overline{X_{ij}} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^n x_{ij}^2}}$$

Table 2: Calculation of Normalized Matrix

National Library	Total Minutes	Collection (in millions)	Budget (INR)	Staff	Library Space (sq mtr)
The British Library	0.205566632	0.69507891	0.184745545	0.365072	0.036088
Library of Congress	0.205566632	0.60819405	0.894024049	0.58574	0.721754
Bibliotheca Nacional Mariano Moreno (Argentina)	0.290211715	0.00347539	0.002708861	0.007017	0.085369
National Library of Australia	0.290211715	0.02683005	0.060186617	0.041548	0.182379
National Library of Brazil	0.241843096	0.03127855	0.014410478	0.105256	0.001552
National Library of Canada	0.266027406	0.16334354	0.176699903	0.157515	0.135814
National Library of South Korea	0.217658786	0.03475395	0.108702412	0.110796	0.147507
Bibliothèque Nationale De France	0.241843096	0.14596657	0.29709913	0.424717	0.224947
National Library of Mexico	0.193474477	0.00451801	0.104439572	0.055398	0.147455
National Library of Russia	0.145105858	0.13901578	0.024937612	0.34162	0.244465
National Library of Turkey	0.193474477	0.01390158	0.000779788	0.120029	0.108651
National Library of	0.193474477	0.15038032	0.084347041	0.25206	0.036088

China					
German National Library	0.314396025	0.17029433	0.064332489	0.113935	0.282881
National Diet Library	0.229750941	0.1532649	0.001515128	0.16527	0.036049
King Fahd National Library	0.338580334	0.00834095	0.08224863	0.064631	0.240585
National Library of Indonesia	0.193474477	0.03009692	0.042456016	0.207003	0.195747
National Library of India	0.193474477	0.00868849	0.009617382	0.083097	0.240585
National Library of South Africa	0.193474477	0.01911467	0.000584841	0.036932	0.128053

The calculation of multiplication of normalized matrix with weightage mentioned in below table.

$$V_{ij} = \overline{X}_{ij} \times W_j$$

Table 3: Multiplication of normalized matrix with weightage to determine weightage normalized matrix

National Library	Total Minutes	Collection (in millions)	Budget (INR)	Staff	Library Space (sq mtr)
The British Library	0.04111	0.13902	0.03695	0.07301	0.00722
Library of Congress	0.04111	0.12164	0.1788	0.11715	0.14435
Bibliotheca Nacional Mariano Moreno (Argentina)	0.05804	0.0007	0.00054	0.0014	0.01707
National Library of Australia	0.05804	0.00537	0.01204	0.00831	0.03648
National Library of Brazil	0.04837	0.00626	0.00288	0.02105	0.00031
National Library of Canada	0.05321	0.03267	0.03534	0.0315	0.02716
National Library of South Korea	0.04353	0.00695	0.02174	0.02216	0.0295
Bibliothèque Nationale De France	0.04837	0.02919	0.05942	0.08494	0.04499
National Library of Mexico	0.03869	0.0009	0.02089	0.01108	0.02949
National Library of Russia	0.02902	0.0278	0.00499	0.06832	0.04889
National Library of Turkey	0.03869	0.00278	0.00016	0.02401	0.02173
National Library of China	0.03869	0.03008	0.01687	0.05041	0.00722

German National Library	0.06288	0.03406	0.01287	0.02279	0.05658
National Diet Library	0.04595	0.03065	0.0003	0.03305	0.00721
King Fahd National Library	0.06772	0.00167	0.01645	0.01293	0.04812
National Library of Indonesia	0.03869	0.00602	0.00849	0.0414	0.03915
National Library of India	0.03869	0.00174	0.00192	0.01662	0.04812
National Library of South Africa	0.03869	0.00382	0.00012	0.00739	0.02561

Highest value was taken as V+ and worst alternative was taken as V- among working hours, Collection, Budget, Staff, and Library Space

Table 4: Determine the highest and worst weightage normalized matrix

V+	0.067716067	0.13901578	0.17880481	0.117148	0.144351
V-	0.029021172	0.00069508	0.000116968	0.001403	0.00031

Then best and worst alternatives are deducted from the weightage normalized matrix

$$s_i^+ = \left[\sum_{j=1}^m (V_{ij} - V_j^+)^2 \right]^{0.5}$$

$$s_i^- = \left[\sum_{j=1}^m (V_{ij} - V_j^-)^2 \right]^{0.5}$$

Then calculate the performance evaluation and ranking on the basis of highest result.

$$P_i = \frac{s_i^-}{s_i^+ + s_i^-}$$

Table 5: Performance on TOPSIS

National Library	S+	S-	Pi
The British Library	0.203922	0.160659	0.440668

Library of Congress	0.031775	0.284337	0.899481
Bibliotheca Nacional Mariano Moreno (Argentina)	0.283902	0.033517	0.105594
National Library of Australia	0.263154	0.048598	0.155887
National Library of Brazil	0.280946	0.028265	0.091411
National Library of Canada	0.230587	0.066895	0.224869
National Library of South Korea	0.254771	0.044723	0.149329
Bibliothèque Nationale De France	0.193902	0.116955	0.376234
National Library of Mexico	0.263246	0.038343	0.127137
National Library of Russia	0.235741	0.087162	0.269932
National Library of Turkey	0.273914	0.032674	0.106573
National Library of China	0.249384	0.060721	0.195807
German National Library	0.234911	0.077751	0.248673
National Diet Library	0.264497	0.04726	0.151591
King Fahd National Library	0.25563	0.064678	0.201924
National Library of Indonesia	0.253657	0.057448	0.184658
National Library of India	0.26522	0.051136	0.161642
National Library of South Africa	0.277841	0.027915	0.091299

The results presented by TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) analysis applied to various national libraries on the basis of three criteria:

- S+ (Positive Ideal Solution Proximity): The closeness of each library to the best possible performance.

- S- (Negative Ideal Solution Proximity): The closeness of each library to the worst possible performance.
- Pi (Relative Closeness to the Ideal Solution): The final ranking score that determines the library's overall preference order.

Table 6: Identification of rank

National Library	Pi	Rank
Library of Congress	0.899481112	1
The British Library	0.440667678	2
Bibliothèque Nationale De France	0.376233937	3
National Library of Russia	0.269932068	4
German National Library	0.248673189	5
National Library of Canada	0.22486935	6
King Fahd National Library	0.201924305	7
National Library of China	0.195807445	8
National Library of Indonesia	0.184658326	9
National Library of India	0.161641607	10
National Library of Australia	0.155886774	11
National Diet Library	0.151591277	12
National Library of South Korea	0.149329395	13
National Library of Mexico	0.127137028	14
National Library of Turkey	0.106573481	15
Bibliotheca Nacional Mariano Moreno	0.105593599	16

(Argentina)		
National Library of Brazil	0.091410873	17
National Library of South Africa	0.091299054	18

The Library of Congress has the highest Pi value i.e. 0.899481, meaning it is most ideal solution among the national libraries considered. The National Library of South Africa (0.091299) and the National Library of Brazil i.e. 0.091411 have the lowest Pi values, indicating they are the farthest from the ideal solution.

To calculate User Satisfaction Rate, information has been gathered mainly from TripAdvisor, where the review is below 50, then data have been taken from Google review. The percentage has been calculated on positive review.

$$\text{Percentage of positive review} = \frac{\text{Positive Review}}{\text{Total review}} * 100$$

Table 7: User Satisfaction Rate

National Libraries	Total Reviews	Positive Reviews	Percentage of Positive Reviews	Rank
Library of Congress	9794	9187	94	1
National Library of Indonesia	8337	7836	94	1
The British Library	4031	3715	92	2
National Library of South Korea	288	264	92	2
National Library of Russia	218	209	92	2
National Library of China	65	60	92	2
National Library of Australia	704	639	91	3
National Library of India	107	95	89	4

Library and Archives Canada	79	68	86	5
King Fahd National Library	3902	3356	86	5
National Library of Brazil	810	688	85	6
National Library of Turkey	1340	1126	84	7
National Library of South Africa	198	166	84	7
German National Library	248	198	80	8
National Diet Library	128	101	77	9
Bibliotheca Nacional Mariano Moreno (Argentina)	314	237	75	10
National Library of Mexico	492	350	71	11
Bibliothèque Nationale De France	479	230	48	12

The Table No 7 shows user satisfaction rate based on positive reviews. The user satisfaction rates for national libraries reveal that the Library of Congress and the National Library of Indonesia share the highest positive review percentage at 94%, earning them the top rank. Several other prominent libraries, including The British Library, and the National Libraries of South Korea, Russia, and China, follow closely with a 92% satisfaction rate, placing them in second position. Bibliothèque Nationale de France stands out with the lowest satisfaction rate of 48%

Table No 8 shows the correlation of TOPSIS rank and User Satisfaction rank and the correlation has been made on both ranks.

Table 8: Comparison of Ranks with Spearman Rank Correlation

National Library	TOPSIS Rank	User Satisfactory Rank
Library of Congress	1	1
The British Library	2	2
Bibliothèque Nationale De France	3	12
National Library of Russia	4	2
German National Library	5	8

National Library of Canada	6	5
King Fahd National Library	7	5
National Library of China	8	2
National Library of Indonesia	9	1
National Library of India	10	4
National Library of Australia	11	3
National Diet Library	12	9
National Library of South Korea	13	2
National Library of Mexico	14	11
National Library of Turkey	15	7
Bibliotheca Nacional Mariano Moreno (Argentina)	16	10
National Library of Brazil	17	6
National Library of South Africa	18	7

Formula

$$\text{Spearman Rank Correlation} = 1 - (6 * \Sigma d^2) / (n * (n^2 - 1))$$

$$= 0.195046439628483$$

The result of correlation shows very slight positive relation between TOPSIS Rank and User Satisfaction Rank. It means traditional metrics does not affect on user satisfaction.

