JOURNAL OF GOVERNANCE AND INTEGRITY
ISSN: 2600-7479 e-ISSN: 2600-786X
VOLUME 8, ISSUE 1, 2025, 940 - 959
DOI: https://doi.org/10.15282/jgi.8.1.2025.11957

RESEARCH ARTICLE

Toward ethical intellectual property governance: A web-based solution for XYZ company in the oil and gas industry

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ABSTRACT - This research paper presents a web-based intellectual property management system exclusively for a mid-sized Malaysian oil and gas company. The oil and gas industry is a powerful engine of the global economy but, for some reason, it lags behind in properly managing intellectual property (IP). The majority of companies, such as XYZ, still rely on outdated tools such as Excel spreadsheets, which leads to issues with data access, tracking, and visualization. This inefficiency affects strategic planning and decision-making. This study resolves these concerns by suggesting an Intellectual Property Management System based on the web that has been created with WordPress, a free and versatile open-source content management system. The system will keep IP records centralized, access easier, and include a standard rubric for assessing and classifying IP assets. The main objectives of the study are to identify the current challenges in IP management in XYZ company, develop a user-friendly, centralized electronic system, and propose a systematic rubric that supports IP evaluation via effective data visualization. Data was collected through semi-structured employee interviews at XYZ to determine current pain points and system requirements. The findings show a centralized web-based solution significantly improves operational efficiency, visibility, and collaboration among stakeholders. In conclusion, this study presents a feasible and practical solution for IP management modernization for the oil and gas sector. Future research can further extend the system to other sectors or add advanced features such as automation and predictive analytics.

ARTICLE HISTORY
Received : 01-02-2025
Revised : 21-04-2025
Accepted : 04-05-2025
Published : 30-07-2025

KEYWORDS
Web-based system
Intellectual property
Data management

1. INTRODUCTION

Long a pillar of the world economy, the oil and gas industry provide for transportation, industrial growth, and energy needs (Lu et al., 2019). The line of activities that comprises this industry includes exploration, extraction, refinement, distribution, and sales, all forming a large part of its supply chain. Even as renewable energy resources are becoming increasingly important, oil and gas remain crucial to worldwide energy supply, and new technologies are continually changing how resources are extracted and used (Fattouh et al., 2019). Variable fuel costs, environmental concerns, and the need for sustainability continue to be key challenges. Intellectual property is indispensable in the preservation of technological innovations within this cutthroat and innovation-driven sector (Naidu et al., 2023). There is a requirement for the protection of patents, trademarks, and trade secrets over exploration methods, refinement procedures, and equipment designs. There is also a growing tendency globally toward not just the protection but also the use of intellectual property to preserve competitive advantages due to modern innovations such as digital twins, automation, and artificial intelligence (X. Li et al., 2024).

Besides being a great consumer of energy, Asia is also an important producer of gas and oil. Countries like China, India, Indonesia, and Malaysia are among the biggest producers and consumers of hydrocarbons (Ahmad & Zhang, 2020). The need for out-of-the-box thinking arises to maximize extraction, distribution, and consumption of resources due to the growing population and industrialization in the region. Asian markets are rapidly adopting Web-based technologies along with other digital revolutions in their effort to become more productive (Romsom & McPhail, 2020). Such systems pave the way for better decision-making, easier access to data, and smooth operations. Digital platforms, for example, assist in inventory management, optimization of drilling operations, and tracking of supply chains (Sharma et al., 2024). They also provide a platform for IP management, ensuring that inventions are protected in an industry prone to technical competition and espionage. With a high production capacity combined with huge reserves, Malaysia emerges as one of the biggest oil and gas players in Southeast Asia. The national oil company of Malaysia is Petronas, which spearheads exploration and production, therefore contributing a lot to the country's GDP (Graham & Ovadia, 2019). The company operates upstream, midstream, and downstream businesses, having served as a catalyst for growth. Modernization and digitization drives have, therefore, made the requirement for efficient systems of IP management seriously felt in Malaysia (Rejeb et al., 2020). Patents for new drilling methods or refining procedures are examples of intellectual property portfolios that, until today, remain kept by many companies in spreadsheet form or standalone documents, allowing very limited strategic usage and accessibility.

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The future of the oil and gas industry in Malaysia will be determined by how modern technologies are adopted to enhance the management of intellectual property. A web-based solution can enhance the efficiency of IP management since all relevant data is stored in one place (Diène et al., 2020). Therefore, key decision-makers can easily and quickly access the information they need. Moreover, such tools would have the potential to visualize some of the critical evaluation parameters, including project relevance or potential financial benefits. One key benefit with a web-based solution is enhanced collaboration (Lyons et al., 2021). All stakeholders will be better equipped to interact with IP-related decisions if they have access to updated information. Another possible benefit is the better handling of IP audits (Krejcar et al., 2020a). Automation of such tools may enable the tracking of important information like when renewals are due, whether any infringement proceedings exist, or general strengths regarding an IP portfolio. Web-based solutions provide insightful information with implemented interfaces (Javed et al., 2024). These dashboards may assist business concerns in putting more emphasis on research and innovation by underlining the value of patents or trademarks. Malaysia's oil and gas industry will become more innovative and efficient by adapting to a digital platform of intellectual property management, which would ensure that the industry remains sustainable and competitive in the ever-evolving global market (Zhai et al., 2022).

