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Master's Thesis

Analysis of Open Government Data development in India

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Analysis of Open Government Data development in India

Objectives of thesis

The primary aim of this thesis is to address the existing issues of Open Government Data in India by analyzing five open source web development tools that can improve data visualization. We will use the multi criteria decision analysis method for defining and analyzing the tools with a focus on virtual data infrastructures.

Methodology

The first part of the thesis will explain in detail about literature review on open data infrastructure development and the issue and solution following with its introduction, background, and research question.

The practical part of the thesis will consist of an analysis of open source web development software with MCDA analysis.

The proposed extent of the thesis

40-50 pages

Keywords

Open Data, Open Government Data, Open Tools, Machine readable, Infrastructure development.

Recommended information sources

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Declaration

I declare that I have worked on my master's thesis titled "Open Data in Infrastructure Development" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on the date of submission _____

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Analysis of Open Government Data development in India

Abstract

Open Data has become a wonderful inspection and research tool, and it has made its way into the Indian government's public entities. The development and digital implementation of Open Data are made up of legal claims and technical solutions that help this development to a large extent.

Hence, this thesis study has a focus on, How Government and Non-Governmental Organizations Interact and Work Together. The goal of this thesis was to give an impression of Open Data in India and how this phenomenon is perceived.

This is accomplished through looking at some of the underlying legal systems, technology, and development projects to gain a better understanding of some of the most important and significant Open Data support systems.

In addition, a description of each of the investigated actors' Open Data identities, obstacles, visions, and goals is provided. The goal is to have a better knowledge and perception of their various approaches to open government data, as well as how they position themselves in relation to one another.

Aside from that, this thesis investigates and examines how the many parties involved define and express Open data. This is done to show how Open Data may be used in a variety of ways. Eventually different topics within this study are discussed to give recommendations and inspiration for further research.

Keywords: Open Government Data, Open Tools, Machine-readable, Infrastructure development.

Analýza vývoje otevřených vládních dat v Indii

Abstrakt

Otevřená data se stala skvělým nástrojem pro kontrolu a výzkum a dostala se do veřejných subjektů indické vlády. Vývoj a digitální implementace Open Data jsou tvořeny právními nároky a technickými řešeními, které tomuto rozvoji do značné míry napomáhají.

Tato diplomová studie se proto zaměřuje na to, jak vládní a nevládní organizace interagují a spolupracují. Cílem této práce bylo poskytnout představu o otevřených datech v Indii ao tom, jak je tento fenomén vnímán.

Toho je dosaženo tím, že se podíváte na některé základní právní systémy, technologie a vývojové projekty, abyste lépe porozuměli některým z nejdůležitějších a nejvýznamnějších systémů podpory otevřených dat.

Kromě toho je uveden popis identit, překážek, vizí a cílů každého z vyšetřovaných aktérů. Cílem je lépe poznat a vnímat jejich různé přístupy k otevřeným vládním datům a také jejich vzájemné postavení.

Kromě toho tato práce zkoumá a zkoumá, jak mnoho zúčastněných stran definuje a vyjadřuje otevřená data. To se provádí proto, aby se ukázalo, jak mohou být otevřená data používána různými způsoby. Nakonec jsou v této studii diskutována různá témata, která poskytují doporučení a inspiraci pro další výzkum..

Klíčová slova: Otevřená data, otevřená vládní data, otevřené nástroje, strojově čitelné, vývoj infrastruktury.

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I. Introduction & Literature Review

1. Background:

Open Government Data (OGD) is a collection of regulations that promotes transparency, legitimacy, and creating value by rendering government data available to the public (Maione, 2019). It represents an unprecedented opportunity for transparency in government institutions and the strengthening of public involvement in those institutions, as well as the benefit of cross-sector innovation. OGD proves interchange for insights into efficient IT technology expenditure, leading to improved operations and provision of government services (Ansari, 2022). However, access to data doesn't necessarily translate into improved results in government functionality. The work herein focuses on the 'Open Government Data (OGD) India' framework for the public authority of India's Open Information Project and its flagship platform OGD India, which offers government-related data access to citizens of the country. That access was meant to ensure transparency; however, it has received a decade of criticism for its poor navigation, user experience, and difficult if not significant lack of data transparency ('Open Government Data to improve Public Service Quality', 2019.

Governments that are signatories to the Open Government Partnership encourage the utilization, recycling, and unrestricted dissemination of data sources to boost business growth, innovation, and public activities. The *OpenGov Foundation* is a United States nonprofit organization conducting research and offering government transparency guidelines by promoting open-source access to public data. In this way, governments such as the United States, the European Union, ASEAN, and Brazil (there are 32 country signatories) can benefit from open data since their goal is to advertise the interests of the public and govern transparently (Saxena, 2018). Under an Open Government Data

framework, citizens have access to independently verifiable information supported by the state or local government and may evaluate the performance of the public sector and push for improvements.

To be clear, India is not a signatory to the Open Government Partnership, rather it has proscribed its own Open Information Project that better reflects the national paradigm of the Indian government. That is to say, the OGD India Framework (and its flagship web platform) offers significant, but not unrestricted access to government data. For this thesis, the focus of the research will reflect the situation in the Indian financial sector which is one sector of economic activity, among many, that is supposed to maintain and improve the OGD India platform and fulfill its requirements for open (financial) data to the public. For example, stock forecasters can use current and previous data, as well as an advanced-level prediction method, to forecast stock trends, which benefits both the organization and the shareholder. Similarly, entrepreneurs can take this data, analyze it, and make their decisions or policies accordingly, like how much of a minimum price they can offer to their clients to pay fewer taxes on a domestic product.

The value that can be extracted from such data can enable community members, entrepreneurs, stock forecasters, and many more in the OGD frame of reference and give them a deeper comprehension of government activities that directly affect residents in government-funded projects relating to public works. Other ministries, departments, and organizations may be also able to prioritize the distribution of financial government datasets with the OGD Platform's robust framework for public interaction to enable users to assess the quality of datasets and request clarity on information from government officials. For instance, the Government of India Association is an organization that oversees public works throughout the country and uses the OGD platform to share many types of data, such as records, administration procedures, and applications that they have assembled for the public advantage

In the case of the financial sector, data is supplied by numerous government entities and sources, yet there are neither conventions, protocols, nor methods in place to assist the compatibility of the data sets. Data sets with a state seal of approval garner more attention from the public but they only make up a small portion of the publicly available data.

Research by journalists, academics, and in some cases even whistleblowers have suggested that there is a much larger repository of data that is held by the government that has been withheld from the public without justification. These concerns led to the creation of a semantically organized web-based data service, and the suggestion of a uniform metadata standard or technique for compatibility. （Humanizing Data） While this alleviated some of the concerns for data standardization, the issue of accessing the data that has been harmonized or deemed available for public viewing lies in the design of the OGD web portal itself.