The graphical representation is showing below-

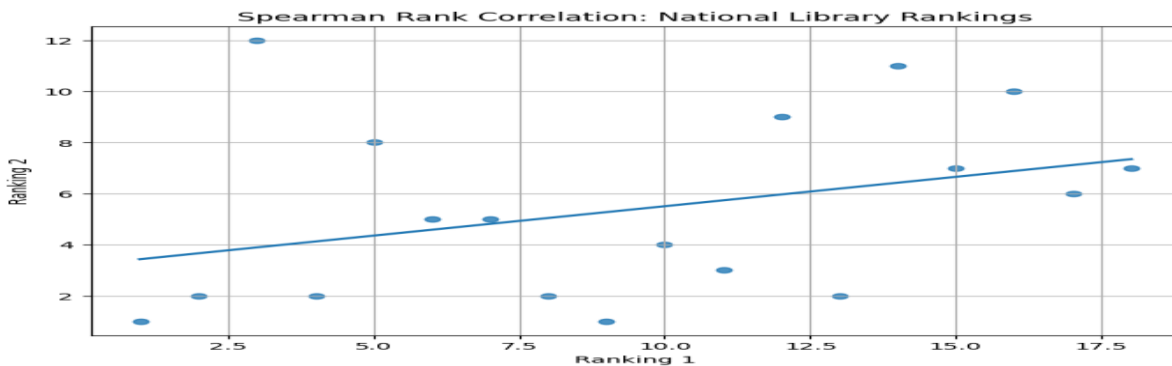


Figure 1: Correlation between TOPSIS rank and User satisfaction

The result implies a slight tendency for the rankings is quite similar, but the correlation is weak. The two rankings may share some common evaluation criteria but also have significant differences. The result implies that traditional library metrics do not fully determine the user satisfaction. Some drawbacks of National Libraries mentioned in the TripAdvisor and Google review like staff unfriendliness, not ease to use, more time in accessibility of books.

Social media is important way of sharing information. Facebook is one of the important tools of social media. SocialInsider tools are used to retrieve data i.e. average post per day, average engagement per post, followers in thousand and these are showing in table 9.

Table 9: Facebook average post per day, average engagement and followers

National Library	Facebook Link	Average Post Per Day	Average Engagement Per Post	Followers in thousand
The British Library	https://www.facebook.com/britishlibrary	0.4	415	186
Library of Congress	https://www.facebook.com/libraryofcongress	0.7	537	562
National Library of Argentina	https://www.facebook.com/@BNMMArentina	0.9	274	166
National Library of Australia	https://www.facebook.com/National.Library.of.Australia	0.7	39	68
National Library of Brazil	https://www.facebook.com/biblioteca nacional.br	1.6	59	235
National Library of Canada	https://www.facebook.com/LibraryArchives	0.8	51	69

National Library of South Korea	https://www.facebook.com/national.library.of.korea	0.4	21	7.4
National Library of France	https://www.facebook.com/bibliotheqnebnf	0.8	294	237
National Library of Mexico	https://www.facebook.com/BiblioNacMex.HemeroNacMex.IIBUNAM/	1.4	19	44
National Library of Russia	https://www.facebook.com/nlr.ru	0.9	5	3
National Library of Turkey	https://www.facebook.com/TCKulturTurizm	0.8	68	135
National Library of China	NA	NA	NA	NA
German National Library	https://www.facebook.com/DeutscheNationalbibliothek	0.2	2	8.6
National Diet Library	NA	NA	NA	NA
King Fahad National Library	https://www.facebook.com/kfnl.govsa	0	0	9.3
National Library of Indonesia	https://www.facebook.com/ayokeperpusnas/	1.7	92	171
National Library of India	https://www.facebook.com/nationallibrary.goi	2.5	37	47
National Library of South Africa	https://www.facebook.com/NationalLibraryofSA	0.4	9	17

In Table no 9, average engagement per post, followers of Library of Congress are showing highest and National Library of India is showing highest in average post per day on Facebook.

Table No 10 shows the average post per day, average engagement per post and followers in thousands of different National Libraries. Data have been gathered by Social Insider tool.

Table 10: Twitter average post per day, average engagement and followers

National Library	Twitter Link	Average Post Per Day	Average Engagement Per Post	Followers in thousand
The British Library	https://x.com/britishlibrary	0.4	55	1700
Library of Congress	https://x.com/librarycongress	0.9	361	1200
National Library of Argentina	https://x.com/BNMMArgentina	0.3	1	20.2
National Library of Australia	https://x.com/nlagovau	0.1	7	45.9
National Library of Brazil	https://x.com/BibNacionalBR	1.4	9	1408
National Library of Canada	https://x.com/BiblioArchives	0.5	4	7315
National Library of South Korea	https://x.com/library1004	0.4	3	9491
Bibliothèque Nationale De France	https://x.com/laBnF	2.4	25	245.2
National Library of Mexico	https://x.com/IIBUNAM	2.1	8	14
National Library of Russia	https://x.com/NLR_library	1.9	3	2440
National Library of Turkey	https://x.com/TCKulturTurizm	1.6	163	453.9
National Library of China	NA	NA	NA	NA
German National Library	https://x.com/DNB_Aktuelles	0.1	2	6443
National Diet Library	https://x.com/NDLJP_en	1.3	13	7830

King Fahd National Library	https://x.com/KFNLGOV	1.5	23	83.3
National Library of Indonesia	https://x.com/perpusnas1	0.6	3	53
National Library of India	https://x.com/NationalLibGoI	2.4	5	6238
National Library of South Africa	https://x.com/NLSA1	0.1	2	3019

Table No 10 represents average post per day, average engagement per post and followers in thousand. Bibliotheque Nationale De France and National Library of India post more. Library of Congress shows highest engagement per post. National Library of South Korea shows highest followers in twitter.

Table No 11 shows average post per day, average engagement per post and followers in thousand in Instagram of different National Libraries.

Table 11: Instagram average post per day, average engagement and followers

National Library	Instagram Link	Average Post Per Day	Average Engagement Per Post	Followers In thousand
The British Library	https://www.instagram.com/britishlibrary/	0.6	1257	435
Library of Congress	https://www.instagram.com/librarycongress/	1	2121	332
Biblioteca Nacional Mariano Moreno (Argentina)	https://www.instagram.com/biblioteca_nacional_argentina/	1	232	93.1
National Library of Australia	https://www.instagram.com/nationallibraryaus/	0.6	51	29.5
National Library of Brazil	https://www.instagram.com/bibliotecanacional.br	2	500	103
National Library of Canada	https://www.instagram.com/libraryarchives/?hl=en	0.4	62	16.3
National Library of	https://www.instagram.co	0.7	74	19.5

South Korea	m/nationallibraryofkorea/			
Bibliothèque Nationale De France	https://www.instagram.com/labnf/	0.6	1121	167
National Library of Mexico	https://www.instagram.com/bibliotecanacionaldemexico/	0.3	54	14.2
National Library of Russia	NA	NA	NA	NA
National Library of Turkey	https://www.instagram.com/tckulturturizm/	0.9	74	242
National Library of China	NA	NA	NA	NA
German National Library	https://www.instagram.com/deutschenationalbibliothek/	2.4	1054	1784
National Diet Library	NA	NA	NA	NA
King Fahd National Library	https://www.instagram.com/kfnlgov	1.7	5	7628
National Library of Indonesia	https://www.instagram.com/perpusnas.go.id/	1.5	550	363
National Library of India	https://www.instagram.com/nationallibrary.goi/	2.1	34	1715
National Library of South Africa	NA	NA	NA	NA

The Table No 11 shows the Library of Congress's average engagement per post is higher than others National Libraries. German National Library posts more updates. Followers of King Fahd National Library are higher in Instagram.

Table No 12 represents average video per day, average engagement per post and subscribers in thousand on YouTube.

Table 12: YouTube Average post per day, average engagement and followers

National Library	YouTube link	Average Video Per Day	Average Engagement Per Post	Subscribers In thousand
The British Library	https://www.youtube.com/@britishlibrary	0.7	15	83.5
Library of Congress	https://www.youtube.com/@loc	0.6	8	328
Biblioteca Nacional Mariano Moreno (Argentina)	https://www.youtube.com/@bnarg	1.2	11	51.4
National Library of Australia	https://www.youtube.com/@NationalLibraryofAustralia	0.5	1	5.7
National Library of Brazil	https://www.youtube.com/Funda%C3%A7%C3%A3oBibliotecaNacional	0.8	9	14.3
National Library of Canada	https://www.youtube.com/@LibraryArchiveCanada	0.4	5	16
National Library of South Korea	https://www.youtube.com/channel/UCKjWKI1yRlZWfgnF98HZ_TA	0.3	4	8.87
Bibliothèque Nationale De France	https://www.youtube.com/@BibliothèqueNf	0.6	15	36.3
National Library of Mexico	https://www.youtube.com/BibliotecaNacionaldeMexico/playlists	0.3	7	4.67
National Library of Russia	NA	NA	NA	NA
National Library of Turkey	https://www.youtube.com/user/KulturTurizmBak	0.9	11	63.8
National Library of China	NA	NA	NA	NA
German National Library	https://www.youtube.com/@DeutscheNationalbibliothek	0.1	1	486
National Diet Library	https://www.youtube.com/@nationaldietlib	0.2	1	7.01

	raryjapan4964			
King Fahd National Library	https://www.youtube.com/channel/UCNTtXgOqs8mnEKkPz4CBWHw	0.1	1	0.807
National Library of Indonesia	https://www.youtube.com/@PerpustakaanNasionalRI	0.1	19	72
National Library of India	https://www.youtube.com/@nationallibraryofindia	0.1	1	0.741
National Library of South Africa	https://www.youtube.com/@NLSAvideos	0.2	1	0.207

From the above table, Bibliotheque Nacional Mariano Moreno posts more videos in Youtube. German National Library has more subscribers in Youtube and Users of National Library of Indonesia are more engaged in Youtube.