1.1 Research Problem

In order to gain a competitive edge, companies seeking to harvest their intangible assets must practice effective intellectual property (IP) management. However, some of organizations' current IP management practices provide significant obstacles. The use of traditional methods, like Excel spreadsheets, has a number of disadvantages that make it difficult for people to access and analyse IP data (Lasantha et al., 2024). In this situation, users may find it extremely challenging to swiftly access and browse the IP inventories, which could lead to inefficiencies and lost chances for well-informed strategic decision-making. An organized evaluation method for the subjective IP in terms of its innovation and market potential is also lacking. Users struggle to understand intellectual property (IP) assets from what they need in the absence of a defined criteria. Another significant issue with process management is the incapacity to see IP data across several categories. It would be easier to identify trends or gaps in innovation and other important areas if organizations have the right resources to visually portray their IP efforts (Moerchel et al., 2024). It might have an impact on strategic planning and well-informed decision-making concerning IP portfolios. The inefficiency and unfriendliness of the current IP data management systems (Cheng et al., 2023), the lack of designed evaluation methodologies for evaluating IP, and the lack of visual indicators that make it easier to understand IP distribution across categories are, in short, the three main issues at the heart of the research problem. Improving IP management practices and optimizing the value obtained from intangible assets require addressing these issues.

1.2 Research Questions

This research has questions on company listed as below:

a. What are the current challenges faced by XYZ company in managing its Intellectual Property?
b. How to improve data management of Intellectual Property in XYZ company?
c. How to enhance the operational efficiency of Intellectual Property management?

1.3 Research Objectives

This study aims to solve the difficulties in administering and managing intellectual property due to the complexity of traditional way keeping list of IPs. It is important to significantly enhance the accessibility of data and visualization of IP. This study aims to create a system that facilitates efficient IP data and characterization in addition to improving IP management. The specific objectives of this study are listed below:

a. Identify the challenges of current intellectual property management practices in XYZ company.
b. To develop a web-based Intellectual Property Management System to improve data management.
c. To recommend a standardized rubric for categorizing IPs and visualize it to enhance operational efficiency.

1.4 Scope of Study

The purpose of this research project is to develop a prototype for XYZ company's web-based intellectual property management system. The main intentions are to shift from a manual, Excel-based system to a website in order to improve IP data management's accuracy, accessibility, and efficiency. Users will find it easier to access and manage IP information with the new system, which also enables category evaluation based on various parameters. In order to ensure that the prototype is user-friendly and in line with organizational expectations, an interview of XYZ company employees regarding current issues and requests will be part of its study.

1.5 Significance of Study

This research project offers a web-based Intellectual Property Management System for XYZ company that aims to address the drawbacks of the current manual procedures. By reducing reliance on Excel spreadsheets, the proposed system will improve data accuracy, enable more effective data retrieval, and assist in the evaluation of intellectual property by providing clear visual representations for different categories. The prototype will increase the efficiency of IP management overall by enabling users to look at IP more effectively and with a lower probability of data inaccuracies.

By classifying and prioritizing the IPs in this way, XYZ company can help other companies make better decisions that support the company's innovation goal.

2. LITERATURE REVIEW

2.1 Intellectual Property

Intellectual property (IP) has grown into the lifeline of modern economies, protecting the products of creativity and innovation (Mahmoud Selwawy Mansy, 2022). As social orders evolve and technology advances, the legal and economic framework surrounding (Pansera & Fressoli, 2021). IP is progressing in continuous epochs (Xu et al., 2023). Aims to delve again into the complexities of IP touching on its significance, challenges, and trends up ahead. At its core, IP envelops a number of intangible assets, including patents, trademarks, copyrights, and trade secrets (Krejcar et al., 2020a). Patents protect inventions and grant their creators exclusive rights (Chatterjee, 2019). Trademarks are responsible for distinguishment; they enable consumers to identify a certain brand among various options (Nasirov, 2020). Copyrights protect works of authorship such as literature, music, and artistic expressions while trade secrets involve confidential information providing economic competition (Boyle, 2020). The importance of protection of IP cannot be belittled. For instance, it helps to stimulate innovation because it gives a reward to whoever has put in efforts to build it already (Haber & Lamoreaux, 2021). This also creates an environment for growth within a country and lures investment and technological advancement for them. However, the whole nature of the world IP landscape remains complex and extremely dynamic (Alex, 2021). Some of the challenges faced include IP piracy, counterfeiting, and the effects of the digital age on conventional concepts of IP (Gupta, 2024).