During the late 2000s, the development of Open Government Data (OGD) platform was developed in stages as the government-related data steadily opened to the public (Gao, Janssen, and Zhang, 2021). However, since its inception, there were issues with its development relating to budget and bureaucracy resulting in a sub-optimal platform. Much research has been conducted proving the criticisms of the platform and how it was developed, which in turn highlight the shortcomings in the overarching India OGD framework. For instance, in India, each government agency has its collection of data, formats, and standards which makes it difficult for users to determine which data is authentic. There are many cases in which government data is inconsistent or outdated, and these agencies harmonize their data with varying degrees of effectiveness. (Ansari et al. 2022). In short, the transparency of the data is largely left ambiguous, and users have a hard time making sense of what is publicly available due to several issues, but mainly, user experience with the OGD platform, the unstructured nature of the data sets, and their veracity. （Ansari , 2022）

The research performed in this thesis will not focus on these shortcomings as they have been widely discussed in the literature, but instead, we will focus on the possible open-source solutions that would be compatible to improve the India OGD platform. At present, the OGD India platform superficially enables access to officially collect data relating to business investment and venture capital information. While much of the data may be deemed open to the public by the Government of India Association, its accessibility is another matter.

1.1 Research Aim

The study aims to address the existing issues with India's Open Data Government web platform with open-source and cost-effective solutions for web design by offering a standard Multi-Criteria Decision Analysis of five open-source web development tools that have not been considered previously in the India OGD retooling towards greater government transparency.

1.2 Research Questions

The problematization of the research considers the following research questions:

1) Which open-source data-visualizing software would be appropriate for supplementing the India OGD platform?

2) What could improve the long-term maintenance of the OGD platform's performance?

1.2 Literature Review

1.2.1 Defining Open Government Data (OGD)

Open government data is a term used to describe the accessibility of government information on the Internet. Information that is open means that it is accessible to the public and meets certain criteria. The term was coined by civil servant Danny Weitzner in 2010. Government data is deemed open if it is made available following the principles. Open government data allows public access to information on issues ranging from health, education, and transportation to open data on crime, environmental protection, and public assistance programs (Khurshid, 2020).

Public data may be seen by anybody with internet access, but it cannot be reutilized or shared due to copyright. But such is rarely the case with 'Open Data', as it is not only accessible but also could be freely utilized or disseminated. This prevents it from being reused or shared while yet allowing access to the public. Public Data may be viewed by anybody, but they

lack the structure of Open Data. Some illustrations of public data might include stock values or media items; one can obtain these by paying for them, but we are only permitted to utilize them following the owner's terms of use. Open data is linked with a set of criteria that allow it to be simple to use and connect. Public data, or any information that is in the public domain, is an exception to this rule. Data that is not in computer-readable style and data that can solely be accessible through a records request are both considered to be public data (Khurshid, 2022).

In addition, open data must be well-organized, kept to a non-proprietary open standard, properly categorized, and connected to other data to provide context (Mensah, 2019; Gao, Janssen, and Zhang, 2021). As per Tim Berners-5-Star Lee's Open Data strategy, a rating system created to enhance the accuracy and usability of data, meeting all these requirements reflects the goal for open data (Op cit. MENSAH, 2019). OGD provides an open-source platform for publicly funded government organizations to publish their datasets in open formats for free public use and to demonstrate transparency. The Web App is available as Software as a Service (SaaS). OGD acts as an Open Data portal enabling governments and non-profit organizations to make their data available for free public use.

Open government data means that the data is free to use, reuse and redistribute. The "Open" in Open Government Data (OGD) refers to the creation of accountability, transparency, and interoperability through the provisioning of federal government data. Open Government makes public information accessible by opening access to agencies' databases under terms that are free to use and free from any restrictions or fees. It has been found that few organizations can effectively harness the benefits provided by open government data. This project will be aimed at involving citizen researchers to enable them to make targeted use of open government data. For example, Data.gov.in is a site that provides access to open data from different central government ministries, departments, and agencies of India (Zuiderwijk et al. 2019).

To enable government data to be open and machine process able, five key principles need to be followed. The first is that all data is published following the CKD (Convention on Data Protection accessibility Principle). Second, all data should be accessible to a broad range of people for a broad range of purposes. Third, data should be appropriately organized before

it can be used. Fourth, the use of automated processing is encouraged whenever possible. Fifth and lastly, technology should always work in tandem with human efforts if they are planning to use certain tools or platforms together. Interoperability is a difficult problem because, although all the data is available in a variety of formats, the standardization or metadata is lacking. Though data is available in a variety of formats on various government websites, it is often poorly structured （Towards a Decade of Open Government Data in Africa, 2019）.

Similarly, the Open Data Foundation is a computerized framework that advances data sharing and utilization. It has become fundamental for the activity of the general public as well as the administrations and offices essential for an economy to work. The data economy for this situation is significantly affecting how we contemplate data security and authorize data assurance regulations. Data infrastructure highlights the importance of the several factors that play an important role in designing, managing, and governing data infrastructures, which helps in creating value from the data assets that they provide. This can help us to publish data by using many different methods. In the last decade, these resources focused on inspiring the creation of several data portals to publish data and make it available via various applications and services. A suitable investment should be made in ensuring these are properly governed so that their operations are sustainable and encourage support for open standards to facilitate access to data (Steinbeck, 2020).

At present, government data sites use the same metadata schemas and it is hard to discover which data is available (there are twice as many government websites that do not have metadata). Also, no standard has been used by Web services developers to convert and exchange between each other when using different software libraries. In addition, different software libraries may have different ways of making a web service call to retrieve data from a server as many layers for security reasons. The main purpose of metadata that promises discoverability is to help a user find the right data and make it easier for other citizens and researchers to be able to use and reuse. I also propose a metadata standard that enables reuse and interoperability among metadata schemas, which can help accelerate the transformation of government data into Linked Open Data (Williamson, 2019).

1.2.2 Case Study: OGD India web-platform

Since the beginning of the OGD India platform's development, there have been studies on its effectiveness as an open-data tool. As pointed out by Ansar and colleagues (2022), many studies described use cases and prototypes without systematically evaluating their usefulness for OGD audiences. Even when there were formal usability assessments, the research methods were frequently not clearly described in a way that could be reproduced or adapted. In other words, the studies on the OGD platform and its role in enabling open-data access have yielded varied results in terms of user experience, and sometimes the quality of the studies are ambiguously determined. The following are a few of the attributes of the Indian government's official OGD India platform:

Various records are widely available through the web platform but are difficult to navigate. The Indian government opted to open more government data through its ODG platform to increase economic opportunity and public accountability. It serves as a repository for handling public and non-public sets of data; it creates the latest records, modifies established ones, and disables any data sources that are no longer mandatory. It is also a framework that provides a solitary point of access to sets of data and systems made available by the administration of ministries, departments, or organizations. Unfortunately, not all agencies and departments have applied it equally in practice. The data portal should, in theory, contain all datasets from the many local and national ministries, departments, subordinate offices, and autonomous bodies.