The exact relation of posts with user engagement is calculated below. From where it is able to understand the whether there is any positive connection of post per day and engagement per post.

The Pearson correlation coefficient measures the strength and direction of the relationship between posts per day and engagement per post.

The formula is:

$$Correl(X, Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

x= post per day

y= engagement per post

- Facebook Correlation: -0.10871791864918018
- Twitter Correlation: 0.03759665944152038
- Instagram Correlation: 0.05074936316803248
- YouTube Correlation: 0.4749450805359161

Youtube only shows positive correlation. It implies that the video post per day and engagement of users correlates each other. Twitter, Instagram also represents weakly positive correlation whereas facebook indicates negative correlation that means no significant relation is there. Graphical representation is given below.

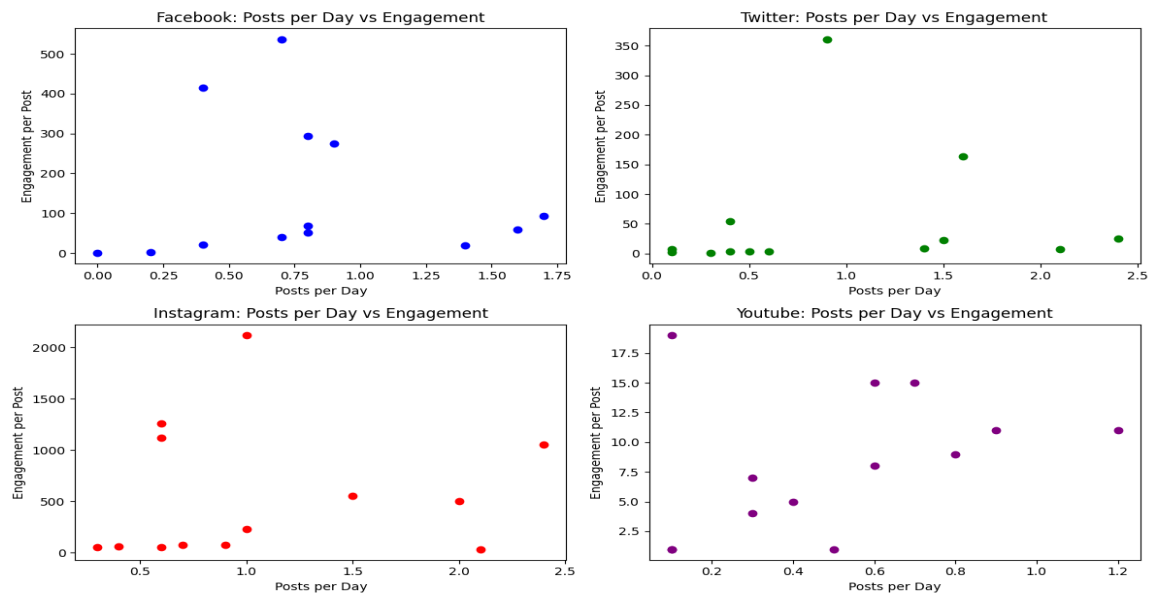


Figure 2: Platform specific comparison of post per day and engagement

Pearson Correlation Coefficients (r) on engagement per post and followers

$$\text{Correl}(X, Y) = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

Value of variable

x =engagement per post

y=followers

- Facebook Correlation: 0.8544480796294764
- Twitter Correlation: -0.22986986828496242
- Instagram Correlation: 0.1739688250189868
- YouTube Correlation: -0.022437690488010042

Facebook has strongest positive correlation. It implies that there is a significant relationship between post and followers of National Libraries data. Slightly correlation shows in Instagram. Youtube shows negative correlation. It implies that there is no significant relationship shows for engagement and followers in Twitter and Youtube. A scatter diagram is shown in below

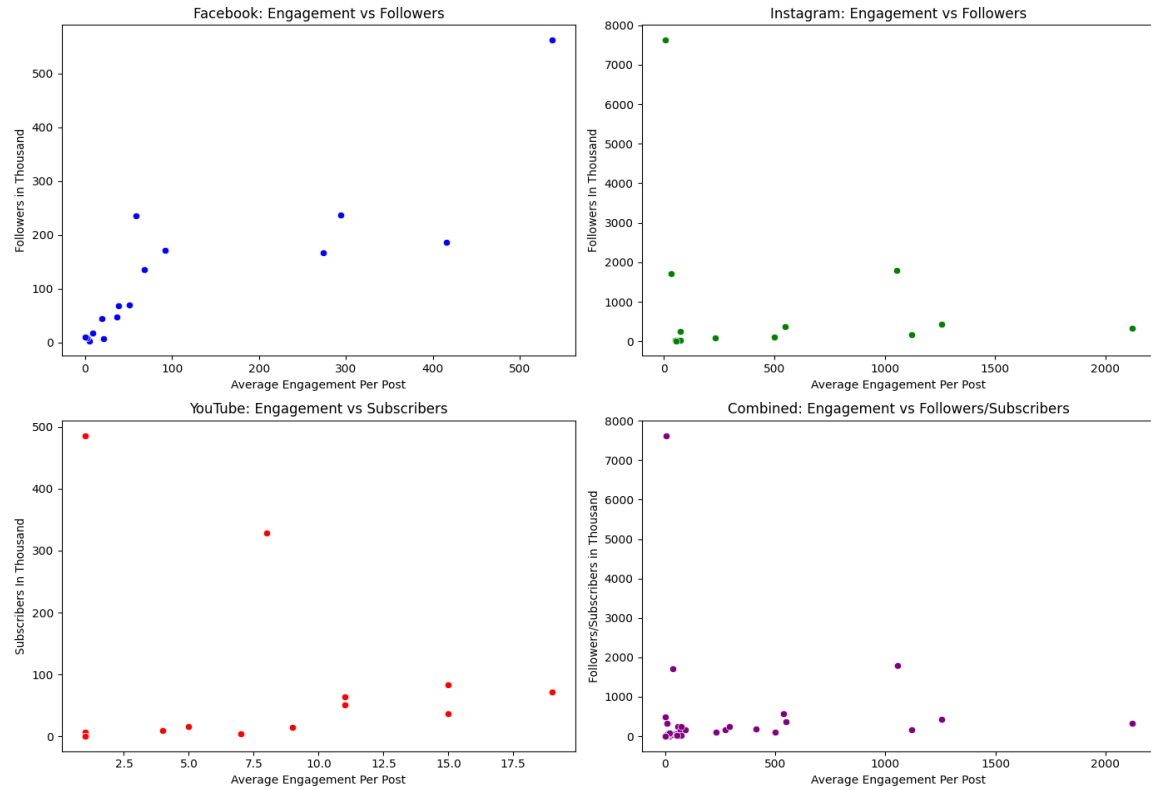


Figure 3: Platform specific comparison of post per day and followers

Table 13: Total engagement of National Library of G20 countries in social media

National Library	Facebook	Twitter	Instagram	YouTube	Total
The British Library	415	55	1257	15	1742
Library of Congress (USA)	537	361	2121	8	3027
National Library of Australia	39	7	51	1	98
National Library of Canada	51	4	62	5	122
National Library of France	294	25	1121	15	1455
German National Library	2	2	1054	1	1059
National Diet Library (Japan)	NA	13	NA	1	14
National Library of South Korea	21	3	74	4	102
National Library of	5	3	NA	NA	8

Russia					
National Library of Argentina	274	1	232	11	518
National Library of Brazil	59	9	500	9	577
National Library of Mexico	19	8	54	7	88
National Library of Turkey	68	163	74	11	316
King Fahad National Library (KSA)	0	23	5	1	29
National Library of Indonesia	92	3	550	19	664
National Library of India	37	5	34	1	77
National Library of South Africa	9	2	NA	1	12
National Library of China	NA	NA	NA	NA	
Total Engagement of G20 Countries	1922	687	7189	110	

Table 13 provides a comparative overview of the total social media engagement (likes, shares, comments, etc.) across four platforms i.e. Facebook, Twitter, Instagram, and YouTube for the national libraries of G20 countries. The data shows that Instagram is the most engaging platform overall, generating 7189 interactions, followed by Facebook, Twitter and Youtube. The LOC records the highest total engagement with 3027, followed by British Library. Total engagement of National Library of Russia is showing lowest.