The past years have seen a growing intersection of technology and IP (Chibuike Daraojimba et al., 2023). Therefore, important views of the policy community and legal theorists grappling with the necessity to acclimatize intellectual property laws to suit the digital age. Moreover, with the rise in cosmopolitan industries, disputes over IP have arisen across borders (Morris, 2018). International treaties and agreements such as the treaties of the World Intellectual Property Organization (WIPO) have been prepared in an attempt to harmonize IP laws and boost international commerce, albeit not without their own share of difficulties between one jurisdiction and another regarding rights (van Greunen & Gobac, 2021). The need for intellectual property (IP) is increasing as time goes on. According to Valle & Oliver (2020), emerging technologies like blockchain and artificial intelligence (AI) are predicted to drastically alter sectors and present new difficulties for IP management. It is crucial to strike a balance between fostering innovation and ensuring that knowledge is accessible (Köhler et al., 2022). An IP system can be designed that will foster innovation and creativity in the near future (Jemala, 2022).

2.2 Data Management

In the digital age, data management is one of the key drivers that influence success in organizations, especially in industries like oil and gas that involve knowledge-intensive businesses and where intellectual property and proprietary knowledge form the bedrock of a company's success (Surbakti et al., 2019). It is the collection, storage, organization, and management of organizational data such that the data remain correct, available for access, and secure for stakeholders across an organization (Shi et al., 2021). Data management has strategic importance in oil and gas organizations, directly influencing intellectual property management, regulatory compliance, and operational effectiveness (Krasnyuk et al., 2023). Data management is indispensable to an intellectual property web-based management system (Pratomo et al., 2024). The management of intellectual property data seems to become much more complex as organizations increasingly cases on digital platforms to manage intellectual property, thus requiring careful management of its intricacies.

Data management includes the various practices or policies governing processing, storage, and use of data (Pansara, 2021). The intellectual property context deals with the collection, storage, and providing legal and ethical bases for using data accumulated (Wang, 2021).While not unimportant, intellectual property rights do affect how data can be used or shared (Alam, 2022).For instance, the raw data has per se become facts that cannot be copyright protected, while how data is combined, arranged, and presented may be protected as an expression of ideas (Kelli et al., 2020). This distinction becomes very important to integrate in organizations that would want to guard business innovations while facilitating collaboration and sharing within the research community.

One of the major relevant challenges of these intellectual property data management systems has to do with compliance with different layers of legislation (Thambisetty et al., 2021).For instance, kinds of regulations such as data ownership, processes of data use rights, and protocols for data sharing often should be followed by an organization (Vlahou et al., 2021).For example, one may enjoy copyright in a compilation of facts if the compilation displays a minimal threshold of originality in selection or arrangement. Accordingly, organizations should develop strong data management plans covering these legal requirements from the very beginning of any IP or related project (Castelli et al., 2021). The licenses can dictate provisions regarding attribution, modification, and redistribution of the work, thus contributing toward a culture of collaboration and innovation. By means of appropriate licensing, organizations may promote the use of their data while maintaining protection for their intellectual property in an appropriate manner (Bal & Ner, 2019). Digital and data management systems provide a streamlined approach to working with complex and large sets of data while enabling efficient access and improved data accuracy (Kaya & Yildirim, 2024). This approach has become increasingly important for industries that depend on real-time data for strategy development. The advent of data management systems overcomes

some of the traditional problems associated with manual data (Yaqoob et al., 2022) These include inconsistent quality of data, duplicative entries, and lapse of security policy (Alshemaimri et al., 2021).With respect to IP management, a system provides a single point of interaction to which all IP-related data is directed in a usable format for persons in many different departments like legal, R&D, and business strategy.

Besides, they do reinforce data accessibility; data management systems also enhance data visualization, which is one of the most critical aspects of IP management (Yousif & Zakaria, 2022). The visualization tools simplify the complicated and heavy data into lucid and insightful graphics to help decision-makers evaluate the value, status, and impact of intellectual property assets (Lo et al., 2020). Visualization tools may present information in many varied styles: trend, patterns, and outliers from any perspective of the IP aspect whereby companies can make proper decisions on IP investment, protection, and monetization (Galli, 2022). This is particularly valuable, however, in the case of the oil and gas industry because commercial potential and legal protection of IP will likely drive strategic decisions (Varadarajan, 2023). Moreover, with the ever-evolving changes in technology, organizations must keep their eyes on the horizon for any emerging trends that become relevant to data management practices. Meanwhile, big data analytics and artificial intelligence are propelling the new thought processes on how and where intellectual property is created, shared, and protected (Agbaji, 2021). For example, large machine learning algorithms require very large datasets, which may involve copyright-protected or proprietary information (Bommasani et al., 2021). Careful navigation is required against such challenges by organizations to circumvent any potential infringements and take maximum advantage of advanced analytical techniques (Weinbaum, 2023)