Visitors can review relevant information that has a government seal; however, these account for a fraction of the total data sets that should be open for public viewing. Data mashups and private sector information products also must be permitted by local municipalities, but more significantly, they must be supported, promoted, and in some cases, carried out by the government. Government obligations go beyond only disseminating data; they also include making it accessible in a way that encourages analysis and improves offline usage. Unfortunately, these functionalities, although promised, were delivered with significant limitations.

Data points as well as other online assistance can be mixed and matched to create unique repositories and web applications. However, because e-government applications in particular seek to integrate people at all levels of society, many users of such applications are unaware of the implications for their privacy as many e-governance initiatives in India were not designed with privacy in mind. Thus, many users are reluctant to even use the OGD platform out of fear that they will be somehow tracked by the government or malicious organizations.

The sets of data are available in an assortment of formats but are often inconsistent or incomplete. Incomplete or irrelevant information is frequently provided. Frequently, it takes longer than the specified period of 30 days to receive the information. This is usually due to poor record-keeping within government agencies, and it is a symptom of a more fundamental problem of a severely lacking information architecture （Pranesh Prakash, Sunil Abraham 2022.）).

- **Observation of OGD India records webpage**

Among the observations related to the government's official website, some of them are foregoing:

A large proportion of data sets are organized (for example, JSON, CSV, XML, XSL, and so on):

- The records in the file system are organized but incomplete or outdated.
- The emphasis on the data published doesn't correlate to the records that visitors perceive the most regularly.
- Most of the provided data is not organized.
- Government agencies use distinct metadata rules and regulations unique to each organization.
- The search result violates the semantic site ideology. The results of the search are simply tables with no answers to the queries.
- There appears to be very little support for independent investigators to collect information or metadata fully and autonomously, as it is in the scenario of

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computerized publishing directories, in which OAI-PMH or OAI-ORE are used to render the records useable for cultivation by any service supplier, (data.gov.in, n.d.)

1.2.3 Comparison of OGD India with five other countries

There are several nations' open data websites accessible these days, but still, only five have been chosen due to their enhanced open data websites, and these countries cover mostly geographic areas around the world. The following are examples of OGD platforms in countries whose governments actively engage in open data access with their citizens:

1.2.3.a India's open data website

The Indian Open Government Data Stage (data.gov.in) is a structure that helps the Open Data drive of the Government of India. The platform is expected to be utilized by bureaucrats or various departments of the Indian government and its affiliated organizations to publicize compiled sets of data, records, facilities, methods, and online services for public consumption (Buteau, 2018). It works to increase transparency in the operations of the government. It also appears plausible to pave the way for numerous inventive uses of government statistics to communicate a variety of viewpoints.

1.2.3.b New Zealand's open data website

On June 5, 2009, the Open Data Catalogue was launched as an official webpage for discovering government data by using the internet. It, like other portals, helps to improve legislative transparency and operational processes. It also appears legitimate to pave the way for innumerable imaginative uses of official data to communicate a diversity of views (Wirtz, 2019). The site's objectives are as follows:

- Mention all of the sets of data that are available publicly.
- Allow visitors to provide constructive feedback on the data sets.
- Develop this website as a user-friendly tool for people to gather the details they require and the people they ought to approach.
- Utilize the public to convey the information proficiently and comfortably.

1.2.3.c Europe's open data website

Public domain data can be used and reconfigured for conventional or non-conventional purposes. The homepage has been an important part of the European Union's open data initiative. The resourceful and institutional impact of data can be enhanced by making it approachable and accessible to all (Kassen, 2020). This platform is also geared toward increasing the visibility and accountability of establishments as well as other European governing bodies. It also works similarly to some other portals to enhance parliamentary accountability and operational strategies. This also enables legitimate redevelopment of the path for countless creative utilities of government statistics to interact from a variety of perspectives.

1.2.3.d UK open data website

The political establishment makes public information accessible to help citizens comprehend how well the administration works and how rules and regulations are established. Although plenty of these records are already available, data.gov.uk consolidates these into a single advanced search framework (Liu, 2020). It also functions similarly to those other sites in terms of improving governmental credibility and strategic initiatives. It also makes it reasonable to transform the road map for uncountable resourceful official statistics utilities to interfere from a different perspective. Also, attempting to make this information more widely available presumes that people will indeed be inclined to render quite enlightened decisions and remarks about the rules and regulations of the government.

1.2.3.e USA Open Data Website

The United States government's official website for open data platforms is data.gov. Records, methods, and resources from the state and municipalities are accessible to conduct investigations, develop applications, create data visualizations, and much more. The Data.gov organization is rooted in the United States General Services Administration, and the web's records are provided by dozens of organizations, along with government agencies (Liu, 2020). It also serves the same purpose as the numerous different web pages in aspects of increasing regulatory body legitimacy and development strategies. This even makes it feasible to change the transition plan so that a plethora of versatile officials figures utilities can intervene from a unique angle.

1.2.3.f The worldwide ranking of five OGD portals

Similar web internet methods are used to determine the international rankings of India's Open Government Data Site (Prantl, 2018). It compares the social standing of the OGD website to other sites such as data.gov, data.gov.in, data.govt.uk, and data.gov.nz. The goal of comparing these websites is to see which country provides the most data or which country has the most people participating in these initiatives for the betterment of society. Similarly, this comparison can aid in identifying key points, increasing not only website traffic but also government credibility.

3. Objectives and Methodology

3.1 Objectives

- To select the best data visualizing software that can be used in a web-based platform performing an MCDA (Multi-Criteria Decision Analysis).
- To recommend changes to the existing web-based platform showing results of the analysis performed and enabling users to access the open data on the platform.

3.3 Multi-Criteria Decision Analysis:

Multi-Measures Choice Investigation, or MCDA, is a helpful guide for making complex decisions. This is the most helpful system for handling confounded issues with several choices (Danesh, 2018). It has every one of the traits of a powerful dynamic strategy. It helps with focusing on what is fundamental, rational, and solid, and is easy to utilize. MCDA is generally useful for:

- Separating the choice into narrower or more manageable chunks
- Inspect every component.
- Incorporating the components to create a comprehensive response.

At the point when used in aggregate choice creating, MCDA helps bunches being developed concerning their decision probability (the worry to be cured) in a way that empowers each other to perceive the rules that each individual holds. This additionally gives people the

possibility to ponder and examine convoluted exchanges between choices (Danesh, 2018). It helps an individual in thinking, re-evaluating, questioning, changing, choosing, reconsidering once more, testing, changing, and in the long run choosing.

MCDA is a choice device used to survey the overall worth of various innovations. It empowers the examination of advances by consolidating individual variables into one by and large evaluation. By consolidating various standards and gauging them against one another. The above flowchart shows how the MCDA structures have taken to pick the choice considering the central goals. This system assists in the review by distinguishing and thinking about the best methodology.