The bar chart is mentioned:

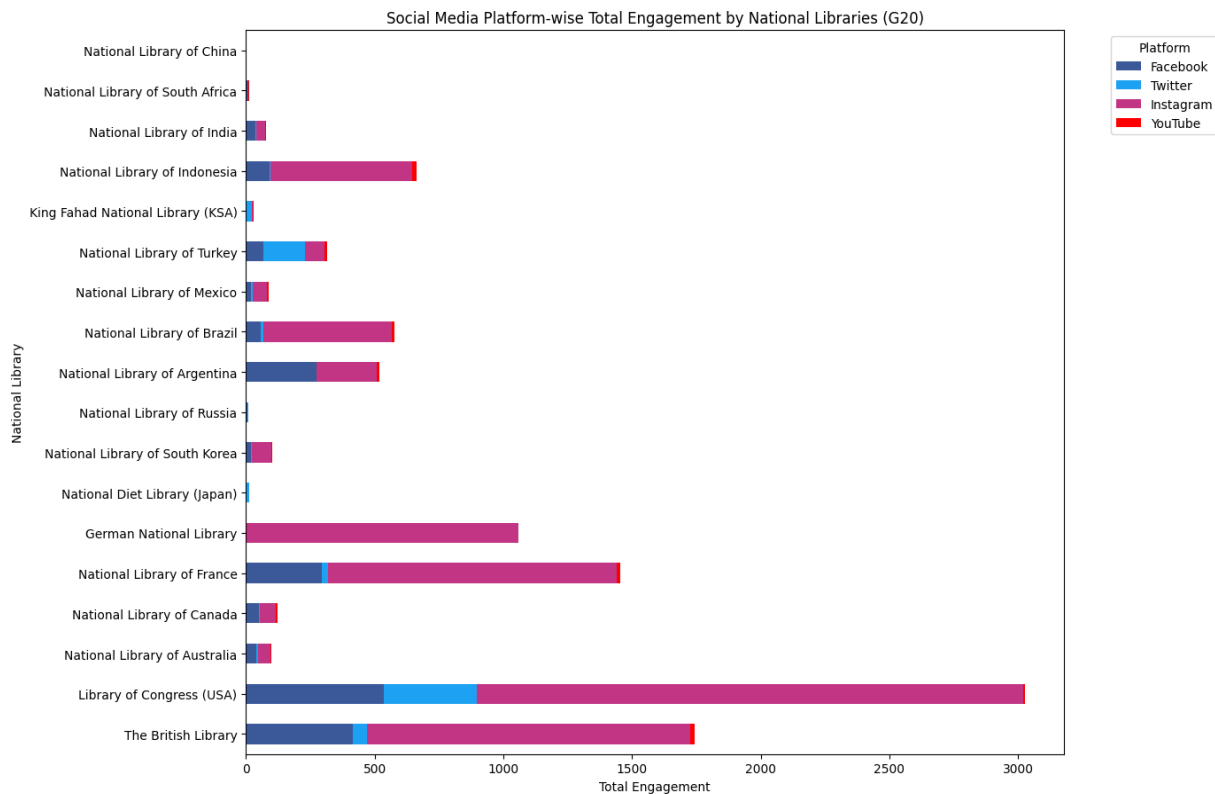


Figure 4: Platform specific comparison of social media engagement for individual National Library

Table 14: Total post of National Library of G20 countries in social media

National Library	Facebook	Twitter	Instagram	YouTube	Total Posts/Day
The British Library	0.4	0.4	0.6	0.7	2.1
Library of Congress (USA)	0.7	0.9	1	0.6	3.2
National Library of Australia	0.7	0.1	0.6	0.5	1.9
National Library of Canada	0.8	0.5	0.4	0.4	2.1
National Library of France	0.8	2.4	0.6	0.6	4.4

German National Library	0.2	0.1	2.4	0.1	2.8
National Diet Library (Japan)	NA	1.3	NA	0.2	1.5
German National Library	0.2	0.1	2.4	0.1	2.8
National Library of Russia	0.9	1.9	NA	NA	2.8
National Library of Argentina	0.9	0.3	1	1.2	3.4
National Library of Brazil	1.6	1.4	2	0.8	5.8
National Library of Mexico	1.4	2.1	0.3	0.3	4.1
National Library of Turkey	0.8	1.6	0.9	0.9	4.2
King Fahad National Library (KSA)	0	1.5	1.7	0.1	3.3
National Library of Indonesia	1.7	0.6	1.5	0.1	3.9
National Library of India	2.5	2.4	2.1	0.1	7.1
National Library of South Africa	0.4	0.1	NA	0.2	0.7
National Library of China	NA	NA	NA	NA	NA
Total Post of G20 National Library	14	17.7	17.5	6.9	

Table No 14 shows more post of National Libraries are posted in twitter i.e. 17.7 per day, emerge as the most frequently used, followed by Instagram, Facebook and Youtube. The table presents the average number of social media posts per day by national libraries of G20 countries, categorized by platform i.e. Facebook, Twitter, Instagram, and YouTube and includes a total posting rate per library. Among all the national libraries, the National

Library of India stands out as the most active, with a total of 7.1 posts per day, primarily driven by high activity on Facebook (2.5), Twitter (2.4), and Instagram (2.1). The bar chart is mentioned -

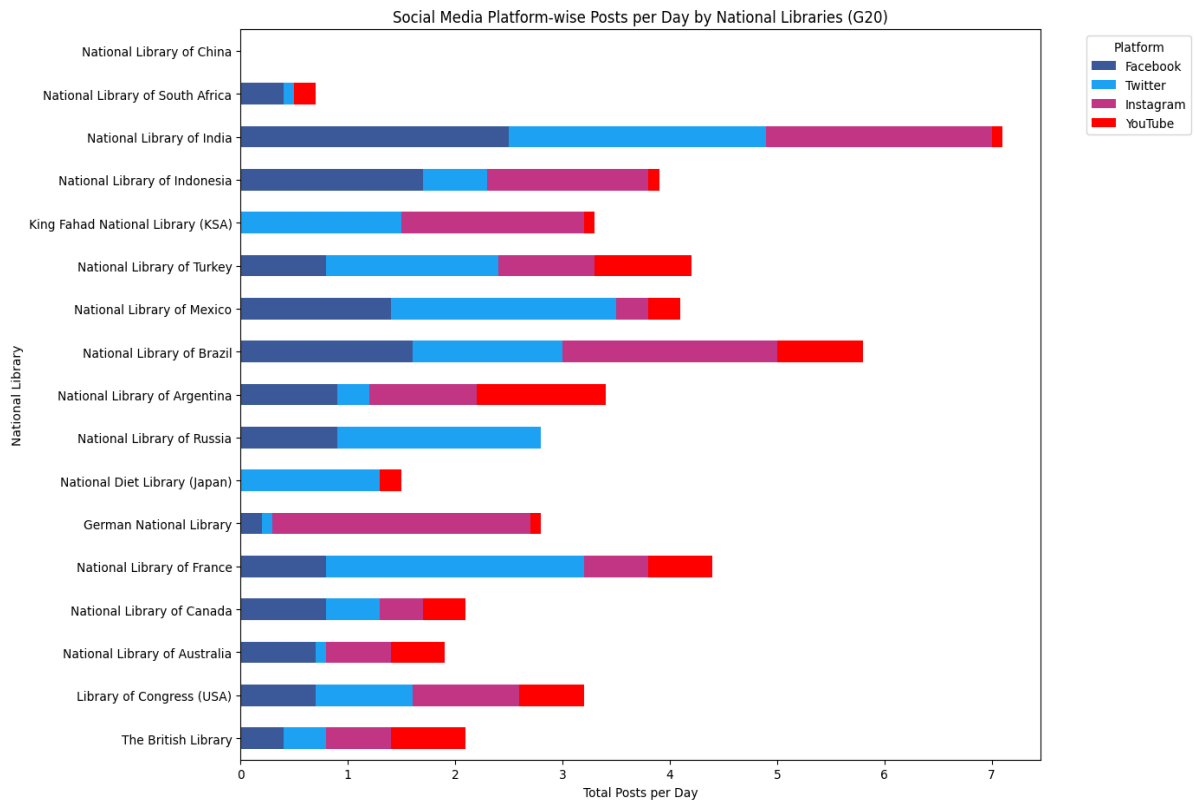


Figure 5: Platform specific comparison of social media post for individual National Library

Instagram shows the highest engagement as social media platforms but the more used (by post) social media are Twitter. Out of 18 National Libraries, 17 National Libraries have twitter account. 16 have Facebook and Youtube account and 14 have Instragram account. A pictorial diagram is mentioned next.

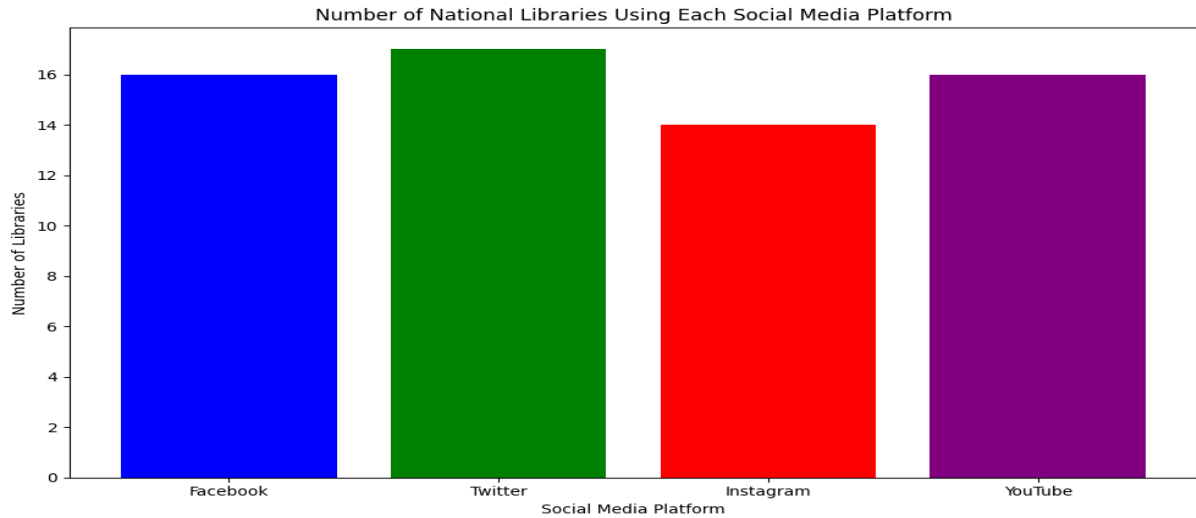


Figure 6: Platform specific comparison of social media usage

Instead 14 libraries has Instagram account, the engagement of followers are more than the others social media platform. Instagram generates the most engagement for most national libraries, particularly for libraries like Library of Congress and The British Library. Twitter and Facebook are also strong platforms, though their engagement varies by library. YouTube shows the lowest engagement across all platforms, particularly for libraries that post infrequently, though 16 libraries has their official Youtube account. The scenario of National Libraries presence is social media is given-