2.3 Web-Based System

The advent of web-based systems has brought profound changes to the ways that companies manage their data and utilize their intelligence, allowing for its novel management, access, and protection. This is of great importance, especially to industries with high information involvement, such as oil and gas, since IP is a valuable asset (Mohan et al., 2021). A web-based intellectual property management system provides centralized access to various professionals, improves the accuracy of collected data, enhances security, consolidates management of sensitive and costly IP data, and rises efficiency (Hernandez-Castro et al., 2008). With the switch from classical data tenders to web-based developments, the organizations which fall under Technonext are prepared to face the new sectors of a digital economy thirsty for data. These are internet-based systems wherein users access data and applications through web browsers without any installations or special software stored locally. This nature of flexibility offers real-time access possibility to the information sprawled on any server-present location, generally cooperation through the user's ability to share screens, and the like using multiple functions. According to (Javed et al., 2024), web-based systems focus on decentralized interaction in which different departments of an organization have access to, updatable information, and through which data can be used in real time. This becomes crucial for managing IP within other specializations because that is the first opportunity at hand where, for example, legal, technical, and business teams must take important decisions faster by getting the information they need at the right time (Spring et al., 2022).

The use of web-based IP management system has the potential to enhance accuracy and reliability of the associated information as one of the main benefits. In many existing solutions, local databases and copying of data into them are used, which leads to inconsistencies between different users of the system – a central web-based system eliminates these problems (Koukoutsis et al., 2020). In IP management decisions are largely information driven, and as such the kind of data emerging has to be credible and comprehensive (Javaid et al., 2023). For instance, one may find that a particular product is protected by a patent, trademark, or licensing agreement, only to discover that the information is wrong, and one is liable to be prosecuted, or, conversely, that a valuable opportunity has been lost. These systems also help with higher data security, which is also an important factor when handling information, as IPs contain data that can valuable for a company and vulnerable to hackers or other security breaches. Manual data handling together with the possibilities to store the information in ordinary files or use different remote databases are very vulnerable to hacking (Anil et al., 2020). Still, web-based systems come equipped with measures such as encryption, multi-factor authentication and controls, designed to prevent IP assets from cyber threats. Modern evolving computing technologies have enabled web-based systems to incorporate highly secure security features that addresses issues of data integrity and confidentiality (Efuntade & Efuntade, 2023).

Also, web-based IP management systems also help in enhancing operational efficiency because several processes that were hitherto done manually are mechanically done. IP management includes work related to monitoring patents' statuses and renewal dates, records of licensing and royalties. The advantages of Automation are that time-consuming paperwork is eliminated and it helps to avoid spot mistakes as well as guarantee certain operations to be performed within the set time (Chen et al., 2021). Optimization in web-based systems is most useful in the IP ownership as it enables organizations to make efficient use of their resources by handling the bulk of possible data and leaving some more important processes, including IP planning and innovations, to the employees. Another advantage of web-based systems is its capability of data integration and data visualization (Veyseh et al., 2021). From these descriptions, it becomes apparent that IP management data is frequently not straightforward, and often complex and three-dimensional and sometimes cross-referenced from legal to technical and from technical to financial aspects. Web based systems allow the amalgamation of data from multiple sources giving users exposure to all the information that they need from a single location (Osman & Walt, 2022). Further, some of these systems allow compiling of raw data into graphical forms like a chart, dashboards

and the like that are easier for strategic analysis. For example, through data visualization, IP managers can easily determine the worth and productivity of various IP assets, patterns among them and make an appropriate decision on the same. The benefits of web-based data visualization are multifaceted as they not only improve knowledge acquisition but also enable anticipatory management – a key component of strategy execution in a highly competitive context of IP management (J. Li et al., 2022).

Moreover, web-based systems provide solution for scalability an area that is crucial in any organization as it starts to develop or expand data handling capabilities. In this case, it is possible to implement updates or modifications to the system without extensive redesigns of the laying or rewiring of infrastructures, which exist in traditional systems implementations, web-based systems can also be extended to deal more with volumes of data and more users. This makes it easier for organization to start with a simple web-based IP management system and then add to the horn as they grow (Capehart, 2020). Scalability is especially important in the IP management field because in most cases, the number of patents, trademarks, and other types of IP assets that an organization owns enlarges in time (Damvakeraki et al., 2024). Web-based system also means that no matter how large the system grows over time; data management will remain practical and affordable. Web-based systems are more responsive to the fluctuating requirements of data driven businesses and hence they are more suitable for long term use.