An open data portal is an online application or website providing a review, search, and visualization of open datasets. In addition to facilitating the user in exploring and querying the available data, open data portals also play an important role in supporting the development and implementation of monitoring, reporting, and re-use services around public sector resources. For the development and integration of open data portals into the e-government framework, it is crucial to pay attention to user interface design. The aim is not just to create simple interfaces that are easy to use but also intuitive. To achieve this goal, well-designed interfaces can play an important role in the success of such portals.

3.3.2   Analytic Hierarchy Process (AHP):

The logical order process includes organizing numerous decision measures into a progressive system, surveying the general significance of these rules, looking at options for every model, and deciding a general positioning of the choices based on cost, advantages, and hazard. The methodology is appropriate to circumstances where numerous decisions can be communicated as different measures.

3.3.3. Building the Decision Framework:

After identification of the parameters i.e., goal, interests, and alternatives, they can be represented as a collection of distinct elements with explicit connections between them. The figure below shows the goal, interest, and alternatives. The goal is to develop a web-based platform for providing accessibility and graphical visualization of the Open Government

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Data for any individual visiting the website. My interests include web development, graphical visualizations, and predictive analysis. The interests are further divided into sub-interests. The sub-interests for web development are simplicity, theme selection, and accessibility. The sub-interests for visualization and analysis are syntax, easy understanding, and IDE selection. The alternatives for web development are Wix, WordPress, and Google sites. Whereas the alternatives for data visualizations and predictive analysis are Python, R language, and Matlab.

Figure 2: Decision Framework
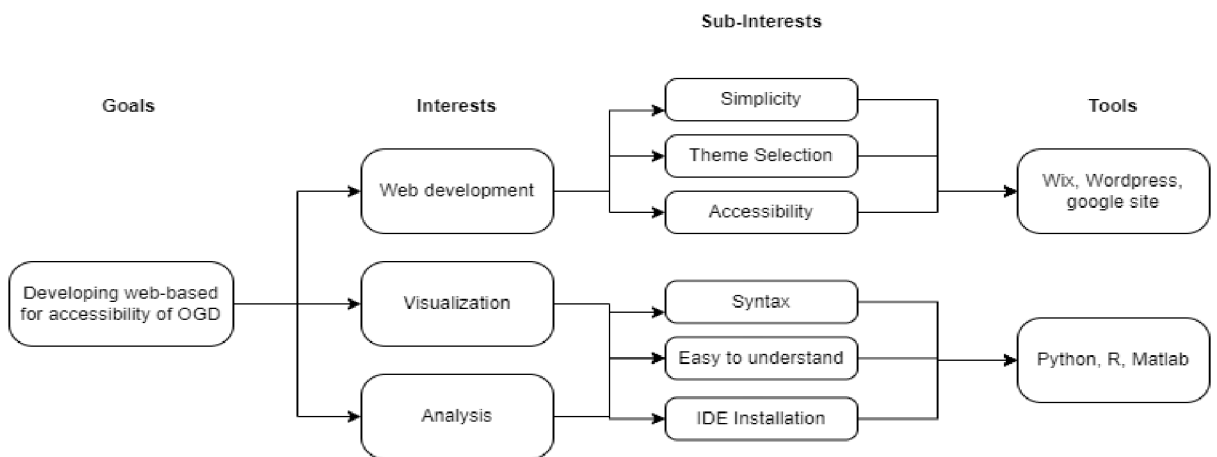
Source: （Aleksandar Rikalovic 2022.）

II. Practical Chapter

4.1. Data Collection

Data collection is typically used to describe a process that involves employing a certain strategy to find the required data. The strategy used to obtain the necessary data is known as the method of data collection, which can be either the primary method or the secondary method. The practice of gathering data that was really acquired earlier by another individual

might be referred to as the secondary technique of data collection. Often, it consists of gathering historical data, government website information, OGD platforms, articles, and other sources are important sources of secondary data. The secondary data method is the preferred approach for data collection in this thesis because it is faster, more economical for us, and much easier than the primary method.

Currently OGD portal don't have access to real-time news or data, in this research we found the major challenges faced by open government websites in India is the need for more transparency and accessibility. Despite efforts to promote open government and improve public access to information, Indian government websites still lack user-friendly interfaces, complete and up-to-date information, and reliable search functionality. Additionally, issues related to data privacy and security have been a concern for users accessing government websites. Moreover, the digital divide in India is also a challenge for open government websites as many people in rural areas do not have access to the internet, and those who do may face slow internet speeds or unreliable connectivity.

Python can be used to develop web applications and automate data processing tasks. With its robust libraries and frameworks, Python can be used to create custom applications that meet the specific needs of government websites. For example, Python can be used to create web scraping scripts that automatically collect data from various sources and display it on the website. WordPress and Wix can be used to create user-friendly and visually appealing website templates that are optimized for mobile devices. Wix also provides features such as drag-and-drop editors, customizable themes, and e-commerce functionality, which can help government websites to create a more engaging and interactive user experience. In this research we used tools like WordPress, Wix, Python which is used for improving user friendly interfaces, search functionality, data privacy, data security in the OGD portal India

4.2 Limitations of the Study

The study went through a recursive process of data collection and changes had to be made regarding the type of data to be used as the access to subject matter experts proved to be difficult. Any request to government officials for access to discuss the functions of the platform were met with numerous obstacles and refusals to meet the researcher. Following

the initial attempt for access, the researcher then elected to refer to the OGD platform itself and provide examples of its deficiencies. However as stated earlier, India does not currently have the virtual infrastructure to implement a transparent open-data policy and the information that is available regarding the financial sector trends are too unstructured or incomplete to be of use in determining what open-source software might be appropriate for the OGD platform's streamlining. Subsequently, the final workaround for these limitations was to mine the 'data' in the form of documents and online resources that do discuss the technical deficiencies outlined in the literature review. These sources served as the baseline for constructing the criteria framework of our MCDA.

4.3 Multiple Criteria Decision Analysis (MCDA) & *fa*-5 Point Scale

Analysis of the decision-making process that considers the presence of competing criteria is known as a Multi-Criteria Analysis (MCA) or Multi-Criteria Decision Analysis (MCDA). As early as 1979, Stanley Zionts published an article titled "MCDM - if not a Roman numeral, then what?" （Zionts） Which he utilized to push the concept forward among his business associates. In the years that followed, the concept gained widespread attention, and organizations dedicated to issues surrounding Multiple Criteria Decision Analysis (MCDA), such as the *Worldwide Society on Multiple Criteria Decision Making* were formed. An extensive MCDA uses data from many different sources, including but not limited to mathematics, finance, data innovation, programming, and other data systems. While a Multiple Criteria Decision Analysis (MCDA) may appear to be like a cost-benefit analysis, it is distinct in that it categorizes competing arrangements of criteria, such as quality vs. Cost of software solutions, as well as hardware utility and user accessibility. Using a tool like Multiple Criteria Decision Analysis (MCDA), it's possible to make better-informed choices regarding improvements to the OGD India platform with a breakdown of the most useful web-development tools for solving open data transparency.