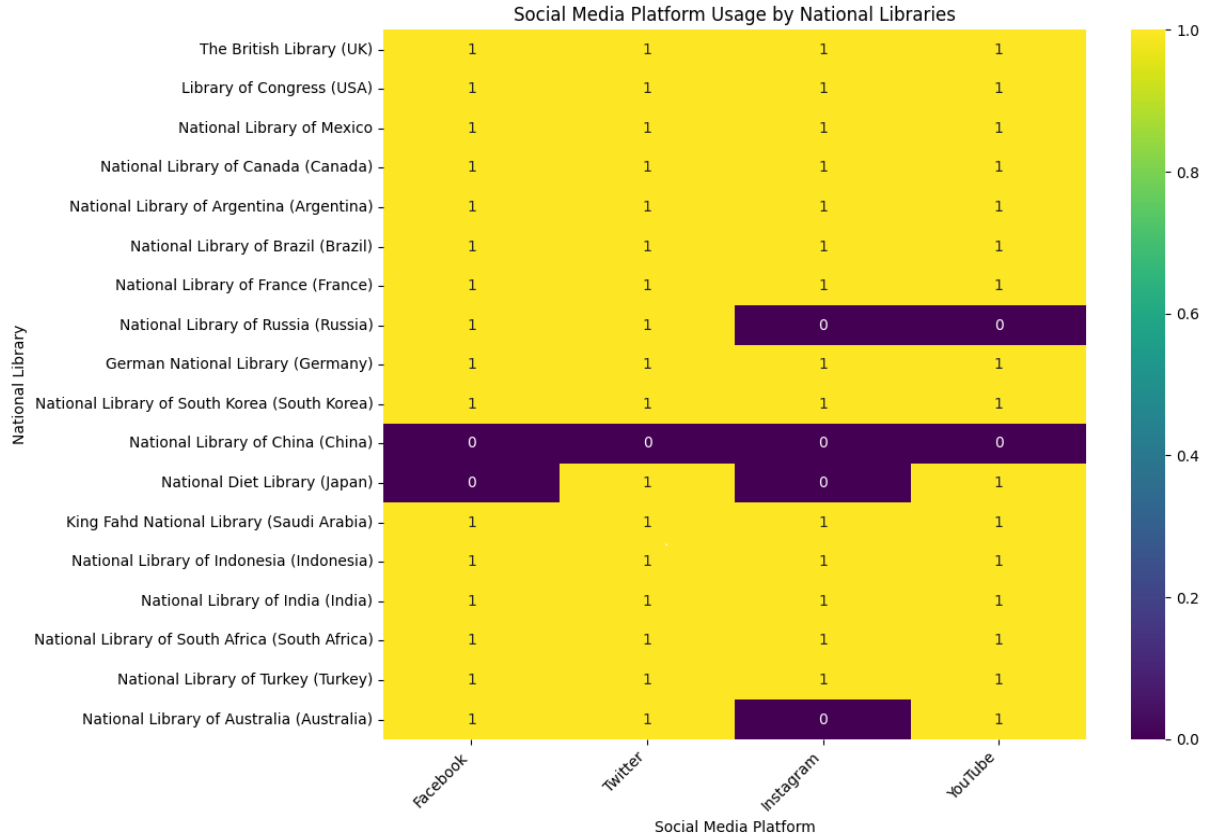


Figure 7: Platform usage by National Library

Table 15: Correlation between Social Media Engagement and TOPSIS Rank

National Library	Rank on Engagement in social media	TOPSIS Rank
Library of Congress	1	1
The British Library	2	2
Bibliothèque Nationale De France	3	3
National Library of Russia	17	4
German National Library	4	5
National Library of Canada	9	6
King Fahd National Library	14	7
National Library of China	18	8
National Library of Indonesia	5	9
National Library of India	13	10

National Library of Australia	11	11
National Diet Library	15	12
National Library of South Korea	10	13
National Library of Mexico	12	14
National Library of Turkey	8	15
Bibliotheca Nacional Mariano Moreno (Argentina)	7	16
National Library of Brazil	6	17
National Library of South Africa	16	18

Table no 15 shows Spearman rank correlation= $p = 0.34984520123839014$ provides a positive correlation between TOPSIS rank and social media engagement rank. It implies that top most library or traditionally rich library somewhat focus on the social media outreach. Though library of Congress, British Library and Bibliotheque Nationale De France have aligned ranking in both categories.

Table 16: Correlation between Social Media Engagement and User Satisfaction Rank

National Library	Rank on Engagement in social media	Rank on User Satisfaction
Library of Congress	1	1
The British Library	2	2
Bibliotheque Nationale De France	3	12
National Library of Russia	17	2
German National Library	4	8
National Library of Canada	9	5
King Fahd National Library	14	5
National Library of China	18	2
National Library of Indonesia	5	1
National Library of India	13	4
National Library of Australia	11	3
National Diet Library	15	9

National Library of South Korea	10	2
National Library of Mexico	12	11
National Library of Turkey	8	7
Bibliotheca Nacional Mariano Moreno (Argentina)	7	10
National Library of Brazil	6	6
National Library of South Africa	16	7

Table No 16 shows the rank Spearman Rank Correlation= $\rho=0.0260$. The value of Correlation is very close to zero. It implies there is almost zero correlation between social media engagement and user satisfaction.

Table 17: Correlation between Post per Day and Social Media Engagement Rank

National Library	Rank on post per day	Rank on Engagement in social media
National Library of India	1	13
National Library of Brazil	2	6
National Library of France	3	3
National Library of Turkey	4	8
National Library of Mexico	5	12
National Library of Indonesia	6	5
National Library of Argentina	7	7
King Fahad National Library	8	14
Library of Congress	9	1
National Library of Russia	10	17
German National Library	11	4
The British Library	12	2
National Library of Canada	13	9
National Library of Australia	14	11
National Library of South Korea	15	10
National Diet Library	16	15
National Library of South Africa	17	16
National Library of China	18	18

The above table shows the Spearman rank correlation= $p= 0.4055727554179567$ between rank on post per day and rank on engagement per post. This implies engagement per post somewhat depends on posting frequency.

Table 18: Correlation between TOPSIS Rank and Rank on Post Per Day

National Library	TOPSIS Rank	Rank on Post per day
Library of Congress	1	9
The British Library	2	12
Bibliothèque Nationale De France	3	3
National Library of Russia	4	10
German National Library	5	11
National Library of Canada	6	14
King Fahd National Library	7	8
National Library of China	8	18
National Library of Indonesia	9	6
National Library of India	10	1
National Library of Australia	11	14
National Diet Library	12	16
National Library of South Korea	13	15
National Library of Mexico	14	5
National Library of Turkey	15	4
Biblioteca Nacional Mariano Moreno (Argentina)	16	7
National Library of Brazil	17	2
National Library of South Africa	18	17

The above table shows TOPSIS rank of library and Rank on post per day. Spearman rank correlation= $p= -0.062$ provides a negative correlation between TOPSIS rank and social media posting frequency rank.

Table 19: Region-wise Engagement and post

North America		Pi	Post	Engagement
Library of Congress	United States	0.899481	3.2	3027
National Library of Canada	Canada	0.224869	2.1	122
National Library of Mexico	Mexico	0.127137	4.1	88
Average		1.251487	9.4	3237
		0.417162	3.133333	1079
South America		Pi	Post	Engagement
Bibliotheca Nacional Mariano Moreno	Argentina	0.105594	3.4	518
National Library of Brazil	Brazil	0.091411	5.8	577
Average		0.197004	9.2	1095
		0.098502	4.6	547.5
Europe		Pi	Post	Engagement
The British Library	United Kingdom	0.440668	2.1	1742
Bibliothèque Nationale de France	France	0.376234	4.4	1455
National Library of Russia	Russia*	0.269932	2.8	8
German National Library	Germany	0.248673	2.8	1059
National Library of Turkey	Turkey	0.106573	4.2	316
Average		1.44208	16.3	4580
		0.288416	3.26	916
Asia		Pi	Post	Engagement
King Fahd National Library	Saudi Arabia	0.201924	3.3	29
National Library of China	China	0.195807	NA	NA
National Library of India	India	0.161642	7.1	77
National Library of Indonesia	Indonesia	0.184658	3.9	664
National Diet Library	Japan	0.151591	1.5	14
National Library of South Korea	South Korea	0.149329	0.7	102
Average		1.044952	16.5	886
		0.174159	2.75	147.6666667
Africa		Pi	Post	Engagement
National Library of South Africa	South Africa	0.091299	0.7	12
Australia				
National Library of Australia	Australia	0.155887	1.9	98

The above table shows the differences in social media activity and engagement across continents. North America, with three libraries, posts on average 1079 interactions. South

America’s two libraries post more frequently i.e. 4.6 but the Pi score is more for Naorth American National Library.