In any case, organizations may experience some difficulty in the implementation of the web-based systems even though these systems come with immense benefits, more so where the organization is migrating from traditional systems. This process is critical in migration and should be well coordinated to meet the specific needs of the organization and all the information being moved should be well transferred with no missing part. It is also feasible to train clients to efficiently use the new system as rejecting the change is a major concern and unfamiliarity with web-based technologies is another major issue. To overcome these challenges, organizations should ensure that its employee receive enough training and support in the web-based system and ensure them about the importance and benefits of using the web-based system so that they can accept and use it. Also, some organizations may want to consider issues to do with data privacy for instance, organizations that deal with highly sensitive data may have to ensure that they adhere to certain regulations put in place over data protection with special emphasis to certain industries.

In addition to improving organizational effectiveness, web-based systems had impact on the subject in that it improves compliance with set regulatory laws. I.P management is regulated by rules of law since different countries have different laws that govern use of intellectual property hence violation of these laws attracts penalties, legal cases and further tarnishes the image of the company. Web-based systems help in achievement of compliance through easy and proper record keeping and through tracking tools for changes in regulations and for overall compliance data. Some of the data processing systems also come equipped with audit trails; activities performed by users and data alterations are recorded this comes handy during audits in an organization. Organizations that have implemented web-based IP management systems are in a better place to meet the set regulatory standards hence minimizing on the risks while enhancing the organizations stochastic independence and hence trust.

Therefore, overall web-based systems that can be used in IP management has several advantages, including, increased accuracy and security of data, operation optimization and compliance with the rules. Web-based systems put the organisations at a position where they can effectively and properly manage their IP assets through centralising the data, automating many of the typical tasks, and supporting integration and visualisation of data. Despite the potential difficulties of converting to a web-based system including data transfer and training of users, the future benefits are considerably greater than the drawbacks. This is particularly true as industries shift from conventional processes more towards use of data in order to discover new ways on how web-based systems can help support organizations manage Intellectual Property for a competitive advantage in a competitive global market (Krejcar et al., 2020b).

2.4 The Case Company

XYZ company is a government-initiated organization working to market, facilitate and nurture the development of the Malaysian Oil, Gas Services and Equipment (OGSE) sector. XYZ company was established in 2011 and company's goal is to develop the OGSE cluster in Malaysia. In its different programmes XYZ company aims at providing incentives to the investors, promoting technological development and empowering local firms operating in the sector. In particular, during the past five years, XYZ company's competitive priorities have included strategic initiatives based on the Ahmetisation of global challenges regarding the Malaysian oil and gas industry. Some of the activities that XYZ company perform are the provision of critical links for international cooperation, sponsorship of sectorial innovations, and local SME boosting in the sector. In 2020, XYZ company implemented the industry's OGSE Blueprint 2021-2030 to catalyse meaningful sustainable growth, digitalisation and technology advancement over the longer term. The plan focuses on digitalisation and innovation as two frontiers that Malaysia needs to invest in to develop its OGSE industry which is in line with XYZ company's goal to use digital tools to enhance IP management practices.

XYZ company also takes an active part in the promotion of IP management as part of the innovation agenda. XYZ company has realized the importance of an efficient technology management process to protect the new advanced technological access being developed by some of the station's companies in OGSE. The adoption of web-based IP management system in XYZ company will also enhance internal IP management as well as act as a benchmark for other firms within the industry leading to enhancement of the global competitiveness of the sector. XYZ company uses a

hierarchical model for its organizational structure, with the CEO Office at the centre. The CEO Office is the highest level of authority within the organization, bearing overall control of strategic direction, executive decision-making, and overall governance. Under the CEO are four divisions-Operations, Corporate Strategy and Research, Strategic Communications, and Human Resources and Corporate Services. The Operations division appears to have overall responsibility for XYZ company's day-to-day business operations, covering activities from project execution to development and production possibilities. It is possible that the Corporate Strategy and Research functions of long-range planning, strategy formulation and research for guiding future decisions fall under this umbrella. The Strategic Communications division is charged with internal and external communications- getting out the right messages and contacts with stakeholders. Lastly, most probably, human resources and other corporate services are concerned with the Human Resources itself, corporate services, and the crucial finance and legal areas.

An apparent specialized function distribution throughout each section. These distributions of functions serve to create greater efficiency and specialization. The additional hierarchical structure apparent serves to enhance executive command, making accountability and decision making more effective. However, without additional context, assessing the organizational structure's effectiveness may prove challenging. The best structure for an organization can depends on factors including its size, complexity, and strategic objectives. The specific roles and duties of positions within each division would help to provide a more comprehensive view of how the organization works. In the XYZ company, there are indeed technology units, which undertake the development of the oil and gas sector. These units can include research and development in focusing on cutting-edge technologies and enhancing those that already exist to improve exploration, production, and processing. The units of technology transfer can also facilitate the same through collaborative means with businesses by means of support and training and encouraging an innovation culture across the sector. Innovation hubs would be a help to foster new ideas for taking the industry further and work as a joint collaborative area amongst academic institutions, research centres, and the participants in this industry.