Analysis of the decision-making process that considers the presence of competing criteria is known as a Multi-Criteria Analysis (MCA) or Multi-Criteria Decision Analysis (MCDA). Practically everyone makes use of this tool periodically throughout their daily activities. Every day, people seek a wide variety of options, yet this same cycle can be observed in the

business world, governmental bodies, and even hospitals. Therefore, an MCDA is useful for groups to make decisions together. While a Multiple Criteria Decision Analysis (MCDA) may appear to be like a cost-benefit analysis, it has the distinct advantage of not being limited to monetary factors when concluding correlations. When making big decisions, it's important to consider a wide range of factors.

Examination of competing arrangements of criteria, such as quality and cost, can occasionally lead to confusion and a lack of clarity. Using a tool like Multiple Criteria Decision Analysis (MCDA), it's possible to make sense of complex situations by making decisions based on several criteria at once. To make better-informed choices, it helps to break down complicated problems and analyze them using various arrangements of criteria. As early as 1979, Stanley Zionts published an article titled "MCDM - if not a Roman numeral, then what?" Which he utilized to push the concept forward among his business associates.

In the years that followed, the concept gained widespread attention, and organizations dedicated to issues surrounding Multiple Criteria Decision Analysis (MCDA), such as the "Worldwide Society on Multiple Criteria Decision Making," was formed. An extensive MCDA uses data from many different sources, including but not limited to mathematics, finance, data innovation, programming, and other data systems.

4.3.1 Defining the criteria selection process

- *Define the context*

We are figuring out the best open-source content management service (CMS) and data visualization techniques than can be used to deploy our Open Government Data (OGD). For this purpose, we selected five major CMS providers and five popular tools and technologies that can be used for data visualization. The National Data Sharing and Accessibility Policy (NDSAP) was designed to fill the need for transparent data access and governance for the Indian government. However, in practice, it has not been implemented equally across all agencies and departments. This has led to a stagnate open-data environment in which people who could benefit from access to this data – such as journalists, researchers, and civil society – are not aware that this data is available (Buteau et al., 2015). This becomes necessary to change the existing data governance by which the ODG India platform's design was guided.

- *Identifying the most accessible open-source solutions*

For our first objective to find out which is the best CMS provider, the research performed extensive desk research consisting of open-access documents related to Open-Data governance from the Open-Data Foundation which serves as a guideline for signatory countries. To be clear, India is not a signatory. However, these guidelines do offer a set of criteria that enabled an MCDA table with the top 5 best options available in this case. These are encompassed in the following criteria:

- *Decide the objectives and select the right criteria that represent the value*

Firstly, the organization of the research was conducted using desk research and consultation with a panel of experts via an open-source forum to discern the most optimal CMS provider and the following criteria:

Simplicity => It is about the ease of using the interface and how easy it is to set up a website and run it.

Theme selection => different themes can be used to simulate a different feel of a website It may be Dark for better Night visibility or of a specific color to give it a professional look, this criterion looks for different available these free or paid to specific CMS Provider.

Accessibility => This includes the uptime of the website deployed, the page loading or opening time, and other hosting-related issues that affect the website's overall performance.

Price => It is the most important factor which determines the selection of required CMS under a specific budget, as most of the CMS Providers charge monthly we calculated how effective it is to deploy a certain website under a specific budget.

For the second objective of choosing a specific data visualization tool, we select the following criteria:

Technical Support => It is about the ease of use of that language or tool available that includes the learning curve to use that language/tool, Available documentation, and technical

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support than can be provided by the company or community working with that language or tool.

Operational Difficulty => This includes prior knowledge required to use that tool or the learning time for that specific language or tools this may include syntax difficulty or operational difficulty.

IDE Installation => This includes all the required to create a fully working data visualization tool and the difficulty is deploying that tool in a web portal.

Price => Some languages and their package are open sources hence it is free to use but can be difficult to learn and deploy there are specific programs that can do it for you with ease but charge annually for their service so they are also included.

- *Weighted scoring using the fa 5-point scale*

Two common types of rating scales used in multi-criterion decision analysis are the relative scale and the ordinal scale, both of which can be used for various criteria. Each choice can be ranked against the others. Using an ordinal scale, we rate the degree to which each option satisfies a certain interest on a scale you select (a 5-point scale). On a scale from 1 to 5, 1 would be the lowest possible score and 5 would represent perfection.

Table 1. MCDA ordinal data

Platform	Simplicity	Theme selection	Accessibility	Price
WordPress	5	5	5	$10
Wix	4	4	4	$22
Shopify	4	3	3	$29
Squarespace	3	3	3	$14
BigCommerce	3	3	3	$30

Table 2. Weighted calculation of crieria

Platform	Technical Support	Operational Difficulty	IDE Installation	Price
Python	5	4	3	Free
R	4	3	4	Free
Matlab	5	2	3	$1000/yr
Google Analytics	5	4	5	50,000/yr
Tableau	4	4	2	1445 X 12/yr

Calculate the different values by averaging out weighting and scores

We normalize both tables on a 5-point scale, with a 5 score for the best and 1 for the worst, as the Price of data visualization platforms goes it is difficult to arrange in that same manner, so we gave 5 for free software and other score related to their price. For our CMS Criteria Simplicity, Theme Selection, and accessibility are 20% each, and Price Is important to us so we gave 40% weightage to it. For data Visualization Software Technical Support is a must so we gave it 30% weightage, 20% to operational Difficulties, 10% for IDE installation as it is a one-time job, and 40% to its Price.

For our second objective of finding the best-visualizing tool that can be implemented on a web portal, we selected the top five popular languages and tools for data visualization -- *WordPress, Wix, Shopify, Squarespace,* and *BigCommerce.* Computer languages are used to implement the underlying data visualization packages for that specific language. As mentioned for each language, the tools used included *Python, R Matlab, Google Analytics,* and *Tableau.*

4.3.2 Open data application for the finance sector

Platform India is a platform for exchanging Open Government Data (OGD) data, papers, and other resources. The portal allows agencies, ministries of the central government, and state governments to share government-owned information, goods, and services.

Organizations and individuals can utilize OGD web services to offer relevant input about publicly available data, to use that data for study, analysis, or teaching, and to make it available to those who are interested in utilizing it.

In the context of this study, we view the element of financial depth as a critical component of financial stability in the Panchyat region. Meaning that the documents that should be available on the ODG webportal serve as one form of metric of financial stability that define a country's or institution's capacity to continue lending during periods of economic expansion by drawing on foreign money. In this way, the data concerning financial depth should be readily available for visualization and ease of access for analysis to demonstrate the availability of domestic savings and lending that support long-term growth. Through a web interface, the financial application for the finance industry provides individuals with reliable and transparent information on banks, securities, and mutual funds. The program includes user-friendly features such as registration, search, and copying and sending financial information to others. Bank services are critical to the national economy (Asongu, and Andrés, 2020).