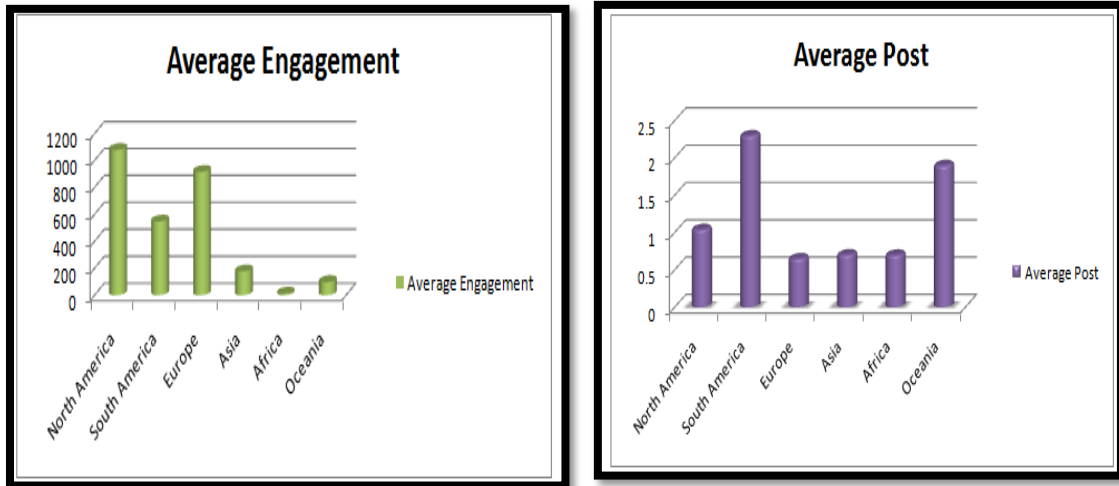


Figure 8: Cross regional comparison

Table 20 presents a comparative analysis of the social media performance of national libraries from developed and developing countries, based on the TOPSIS (Pi) values along with operational social media indicators such as posting frequency (posts/day), engagement per post, and followers per post (in thousands). The inclusion of both developed and developing nations highlights the contrast in digital strategies, user interactions, and overall visibility of national libraries across different economic contexts.

Table 20: Comparison on Economic Developed and Developing Country

National Library	Developed Country	Pi Value	Total Posts/Day	Total Engagement per post	Total (k) followers per post
Library of Congress	United States	0.899481112	3.2	3027	2422
The British Library	United Kingdom	0.440667678	2.1	1742	2404.5
Bibliothèque Nationale de France	France	0.376233937	4.4	1455	685.5
German National Library	Germany	0.248673189	2.8	1059	8721.6
National Library of Canada	Canada	0.22486935	4.4	122	7416.3
National Library of Australia	Australia	0.155886774	1.9	98	149.1
National Diet Library	Japan	0.151591277	1.5	14	7837.01
National Library of South Korea	South Korea	0.149329395	2.8	102	9526.77
National Library	Developing Country	Pi Value	Total Posts/Day	Total Engagement per post	Total (k) Followers per post
National Library of Russia	Russia	0.269932068	2.8	8	2443
King Fahd National Library	Saudi Arabia	0.201924305	3.3	29	7721.4
National Library of China	China	0.195807445	NA	NA	NA
National Library of Indonesia	Indonesia	0.184658326	3.4	664	659
National Library of India	India	0.161641607	7.1	77	8000.7
National Library of Mexico	Mexico	0.127137028	4.1	88	76.87
National Library of Turkey	Turkey	0.106573481	4.2	316	894.7
Bibliotheca Nacional Mariano Moreno	Argentina	0.105593599	3.4	518	330.7
National Library of Brazil	Brazil	0.091410873	5.8	577	1760.3
National Library of South Africa	South Africa	0.091299054	0.7	12	3036.2

The above table shows comparison social media activity and engagement metrics between national libraries of economically developed and developing countries. Libraries in developed countries, such as the Library of Congress and The British Library, tend to have high engagement per post (3027 and 1742 respectively) and large follower bases relative to their posting frequency. However, some developed-country libraries, like the National Diet Library and National Library of South Korea, show lower engagement despite a moderate number of posts. Developing country libraries generally post more frequently, with some like National Library of India posting 7.1 times per day, but they often have lower engagement per post. Overall, developed country libraries show stronger engagement and larger follower counts per post, while developing country libraries focus on higher posting volumes with varied engagement results.

Table 21: Comparison on Economic Developed and Developing Country

		Social Media		
	Average Pi Score	Average Post Frequency	Average Engagement	Average Followers Count
Developed Country	0.33084159	2.6	952.375	4895.348
Developing Country	0.15359778	3.53	228.9	2492.293

Table 21 represents the social media performance differences between national libraries in developed and developing countries. Libraries in developed countries have a higher average Pi score (0.33), indicating stronger traditional metrics. They post less frequently,

averaging 2.6 posts per day, but achieve significantly higher average engagement per post (952) and have nearly double the average follower count (4,895k) compared to libraries in developing countries. In contrast, developing country libraries post more often (3.53 posts per day) but receive much lower engagement (229 per post) and have fewer followers on average (2,492k). This suggests that while developing country libraries are more active on social media, developed country libraries tend to generate greater reach and user interaction per post.

Pi value, post per day, engagement per post, followers of different National Libraries has been presented by below bar diagram.

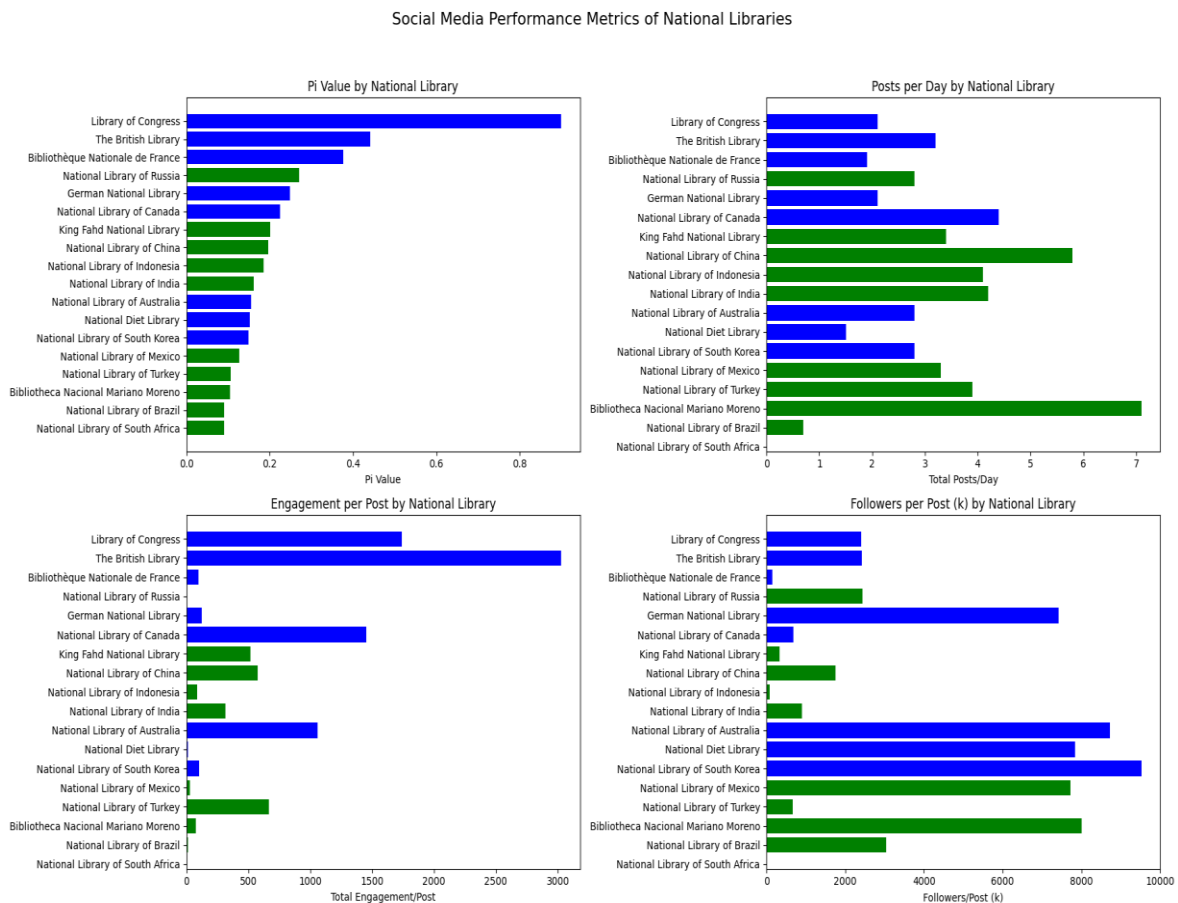


Figure 9: Comparison on Economic Developed and Developing Country

Table 22: User Satisfaction of Developing Countries

	Total Reviews	Positive Reviews	Percentage of Positive Reviews
National Library of Developed Countries			
Library of Congress (USA)	9794	9187	94%
The British Library (UK)	4031	3715	92%
National Library of South Korea	288	264	92%
National Library of Australia	704	639	91%
Library and Archives Canada	79	68	86%
National Library of Germany	248	198	80%
National Diet Library (Japan)	128	101	77%
Bibliothèque Nationale De France	479	230	48%
National Library of Developing Countries			
National Library of Indonesia	8337	7836	94%
National Library of Russia	218	209	92%
National Library of China	65	60	92%
National Library of India	107	95	89%
King Fahd National Library (Saudi Arabia)	3902	3356	86%
National Library of Brazil	810	688	85%
National Library of Turkey	1340	1126	84%
National Library of South Africa	198	166	84%
Biblioteca Nacional Mariano Moreno (Argentina)	314	237	75%
National Library of Mexico	492	350	71%

The analysis of user satisfaction shows the National Libraries across G20 countries reveals interesting patterns in terms of public satisfaction. Among developed nations, The Library of Congress and National Library of Indonesia stand out with high percentage. Bibliothèque Nationale De France though it is under developed countries, shows lower

percentage on User Satisfaction. The range taking user satisfaction gap between upper and lower are analyzed below.

Table 23:User Satisfaction Range between developed and developing countries

Developed Countries' User Satisfaction Range	Developing Countries' User Satisfaction Range
Max: 94%, Min: 48%	Max: 94%, Min: 71%
Range = Max - Min = 94% - 48% = 46%	Range = Max - Min = 94% - 71% = 23%

The user satisfaction data shows that developed countries have a wider range of satisfaction(46%), with the highest at 94% (Library of Congress) and lowest at 48% (France). In contrast, developing countries show a narrower and more consistent range (23%), from 94% (Indonesia) to 71% (Mexico). This explores that while some developed libraries receive very high satisfaction, others lag significantly whereas user satisfaction in developing countries is more evenly distributed.