3. METHODOLOGY

The study employed a qualitative approach in researching the issues and developing an efficient solution for Intellectual Property (IP) management in XYZ Company. The study was undertaken in two main stages: the exploratory (qualitative data collection) stage and the SDLC-based system development stage. This approach was employed to guarantee both practical issues and technical requirements were adequately addressed.

3.1 Qualitative Approach

The qualitative phase involved literature review and semi-structured interviewing. Literature review of past research work and academic papers on IP management, data handling, and web-based systems provided a sound theoretical foundation. This provided an overview of the recent trends, technology practices, and industry best practices that can be applied to system development. This was followed by an informal but structured interview with the XYZ Company Manager of OGSE Technology, a key informant who was directly engaged in IP data management. This was an effort to obtain views on urgent issues, user grievances, and specific system requirements. This stage was instrumental in defining the scope of the system, with aspects like increasing IP information availability, facilitating searchability, and streamlining categorization processes.

3.2 System Development Phase – SDLC Methodology

Upon gathering the user requirements, the development of the system followed the System Development Life Cycle (SDLC) approach. Using this systematic approach, the project was handled in a logical and efficient manner, going through the five important phases. Upon planning, the project goals, timeline, and resources were outlined to guide the development process. The requirements analysis stage entailed organizing the knowledge obtained during interviews with stakeholders to determine the functional and non-functional specifications such as enhanced data availability, user-friendly interfaces, and secure IP data management. The system design phase transformed these specifications into a technical plan. This included designing the user interface (UI), database schema, and data flows to make the system easy to use and aligned with user beliefs. During the course of development, the system was built on the WordPress platform, which meant creating custom post types, establishing meta fields, and integrating required plugins for features such as data visualization, user authentication, and categorization. Stakeholder feedback was collected at this phase to validate that the system met the original requirements. Finally, at the testing phase, rigorous testing was conducted to validate the functionality, usability, and security of the system. Feedback was collected to further hone the system into one that fulfills the operational needs of XYZ Company. With systematic development, the resultant platform was both scalable and dependable, offering an effective solution for centralized and efficient intellectual property management.

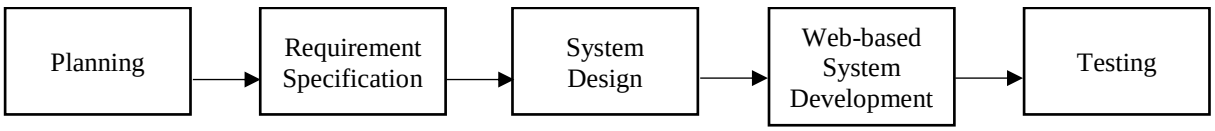

Figure 1. System development process

3.3 Rationale for Using WordPress

WordPress was selected due to its open-source, very much customizable, and scalable characteristics. It boasts a high number of plugins and themes, which enabled rapid development of custom functionalities without needing to start from scratch. This ensured it was a cost-effective and efficient means to meet the needs of the project, for example, secure data storage, dynamic presentation of information, and responsive interface design. WordPress also possesses the capability of role-based user access, crucial to managing sensitive IP information in organizational workflows.

4. RESULTS AND DISCUSSION

A systematic approach in investigating the real causes of these problems was performed using the conceptual illustration. This technique filters down to the real reason for each problem and addressing possible solution. Figure 2 showed the conceptual illustration of challenges.