Credit expansion, as measured by demand for financial services, is a necessary component of economic growth. The link between banks and economic growth is important in policymaking. Its financial efficiency is defined as its capacity to accomplish the primary function of converting deposits to credits. Credit is an important component of an efficient financial system that may contribute significantly to economic growth. Banks usually regard credit with or without collateral to be of the same value. Bank credit accelerates the country's economic growth process by making timely loans to industries (Tripathy, 2019).

The stock market grows with the expansion of capital markets, which promotes the channeling of savings into productive investments, resulting in increased economic growth. Typically, stock market growth is measured using capitalization and the BSE Sensex. The BSE gave different administrations to financial exchange players and contacted financial backers from one side of the planet to the other. Exchanging volumes is a sign of financial exchange advancement since stock costs expect volume to move. Stock value instability is brought about by volume unpredictability and exchange movement; for instance, bank credit, bank store, BSE Sensex, BSE volume of exchanges, and BSE market capitalization are

utilized as intermediaries for the monetary turn of events. The BSE Sensex is utilized to check by and large securities exchange development and market capitalization. Moreover, BSE made the benefit of numerous assets accessible to financial backers all through the world, for example, by exchanging stages and data administrations. Exchange volumes are utilized as a sign of financial exchange advancement since stock costs expect volume to move.

4.1.1 Use Case 1: OGD India Platform

The case study which is used in this study is the finances of the panchayat union the dataset detailed in the above section in the data collection heading. Panchayat is a local organization in a state or district that makes decisions on issues that develop in a given region. In terms of Panchayat's functioning, questions are raised about the frequency of meetings, the participation and attendance of marginalized community members, the creation of consensus at these meetings, and the kind of subjects covered. It examines training attended and arranged, as well as the work done by the Panchayat, under Personnel Capacity Building. The third part is planning, which is measured by examining the process of developing annual plans and budgets.

The information received through this Use Case is mostly utilized to monitor Panchayat operations. The emphasis is on the critical evaluation of plans, budgets, and their success. By performing a periodic evaluation of their execution, this information aids in the improvement of services and their access to marginalized populations. The IEC will be a performance indicator and will provide the Panchayat with the ability to measure local income generation. It provides the Panchayat with an easy method of revenue collection and allocation. The performance will be measured in terms of physical achievements, financial expenditure, IEC activities undertaken, and any other special initiatives taken by the Panchayat. It provides all the basic infrastructure to improve the quality of services being rendered to citizens. The Panchayat Raj Institution under the Constitution is a key mechanism for decentralizing power and authority. The function of local self-government in India, which is present at all levels of governance, has been identified as a model on par with other democratic forms of government (Reddy, 2020).

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In the current case, the Panchayat Union is the main district the dataset is of complete expenses, taxes, salary, and closing balance of each Panchayat Union. The Numeric values present in the dataset are simple numeric values not in large numbers means in lakhs because it will make the dataset complicated after understanding the analysis now create the analysis model in the UML diagram will come into place so, to create your analysis model, you should first know what you want in the final product. If it's just a job, then you want to create something that will be completed on time and meet the expectations of the design.

4.3.2 Web portal design process – Criteria selection for MCDA

- Successful Use of the Self-Sufficiency:

To attain the aims, the government must take action to increase self-sufficiency and lessen reliance on external help by offering a more organized and equitable economic growth model. It likewise plans to foster a framework in both metropolitan and rustic districts with public support by requiring a base public commitment of 33% of all out cost on works finished as a feature of the task. Notwithstanding these stages, it allows people to take part exclusively or by and large in the improvement of the main resources for current living. The cycle brings about the formation of local area resources through the pooling of individual and state assets, bringing about the development of a feeling of normal proprietorship and an interest in the resources' continuous support, as well as advancing public cooperation through an expanded job in the preparation, putting together, and subsidizing of local area exercises.

Table 3: Number of Panchayats Compared in India

Block	Number of Panchayats	2011-12		2012-13	
		Number of physical works completed	Amount spent (Rs Lakh)	Number of physical works completed	Amount spent (Rs Lakh)
Sankari	22	3	2.69	3	7.7
Nangavalli	9	0	0	0	0
Kongapuram	9	0	0	0	0
Edappadi	10	3	2.13	8	25.96

In the above table, we have explained how many blocks of Panchayats in India and how much work they have completed, and how much money they spend on each project. Sankagiri Town Panchayat comes under the administrative territory of Sankagiri Taluk. Nangavalli is Second Grade Town Panchayat located in the Salem district Tamil Nadu, It is Situated on Tharamangalam. Kongapuram and Edappadi are the other 2 also coming under small districts in south India.

5. Results and Discussion

Currently, the OGD India platform is set up to serve as a collaborative conduit for users and developers who are interested in developing applications on the available data. To better enable this collaboration, a well-defined web development strategy is the foundation of any successful project (Ambani et al., 2020; Hamza and Hammad 2020). The web development stages approach demonstrates how to move from research and development to building an immersive, compelling experience that engages users and improves user retention. Web development approaches are the techniques and methods that are used in the creation of a website. The process of creating a new website involves handpicking one of these approaches and then combining it with the needs and objectives of the project to create a winning solution. To provide the best options for developing the online presence, it will help to explore every angle of development to see what works best for the circumstances.

4.5.1 Discovery and project research

The first step in finance web development is to determine the users. What information does the user need, and how can you help them get it? The basic principle of web development in finance is to tailor the site's design to suit the user. This may involve a great deal of flexibility with settings, but also has a positive impact on every aspect of their experience. The web business model is based on the fact that people prefer to use apps over websites. They need to find out how they want to interact with the site and tailor it accordingly before coding or designing the site in any way (Ambani et al. 2020).

4.5.2 Wireframes and prototypes creation

Web development is a part of managing projects in finance that involves creating an informative website. The content of the site should be easy to understand so that users can find what they want on the site. Users should also find this website informative and useful, which means that the site needs to be informative and useful. A prototype is a webpage made from code and images which allows us to test ideas more effectively with real users. A wireframe is a quick, low-fidelity mock-up that shows the essential elements of your design (Hamza and Hammad 2020). Low-fi wireframes are fast to create, give an idea of how a web page will look and can be used to communicate ideas quickly.

4.5.3 UI design

The user interface design is the most important part of the website because it sets the tone for how a user will interact with the website. It should make handling transactions easy, intuitive, and safe without burdening the customer with too many unnecessary steps. The UI is also an opportunity to present design elements that will improve brand recognition, which can stimulate additional sales. A good design (UI) increases customer involvement and creates a strong link between the customers, who are more likely to buy products or services if they are pleased with their first impression of the website (Hamza and Hammad 2020).