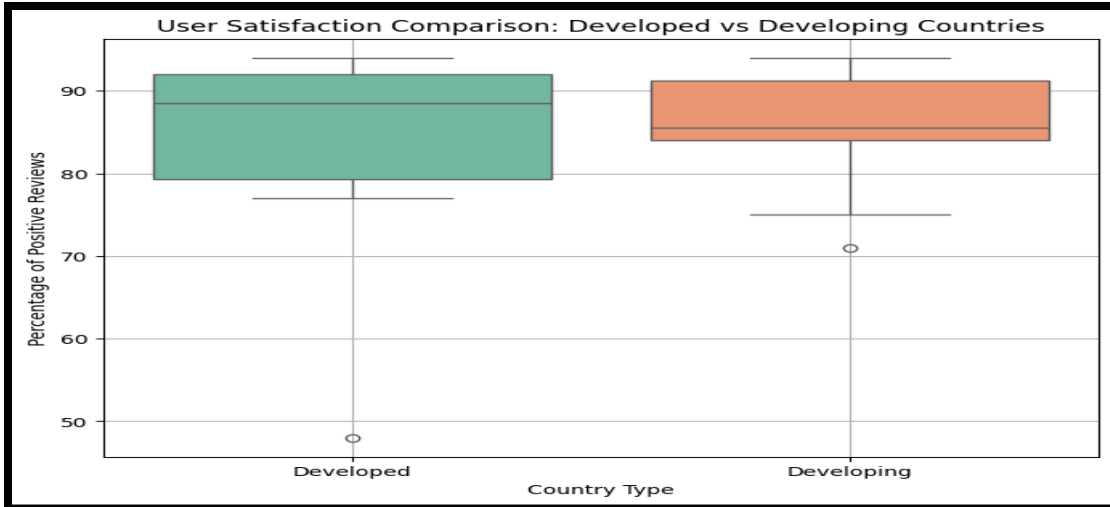


Figure 10: User Satisfaction ranges for developed and developing countries

5.3 Conclusion

This analysis of G20 national libraries' social media performance reveals how these institutions utilize digital platforms to engage with the public. Instagram emerged as the most engaging platform overall, while Twitter is more frequently used, especially by libraries in developed countries. The study also found that national libraries from countries like the USA, UK, and France demonstrated strong engagement despite moderate posting frequencies. In contrast, some developing countries, such as India and Brazil, exhibited high posting activity but mixed engagement outcomes, possibly due to differences in digital infrastructure, audience behavior, and content targeting. The user satisfaction data shows that developed countries have a wider range of satisfaction and developing country consists evenly distributed range. For national libraries to enhance their digital presence, they must focus not only on frequency but also on content relevance, platform dynamics, and audience engagement patterns.

Chapter 6: Findings and Conclusions

6.1 Introduction

This is a comparative study of National Libraries of G20 countries, done by performance score of traditional metrics and social media performance and also it leads to the result of comparative study economic developed and developing countries. The results concluded with some vital points. Performance score on traditional matrices does not mean higher satisfaction of users. Service does not depend on the physical parameters only. North Americans library and economic developed library's performance score on physical parameters are high and also high in engagement on social media. National Libraries of economic developing countries' post frequency is more. Notably, National Library of India ranks highest as per post frequency.

6.2 Findings

Traditional Rank and User Satisfaction Metrics

The TOPSIS method is utilizing traditional metrics on collection size, budget, time, space and staff strength, ranked Library of Congress highest among the evaluated institutions, followed by the British Library. In this study, the Library of Congress scored a performance index (Pi) of 0.89, indicating superior than others.

User satisfaction indicates that the Library of Congress ranked highest in user experience metrics. Table No.7 shows the user satisfaction rank. User Satisfaction rate evaluated on the percentage of positive reviews. Negative reviews are not considered for the

calculation. Sometimes, high Pi score does not indicate higher User Satisfaction, Bibliotheque Nationale De France ranks 3rd as per TOPSIS but it ranks 12th according to User satisfaction rate. Because of this, correlation shows slightly positive results.

Correlation analysis shows a low positive relationship i.e. 0.19 between traditional metrics and user satisfaction, suggesting that satisfaction does not depend on only 5 parameters of CENL report and Pi score high does not indicate good service. The rude behaviour of staff, excess restriction and more waiting time may affect the satisfaction rate.

Library of Congress ranked highest as per TOPSIS analysis and User Satisfaction Rate. Table No 8 shows the ranking of National Libraries by traditional metrics and User satisfaction rank.

Platform-Specific Comparison

YouTube only displays positive correlations. It suggests a positive correlation between daily posts and user engagement. While Facebook shows a negative correlation, indicating no meaningful relationship, Twitter and Instagram both show a very weak positive association. Figure 2 represents the details.

In the Figure No 3, Facebook provided strongest correlation i.e. 0.85 on engagement per post and followers. It suggests that followers directly increase interaction for facebook. There is a slight link between Instagram. YouTube and twitter display a negative correlation. It suggests that there is no discernible correlation between followers and engagement on YouTube and Twitter.

A comparative summary of the total social media engagement (likes, shares, comments, etc.) for the national libraries of G20 nations across four platforms Facebook, Instagram, Twitter, and YouTube are given in Table 13. According to the data, Instagram generates 7,189 interactions, making it the most engaging platform overall.

Table No 14 shows National Libraries are more active in Twitter. Twitter's posts per day is 17.7 emerge as the most frequently used, followed by Instagram, Facebook and YouTube.

Engagement Specific Comparison

Table No 13 shows the Library of Congress records the highest total engagement with 3027, followed by British Library. It means user of LOC involved more in social media. They make interaction in LOC page frequently.

Table no 15 shows Spearman rank correlation= $p= 0.34984520123839014$ provides a positive correlation between TOPSIS rank and social media engagement rank. It implies that top most library or traditionally rich library somewhat focus on the social media outreach. Though library of Congress, British Library and Bibliotheque Nationale De France have aligned ranking in both categories.

Table No 16 shows the rank Spearman Rank Correlation= $p= 0.0260$. The value of Correlation is very close to zero. It implies there is very slight correlation between social media engagement and user satisfaction. More interaction in social media does not indicate the satisfaction of users.

Table No 17 shows the Spearman rank correlation is 0.4055727554179567. This implies engagement per post somewhat depends on posting frequency. Posting may lead more user engagement but exception occurs for Library of Congress.

Performance of National Library in social media

The table no 18 shows TOPSIS rank of library and Rank on post per day. Spearman rank correlation=-0.062 provides a negative correlation between TOPSIS rank and social media posting frequency rank. The higher traditional metrics does not indicate the activeness of National Library in social media platforms.

Table No 14 shows that National Library of India is most active, with a total of 7.1 posts per day, primarily driven by high activity on Facebook (2.5), Twitter (2.4), and Instagram (2.1). The bar chart is mentioned below-

Table No 17 shows the Spearman rank correlation is 0.4055727554179567. This implies engagement per post somewhat depends on posting frequency.

Facebook shows the highest engagement as social media platforms for Library of Congress but the more used social media for National Libraries are Twitter. Out of 18 National Libraries, 17 National Libraries have twitter accounts. 16 have Facebook and Youtube accounts and 14 have Instagram accounts.

Cross Region Analysis

The table no 19 represents that the Pi score is showing higher in National Libraries of North America. National Libraries of North America includes Library of Congress, National Library of Canada, National Library of Mexico. The performance based on the parameters i.e. budget allotted, total opening time, total collection, staff and library space

identified by CENL report. National Library of Africa Region i.e. National Library of South Africa's Pi score is lower than others.

The table no 19 also shows the differences in social media activity and engagement across continents. North America, with three libraries, posts on average 1079 interactions. It implies that North American users of National Libraries are more engaged in social media account. National Library of South Africa's Pi score is lower than others.

South America's National Libraries named National Library of Argentina and National Library of Brazil post more frequently i.e. 4.6. It implies that National libraries of South America are more involved in posting though the average Pi score is lower i.e. 0.098502 and average engagement rate is 547.5.

National Library of India is more active in social media whereas users of Library of Congress are more engaged in social media. Engagement rate of Library of Congress is higher than others. Not only engagement rate the user satisfaction is more. In terms of involvement, National Library of India posts most. Posting is not directly related to National Library. It provides communal information also.

Comparison of Economic Developed and Developing Country

Table No 21 represents Pi score of economic developed and developing countries. Developed countries Pi score is higher than the developed countries. Pi score of developed countries is 0.3308 and Pi score of developed countries is 0.1535. It implies performance on TOPSIS parameters of developed countries is more than the developing countries.

Table no 21 also represents average post frequency, average engagement and average followers' count of economic developed and developing countries. Average post frequency of developed countries is lower than the developing countries. Average post frequency of developed countries is 2.6 and developing countries is 3.53. It implies that National Libraries of developing countries posted more than developed countries. Average engagement rate and average followers' count of developed countries are more i.e. 952.375 and 4895.34 respectively than the developing countries i.e. 228.9 and 2492.29 respectively. It indicates that users are more engaged in the social media of developed countries with higher followers. For developing countries, users are less active.

Table No 23 shows that user satisfaction rate of developed and developing countries where it is identified that the range of satisfaction for developed countries are wider than developing countries though it is highest for Library of Congress and lower for Bibliotheque Nationale De France. So the range is wide i.e. 46% and for developing countries range is lower i.e. 23%. It means National Library of developing countries users are more satisfied though the Pi score lower than the developed countries, they are tried to satisfy their users more. Activeness in social media and higher satisfaction rate of users prove that National Library of developing countries is trying to make users satisfy with their minimal capacity.