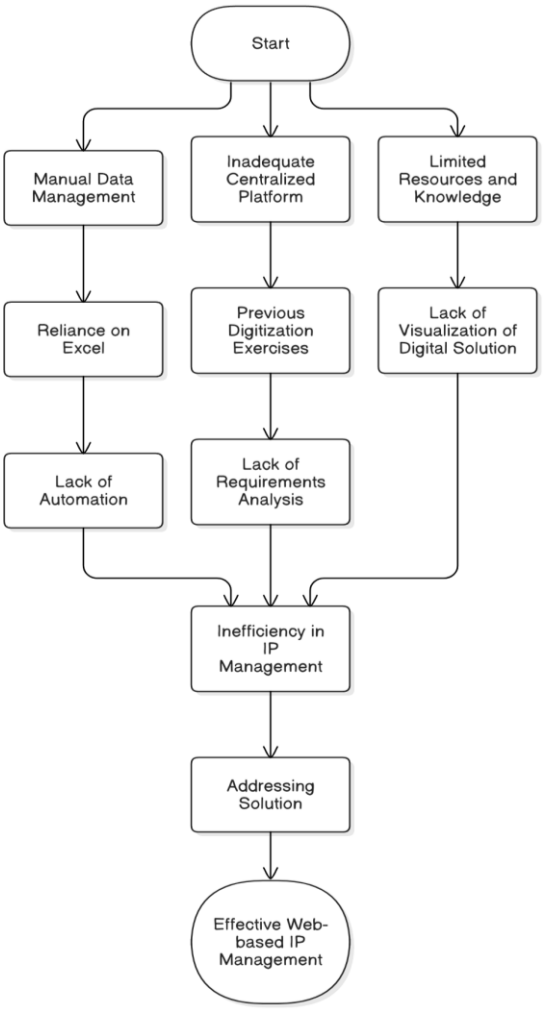

Figure 2. Conceptual illustration of challenges

The inefficiency in IP management traces back to reliance on Excel spreadsheets for manual data management. An approach that is conducted manually lacks automation, centralization, and scalability inherent in a well-designed web-based system. This dependency on manual mechanisms is basically because of an inadequate, centralized digitized platform. The latter is a consequence of the previous digitization exercises that were not based on sound requirements analysis. Because of a lack of explicit identification of the exact needs and pain areas of its stakeholders, such efforts could not come up with an end-to-end solution. The second reason for not having an organized approach to the requirements analysis might be supported by limited resources and knowledge in the organization in terms of web-based systems development. It is just that such limited expertise precluded them from considering or even visualizing a better digital solution. In a nutshell, inefficiency in IP management is an intricate problem caused by a combination of factors: manual processes, absence of a centralized system, inadequate requirements analysis, and scarcity of technical resources. Addressing these issues can lead to effective web-based IP management systems with better operational efficiency, more effective decision-making, and all-around efficiency.

4.1 Web-Based Intellectual Property Management System

This project requires the creation of custom post types because some categories of information need to be managed and organized in ways that exceed the default WordPress content types, such as pages and posts. By nature, this structured into data that needs to be organized in the form of "R&D&C&I Funding," "OGSE IP Marketplace," and "OGSE Technology Solution" just to name a few, these are distinct entities that need dedicated content management. By using CPTs, the system can sort, show, and handle this information in a way that is easy for users to understand and well-organized. This supports the goals of improving accessibility and usability. Creating custom post types in WordPress is of utmost importance in the sense that it helps customize and separate content into logical groups, ensuring that each type of data gets its own interface for input and management. For example, "R&D&C&I Funding" can have special input fields like the funding amount, timeline, and eligibility criteria. On the other hand, "OGSE Technology Solution" might want solution categories, technological specifications, and implementation details. All these differences mean that using plain WordPress posts or pages is not enough because they don't provide the level of customization that this particular content requires. Figure 3 showed the Custom Post Type.

Figure 3. Custom post type

In this project, the integration of the custom meta fields is one such fundamental step towards effectively organizing and presenting intellectual property (IP) data within a web system. The default structure of WordPress is restrictive to such simple fields as title and content and, therefore, not enough for this particular, very granular requirement of this project. Custom meta fields enable the addition of tailored input areas that capture relevant information about intellectual properties, such as "Intellectual Property Name," "Intellectual Property Owner," "Application Number," "Application Year," "Status," and "Abstract/Description.". These domains permit the system to retain, categorize, and select data systematically, which consequently leads to improved performance and user quality.

This need for the introduction of these meta fields arises from the intricacy and specificity of the data being handled. For example, the "Application Number" and "Application Year" fields are very important for understanding the temporal and identity characters of intellectual property application, and the "Status" field can help us understand whether the application is current, in progress or dead. The availability of an "Abstract/Description" field guarantees that users can retrieve a brief description of each IP data, thereby leading to an increased informational depth of the system. Defining these custom fields, the project is compatible with its desire to substitute conventional Excel-based management with a more straightforward, well-organized web-based interface. Developing these fields in a code-free way is made possible through WordPress plugins (JetEngine or Advanced Custom Fields (ACF). These tools offer a graphical user interface to establish and structure the meta fields, so that, even a non-technical operator can configure the changes with effectiveness.

It is, in fact, crucial for the success of the project's objective, to build a user-friendly system that makes it easy to enter and look up data. In addition, custom fields enhance search and filter capabilities, allowing users to search for specific intellectual property records quickly. Summing up, the creation of these tailored meta fields is very important in order to fulfil the specific requests of the project. By extending the default WordPress capabilities, this approach enhances the system's ability to manage intellectual property data in a way that is organized, accessible, and scalable. This guarantees that the web-based platform not only fulfils the short-term objectives of the project, but also provides a long-term data management solution. Figure 4 showed the Meta Field of Custom Post Type.

The front page of the website, especially in the Technology chapter, offers a strong view of Malaysia's Oil and Gas Services and Equipment (OGSE) industry. It emphasizes the key role of technology to innovation and transforming regional businesses into global powerhouses. The emphasis on the need for cooperation among government, industry and academia is contained on that page. It highlights the importance of promoting innovation and knowledge transfer at the OGSE community level. The creation of the OGSE Technology Network (OGTEN) represents an important milestone toward goals such as these. This provides a responsive platform that integrates the world's stakeholders and drives technology adoption, research and development and commercialization. In general, the front page describes the different activities and programs that XYZ company has been running to encourage technology adoption and innovation. These are technological platforms, funding mechanism, and service provision to companies. Basically, the technology unit home page of the website can be used to reflect the commitment of XYZ company to create technological progress in the field of OGSE. It focuses the role of cooperation, innovation and knowledge transfer in making Malaysia a global reference in the field.