4.5.4 Back-end development

Back-end development is the process of creating websites for finance and supporting them, which means working on server-side software. It focuses on everything that cannot be seen on a website, including databases, back-end logic, API architecture, and servers. Back-end developers ensure the website performs correctly by programming software that interacts with databases and other backend systems. This type of coding focuses on everything you can't see on a website, from backend logic and architecture to databases." They work to ensure the data stored on a database is accurate and secure, design complex APIs to interact with a variety of back-end systems and build modern applications that take advantage of the latest web platforms (Zahroh, 2022).

4.5.5 Front-end development

The front finish of a site handles all that clients outwardly see first in their program or application. Front-end engineers are liable for the look and feel of a site. It is generally centered around making visual components like illustrations, pictures, text, and essential design - conversely, with back-end advancement which is significantly more about coding in the background (Li et al. 2019).

4.5.6 Quality assurance

Website quality assurance (QA) is the process of scanning and testing your website's code. This includes mobile and tablet versions, as well as assisting in debugging issues on multiple devices. Our team of QA specialists will rigorously test your site using a variety of tools to ensure that all critical interactions are tested properly across all browsers and operating systems. This is an important part of being a high-end financial website that provides high-

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quality services to its clients (Zahroh, 2022). Online banking has become much simpler over the years but maintaining website quality assurance can be a challenge for many banks and credit unions.

4.5.7 Launch

The first step in launching any new product or service is competitor research. It is needed to identify the target audience and what they look for when it comes to finding financial information. Once they have identified the people who meet these needs, they can develop a content strategy to guide the creation of the website. The next step is planning a content strategy for Finance Base that will support its goals, as well as develop and promote new features to bring in additional traffic. This process may take several months or even years, but it is critical for a successful launch (Li et al. 2019). Then, it will need to choose between using a paid advertising campaign and creating an organic one.

4.5.8 System architecture

The issue in web portal development is to produce a website with the appropriate level of quality. Modifying the platform's design would almost certainly necessitate rebuilding it from the ground up at the same expense (Hassan, 2021). A web-based economic application enables users to obtain stock data from any location and at any time around the world. It also saves time and money while improving interaction with the other partners and clients. Web-based implementations are simple to utilize and incorporate without disruption. The development of web applications can be accessed from both a cell device and a home computer. Various implementations can be accessed via mobile and personal computers, but the difference is that it is the monetary sector that accesses a database with vast amounts of data and numerous stored procedures, triggering, and so on.

The front finish of a site handles all that clients outwardly see first in their program or application. Front-end designers are liable for the look and feel of a site. It is normally centered around making visual components like designs, pictures, text, and fundamental format - interestingly, with back-end advancement which is significantly more about coding behind the proposed system utilizing the dexterous improvement strategy. A "nimble methodology" is a trick all expression for an assortment of steady and iterative programming creation techniques. Scrum, Outrageous programming (XP), precious stone, lean turn of

events, dynamic systems advancement technique (DSDM), and highlight-driven improvement (FDD) are the absolute most famous dexterous procedures (Shafiq, 2018). Though each nimble methodology is particular in its procedure, they all have a shared objective and fundamental standards. They naturally coordinate emphasis and the ordinary criticism that it offers to refine and deliver a product application in stages. They all include steady preparation, consistent testing, nonstop sending, and different types of venture and programming development. Scenes

The system's dependability and security are two of the most important considerations. The system must be dependable so that it doesn't break down and have high availability. Because stock contains a large amount of private information, security is critical. If this private data was made accessible to individuals who should not have had direct exposure to it, the company that created the system could face a slew of legal problems because of the breach of privacy (Bustos, 2020). A stock system must ensure that individuals who are authorized to access the system can do so while also keeping unauthorized access out of the framework and preventing them from attacking it. This system must be capable of withstanding a wide range of attacks.

A central data structure is the system's main component. This database model can communicate with some other system components. Furthermore, the structure of these systems enables impartial computational elements. This allows multiple processes to run concurrently and use information from the pivotal repository. One of the most important aspects of the repository strategy is the ability to have data accessible to a wide range of processes at the same time.

The final database-centric approach is to use the central database as the primary means of correspondence between various processes in implementations. This capability enables the use of application components to optimize some database management applications. These structures can perform better in terms of transaction processing and activity indexing. This enables a high level of reliability and effectiveness as well as the capacity to handle high traffic volumes (Nikkinen, 2020). These advantages would be critical to this system. The system's dependability and security have already been discussed in this study. It is among

the most essential components of the system, which could be a major reason for selecting this architectural style.

Since every one of the components of the client-server design should be related over a system from the client to the server as well as the other way around, bottlenecks on the server side of things cause execution issues. This issue might make a system glitch or not be able to make changes above and beyond time. A characteristic solution for this issue could be to endeavor to take out the bottlenecks by parting the server side of things into multiple servers, every one of which accomplishes something else with the data (Chen, 2022). This strategy is known as the multi-layered structural style. The most well-known of these is the three-layered structural style, which will be evaluated for its reasonableness for a stock-based web system. Thus, this system depends on the previously mentioned engineering, and a portion of the outcomes are connected beneath.

Table 1. MCDA table after Normalization and averaging out weighting scores

Platform	Simplicity	Theme selection	Accessibility	Price
WordPress	5/5 x 0.2	5/5 x 0.2	5/5 x 0.2	10/10 x 0.4
Wix	4/5 x 0.2	4/5 x 0.2	4/5 x 0.2	10/22 x 0.4
Shopify	4/5 x 0.2	3/5 x 0.2	3/5 x 0.2	10/29 x 0.4
Squarespace	3/5 x 0.2	3/5 x 0.2	3/5 x 0.2	10/14 x 0.4
BigCommerce	3/5 x 0.2	3/5 x 0.2	3/5 x 0.2	10/30 x 0.4

We have compared five lists of the most popular, mainstream content management systems. In the above tables, we used for comparing their technology, themes, accessibility, and price to show which CMS is best in current market research. Due to its adaptability and limitless integrations and plug-ins, **WordPress** is without a doubt the most well-liked and frequently used content management system.

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Table 2. MCDA table after Normalization and averaging out weighting Scores

Platform	Technical Support	Operational Difficulty	IDE Installation	Price
Python	5/5 x 0.3	4/5 x 0.2	3/5 x 0.1	5/5 x 0.4
R	4/5 x 0.3	3/5 x 0.2	4/5 x 0.1	5/5 x 0.4
Matlab	5/5 x 0.3	2/5 x 0.2	3/5 x 0.1	3/5 x 0.4
Google Analytics	5/5 x 0.3	4/5 x 0.2	5/5 x 0.1	2/5 x 0.4
Tableau	4/5 x 0.3	4/5 x 0.2	2/5 x 0.1	1/5 x 0.4

After Normalization and Weighting Scoring, these are the final scores that we will use for our Multiple Criteria Decision Analysis. By doing research online for the below CMS platform. For the MCDA method, we need 5 or 6 parameters are required for input into the MCDA tool. Which use online or CMS. In this study, we used 5 platforms to compare the MCDA method. We used a few categories to compare scores and show which platform is preferable.