6.3 Conclusion

This study of national libraries using the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method based on traditional performance metrics revealed that the Library of Congress and British Library ranked higher. These rankings were primarily determined through indicators such as budget allocation, staff strength, collection size, opening time and space of National Library. User satisfaction is analysed by Review of users. Notably, it is represented weak or statistically insignificant correlation between traditional metrics and user satisfaction rankings, indicating that institutional resource strength alone does not directly translate into a more favorable public perception or user experience.

The platform-specific comparison reveals that YouTube demonstrates the strongest relationship between the number of posts per day and engagement per post. Facebook shows correlation between engagement per post and the number of followers. Instagram had the highest average engagement per post across platforms; Twitter remained the most widely used social media platform among national libraries.

Regarding engagement-specific comparisons, Library of Congress and British Library has been found to have the highest engagement rankings with traditional metrics. Their social media strategies yielded stronger audience interaction. A positive correlation was identified between social media engagement and traditional metrics, indicates that resource availability does guarantee digital engagement success. However, correlation of social media engagement and user satisfaction ranks is almost zero, suggesting that social

media interaction does not contribute to better public perception. Moreover, a positive relationship was observed between posting frequency and engagement levels.

In examining the performance of individual national libraries on social media, it is observed that a high-Performance Index (Pi), which combines metrics such as engagement rate, follower count, and content frequency, does not necessarily correlate with frequent posting. Some libraries achieved high Pi scores through more strategic, high-quality, and targeted posts rather than frequent updates. In contrast, libraries such as the National Library of India exhibit high posting frequencies though the level of engagement varied considerably based on content effectiveness.

Cross-regional analysis highlights significant differences in engagement patterns. Libraries located in North America show the highest average engagement per day. These results reflect the activeness of users. In contrast, national libraries across Asia demonstrate the highest frequency of daily posts, especially from the National Library of India, reflecting community-oriented outreach.

A comparison between economically developed and developing countries reveals substantial disparities. Libraries in developed countries consistently exhibited higher Pi values, reflecting stronger digital performance. These libraries also recorded higher average engagement rates, greater follower counts, and broader reach. Conversely, national libraries in developing countries show higher average posting frequencies but struggled with lower engagement rates, pointing to challenges related to quality of post and audience targeting.

In short, this study provides a multidimensional evaluation of national libraries, integrating traditional performance metrics, user satisfaction, and social media analytics. The findings reveal that while traditional metrics such as budget, staff size, opening hour, space and collection strength continue to be important indicators of institutional capacity, they do not necessarily align with user satisfaction or digital engagement outcomes. Library that scored highly on traditional indicators, such as the Bibliotheque Nationale De France, does not always lead in user satisfaction, suggesting disconnect between resource availability and public perception.

Social media analysis shows that engagement is platform-specific and influenced by both posting frequency and content quality. Facebook emerge as the most effective platforms for generating user engagement by followers. Instagram generates more engagement overall while Twitter remains the most widely used. National libraries of North America, achieved high engagement rates despite moderate posting frequencies. Libraries in Asian countries are more active in terms of post frequency.

The correlation between social media engagement and traditional metric is moderate, underscoring the need for libraries to treat digital engagement as a distinct area of performance. However, very poor correlation between social media engagement and user satisfaction suggests that effective digital communication strategies cannot enhance public perception and user experience. Posting frequency is positively associated with engagement, reinforcing the value of consistent digital activity.

When comparing developed and developing nations, libraries in developed countries consistently better in digital engagement, followers, and overall Performance Index (Pi).

This disparity points to the influence of technological infrastructure, digital literacy, and strategic communication planning. Libraries in developing countries demonstrated strong potential through frequent content posting, highlighting their commitment to visibility despite limited resources.

Lastly, national libraries must adopt a more integrated approach to performance evaluation that not only accounts for institutional inputs but also emphasizes user-centric outcomes and digital engagement effectiveness. Strategic use of social media, qualitative content, and responsiveness to user needs can significantly enhance library visibility, relevance, and public satisfaction in both physical and virtual spaces.

6.4 Suggestions

To enhance user satisfaction and digital engagement, national libraries should focus on improving in-person experiences by addressing common user concerns such as staff behavior, seating availability, and document access times. On the digital front, libraries should engage in high-engagement platforms by maintaining high-quality post, diverse content that resonates with their audience.

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Appendices

Supporting Information of Chapter 5

National Library of Developed Countries	Country	Pi Value
Library of Congress	United States	0.899481112
The British Library	United Kingdom	0.440667678
Bibliothèque Nationale de France	France	0.376233937
German National Library	Germany	0.248673189
National Library of Canada	Canada	0.22486935
National Library of Australia	Australia	0.155886774
National Diet Library	Japan	0.151591277
National Library of South Korea	South Korea	0.149329395
National Library of Developing Countries	Country	Pi Value
National Library of Russia	Russia*	0.269932068
King Fahd National Library	Saudi Arabia	0.201924305
National Library of China	China	0.195807445
National Library of Indonesia	Indonesia	0.184658326
National Library of India	India	0.161641607
National Library of Mexico	Mexico	0.127137028
National Library of Turkey	Turkey	0.106573481
Bibliotheca Nacional Mariano Moreno	Argentina	0.105593599
National Library of Brazil	Brazil	0.091410873
National Library of South Africa	South Africa	0.091299054

AVG Pi for Developed Country	0.33084159
AVG Pi for Developing Country	0.15359778

SI No	National Library of Developed Countries	Facebook	Twitter	Instagram	YouTube	Total Posts/Day
1	The British Library	0.4	0.4	0.6	0.7	2.1
2	Library of Congress (USA)	0.7	0.9	1	0.6	3.2
3	National Library of Australia	0.7	0.1	0.6	0.5	1.9
4	National Library of Canada	0.8	0.5	0.4	0.4	2.1
5	National Library of France	0.8	2.4	0.6	0.6	4.4
6	German National Library	0.2	0.1	2.4	0.1	2.8
7	National Diet Library (Japan)	NA	1.3	NA	0.2	1.5
8	National Library of South Korea	0.2	0.1	2.4	0.1	2.8

Sl No	National Library of Developing Country	Facebook	Twitter	Instagram	YouTube	Total Posts/Day
1	National Library of Russia*	0.9	1.9	NA	NA	2.8
2	National Library of Argentina	0.9	0.3	1	1.2	3.4
3	National Library of Brazil	1.6	1.4	2	0.8	5.8
4	National Library of Mexico	1.4	2.1	0.3	0.3	4.1
5	National Library of Turkey	0.8	1.6	0.9	0.9	4.2
6	King Fahad National Library (KSA)	0	1.5	1.7	0.1	3.3
7	National Library of Indonesia	1.7	0.6	1.5	0.1	3.9
8	National Library of India	2.5	2.4	2.1	0.1	7.1
9	National Library of South Africa	0.4	0.1	NA	0.2	0.7
10	National Library of China	NA	NA	NA	NA	NA

Total Post of Developed Country	2.6
Total Post of Developing Country	3.53

	National Library of Developed Countries	Facebook	Twitter	Instagram	YouTube	Total
1	The British Library	415	55	1257	15	1742
2	Library of Congress (USA)	537	361	2121	8	3027
3	National Library of Australia	39	7	51	1	98
4	National Library of Canada	51	4	62	5	122
5	National Library of France	294	25	1121	15	1455
6	German National Library	2	2	1054	1	1059
7	National Diet Library (Japan)	NA	13	NA	1	14
8	National Library of South Korea	21	3	74	4	102
	National Library of Developing Countries	Facebook	Twitter	Instagram	YouTube	Total
1	National Library of Russia*	5	3	NA	NA	8
2	National Library of Argentina	274	1	232	11	518
3	National Library of Brazil	59	9	500	9	577
4	National Library of Mexico	19	8	54	7	88
5	National Library of Turkey	68	163	74	11	316
6	King Fahad National Library (KSA)	0	23	5	1	29
7	National Library of Indonesia	92	3	550	19	664
8	National Library of India	37	5	34	1	77
9	National Library of South Africa	9	2	NA	1	12
10	National Library of China	NA	NA	NA	NA	

Engagement for Developed Country	952.375
Engagement for Developing Country	228.9

	National Library	Facebook (k)	Twitter (k)	Instagram (k)	YouTube (k)	Total (k)
1	The British Library	186	1700	435	83.5	2404.5
2	Library of Congress (USA)	562	1200	332	328	2422
3	National Library of Australia	68	45.9	29.5	5.7	149.1
4	National Library of Canada	69	7315	16.3	16	7416.3
5	National Library of France	237	245.2	167	36.3	685.5
6	German National Library	8.6	6443	1784	486	8721.6
7	National Diet Library (Japan)	NA	7830	NA	7.01	7837.01
8	National Library of South Korea	7.4	9491	19.5	8.87	9526.77
	National Library	Facebook (k)	Twitter (k)	Instagram (k)	YouTube (k)	Total (k)
1	National Library of Russia	3	2440	NA	NA	2443
2	National Library of Argentina	166	20.2	93.1	51.4	330.7
3	National Library of Brazil	235	1408	103	14.3	1760.3
4	National Library of Mexico	44	14	14.2	4.67	76.87
5	National Library of Turkey	135	453.9	242	63.8	894.7
6	King Fahad National Library (KSA)	9.3	83.3	7628	0.807	7721.407
7	National Library of Indonesia	171	53	363	72	659
8	National Library of India	47	6238	1715	0.741	8000.741
9	National Library of South Africa	17	3019	NA	0.207	3036.207
10	National Library of China	NA	NA	NA	NA	0

Followers for Developed Country	4895.348
Followers for Developing Country	2492.293