Platform	Simplicity	Theme selection	Accessibility	Price	Total
WordPress	0.2	0.2	0.2	0.4	1.0
Wix	0.16	0.16	0.16	0.18	0.66
Shopify	0.16	0.12	0.12	0.14	0.54
Squarespace	0.12	0.12	0.12	0.28	0.64
BigCommerce	0.12	0.12	0.12	0.13	0.49

MCDM is involved with constructing and resolving multiple-criteria decision and planning problems. The goal is to assist decision-makers who are dealing with these issues. For such

challenges, there typically isn't a single best answer, hence it's vital to compare ideas using the decision-makers' preferences. Several meanings might be attached to the word "solving." It can be equivalent to selecting the "best" option from a list of available options (where "best" can be interpreted as "the most preferred alternative" of a decision-maker). Another definition of "solving" might be selecting a small number of worthwhile options or organizing options into various preference sets.

In above table we are comparing and analysis some parameter with various platform available in CMS systems and choosing the best solution. While MCDA is comparable to a cost-benefit analysis, it assesses more than simply cost. We find out objective and according to the MCDA table result. To calculate the weighted normalized values, they multiply each by WordPress in simplicity 0.2. since WordPress has the highest performance score after the calculation of multiplex criteria. So, it is the best choice for OGD portal.

Table 3: MCDA table after Normalization and averaging out weighting Scores

Platform	Technical Support	Operational Difficulty	IDE Installation	Price	Total
Python	0.3	0.16	0.06	0.4	0.92
R	0.24	0.12	0.08	0.4	0.84
Matlab	0.3	0.08	0.06	0.24	0.68
Google Analytics	0.3	0.16	0.1	0.16	0.80
Tableau	0.24	0.16	0.04	0.08	0.52

Table 4. MCDA ordinal data

Platform	Simplicity	Theme selection	Accessibility	Price
WordPress	5	5	5	$10
Wix	4	4	4	$22
Shopify	4	3	3	$29
Squarespace	3	3	3	$14
BigCommerce	3	3	3	$30

Here we compare the analytics language platform with the MCDA method, showing the difference in usability, price, and support for these language platform tools.

Table 6. Weighted calculation of criteria

Platform	Technical Support	Operational Difficulty	IDE Installation	Price
Python	5	4	3	Free
R	4	3	4	Free
Matlab	5	2	3	$1000/yr
Google Analytics	5	4	5	50,000/yr
Tableau	4	4	2	1445 X 12/yr

This table clearly shows that WordPress and Python are the best options for hosting and visualizing Open Government Data. The utilization of an MCDA accompanies different benefits when contrasted with a decision-production device not given explicit criteria as It's open and express, The picked criteria can be changed, and various entertainers can measure

up to each other, A Multiple Criteria Decision Analysis (MCDA) awards knowledge into various decisions of significant worth, Execution estimations can be passed on to specialists, Scores and loads can be utilized as a reference, It's a significant method for correspondence between the various gatherings associated with the decision-production process

After performing our Multiple Criteria Decision Analysis to figure out which of the following content management service is best, WordPress comes out with most scores due to its low cost of deployment, simplicity, and much larger options for theme selection It is even possible in *Wix* to deploy a free site to test the thing out. Similarly, after performing our Multiple Criteria Decision Analysis to select the best visualizing software Python comes out to be the best language with a score of 0.92. Python itself is not a visualization software but a tool some Libraries are robust and have community support for their various Libraries that are written in different languages which gives an advantage to python over other data visualization software. Libraries like Matplotlib, Plotly Seaborn, GGplot, and other libraries can easily be used to create simple or time series graphs with static or constantly updating data.

6. Conclusion

The shortcomings of the India OGD platform have been thoroughly investigated over the past decade, yet the issue of poor access, platform stability, technical maintenance, and bureaucracy have persisted. To increase transparency, openness, and oversight, and ensure the ethical use of AI in data collection and processing, it is necessary to consider the retooling of the India OGD platform towards citizen-centric technologies. This way, it becomes possible to build stronger relationships between government data providers and the data users and ensure that end users of the platform are involved throughout the data collection and distribution process. Furthermore, the commitment to do so must be sustained over an extended period and involve the governmental and non-governmental organizations that can benefit most from the use of this data.

1) Which open-source data visualizing software would be appropriate for supplementing the India OGD platform?

Resolution: With the use of the MCDA upon the selection criteria, this study found that the best open-source data-visualizing software is WordPress and Python are the best option for hosting and visualizing Open Government Data. WordPress the highest ratings after our Multiple Criteria Decision Analysis to determine which of the following content management services is the best because to its minimal implementation costs, simplicity, and significantly more theme selections. Python is visualization software, but rather a tool for some libraries that are robust and have community support for their various libraries written in different languages, giving Python an advantage over other data visualization software. The readability of Python allows engineers to save time by writing fewer lines of code to complete tasks. Python's speed is ideal for data analysis. This is due to widespread adoption, as well as the availability of a plethora of open-source libraries for a variety of purposes, including but not limited to scientific computing. As a result, it's no surprise that it's hailed as the best programming language for data science. Python has a variety of distinct features that make it the best choice for data analysis.

2) What could improve the long-term maintenance of the OGD India platform's performance?

Resolution: Although this study did not perform an analysis of the ODG India platform's user experience directly, we assume the position of the literature that indicates previous studies have already pointed out the platform's technical shortcomings. With that said, our findings may indirectly influence a lean towards better transparency if the platform's data visualization features are overhauled to offer better AI and machine learning capabilities. Furthermore, the software our MCDA highlights is cost-effective and may not require a significant investment.

The utility and benefit of OGD India are evident, and it can produce better citizen participation in government oversight if the platform were more navigable and offered better and easier-to-use data visualization. This coupled with a streamlined user-experience design would significantly enable better participation in India's democratic experience and strengthen transparency and public support for the government.

In conclusion, this study contributed to the overall literature that exists regarding OGD framework in India and the wider policy concerning data governance and transparency. Theoretically, we demonstrated that the MCDA has relevance to this type of research, especially dealing with issues of transparency in governmental open information projects. In this case, we demonstrated that streamlining the virtual embodiment of India's open information project; the OGD India platform, needn't be an expensive affair. Rather, decision-makers can take into consideration the vast wealth of knowledge available in open-source tools that can resolve some of the platform's issues relating to data visualization and access. With regards to future research, it is recommended that they focus on the technical aspects of the OGD India platform that have not been mentioned in this thesis and approach them with a perspective toward citizen-centric technologies. In this way, possible solutions to the existing OGD India platform at the time of this writing could be better addressed and offer practical solutions that may reverberate into better more visible data transparency and the strengthening of India's democracy.

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