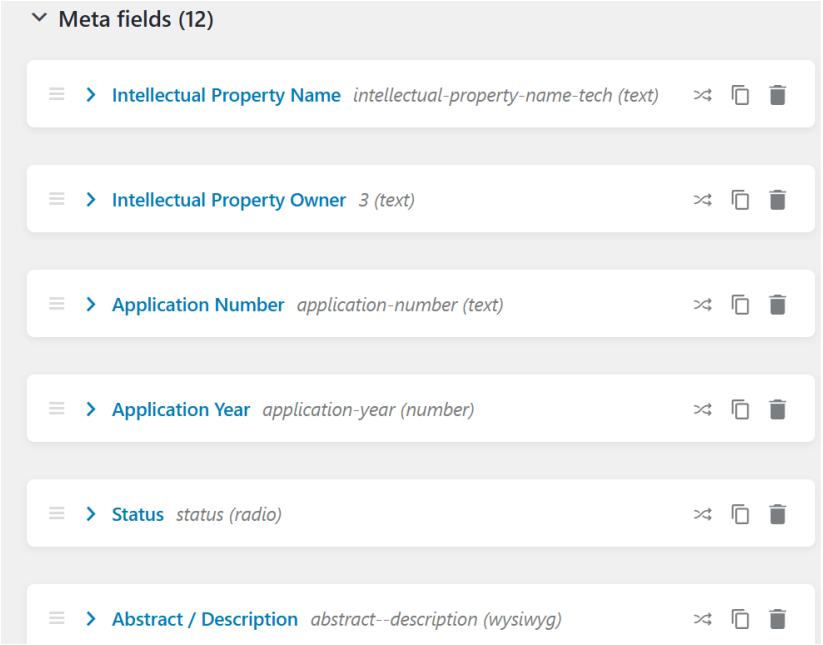

Figure 4. Meta field of custom post type

The OGTEN site is a technology unit platform that can be found on the homepage of the i-OGSE site. It is a one-stop centre for technology solutions, intellectual property (IP), and funding opportunities related to the Oil and Gas Services and Equipment (OGSE) sector. This holistic platform provides breathing space for start-ups, so they could stretch their wings and take off with the creativity flight within the oil and gas industry. The OGTEN site centralizes digital tools that help companies to monetize capabilities by automating processes, implementing smart machines, going digital, and embracing the latest technologies. Generally, OGTEN site enables firms to address challenges in areas like business performance, optimization of costs, and exploiting differentiated product offerings.

In addition, the OGTEN site supports the development of innovation and intellectual property in the oil and gas services and equipment (OGSE) sector. Supporting the protection, commercialization, and licensing of Intellectual Property (IP) know-how, the node nurtures innovation while bending the direction of existing technology and developing new products. As the primary focus of this initiative is Intellectual Property, the resulting environment encourages firms to participate in the process of invention. Besides technology proposals and Intellectual Property support, the OGTEN site offers businesses a unique gateway to a demonstrated collection of financial reservoirs. Making use of personal relationships existing between the companies and potential investors, as well as public or private funding entities, the site translates the business ideas into money making them happen and subsequently expanding businesses. Through these core service offerings merged into a single platform, the OGTEN site makes the acquisition of technology, IP, and finance much easier for OGSE companies. This optimized approach reduces the number of employees and manual work involved in everyday business, thus enabling easier scaling of the business. To sum up, the OGTEN site is a significant channel for the OGSE sector, well-equipped with a technology solutions-IP support-funding opportunity ecosystem. By way of incubation, nascent enterprises, and other players in the sector are connected, supported, and made competitive not just to the market but to the international level, thus gracing the sector with development and competitiveness. Figure 5 showed the Front-page website of Technology unit XYZ company.

The development of a web-based system that will represent the IP products and technologies in an accessible and professional manner is required. In such a platform, information should be centralized and organized in order to enable easy access and discovery of technologies for the stakeholders with specific interest in the oil and gas industry. The products/technologies to be showcased on the interface are those at Technology Readiness Levels-TRL 8 and 9, meaning fully developed or almost commercialized. A look at the technologies in use today, and those that have not made it to the commercial market, will give one a proper picture of the inventive potential of the industry. It encourages navigation and makes usage easy because of the clean, less-cluttered nature of the platform. On top of the platform, there is a search box at which visitors can just type relevant terms in order to find some technologies or products. Such a function would save them from navigating line by line in order to find information. Below the motto, which encourages users to browse through the collection, is "Technology-based Product". The key display area has a card-based layout where each card gives detailed information about a product. The name of the product, a high-quality photograph, ownership information, and a "More Details" button linking consumers to detailed descriptions that include technical specifications, applications, and possible advantages are some of the elements displayed in every card.

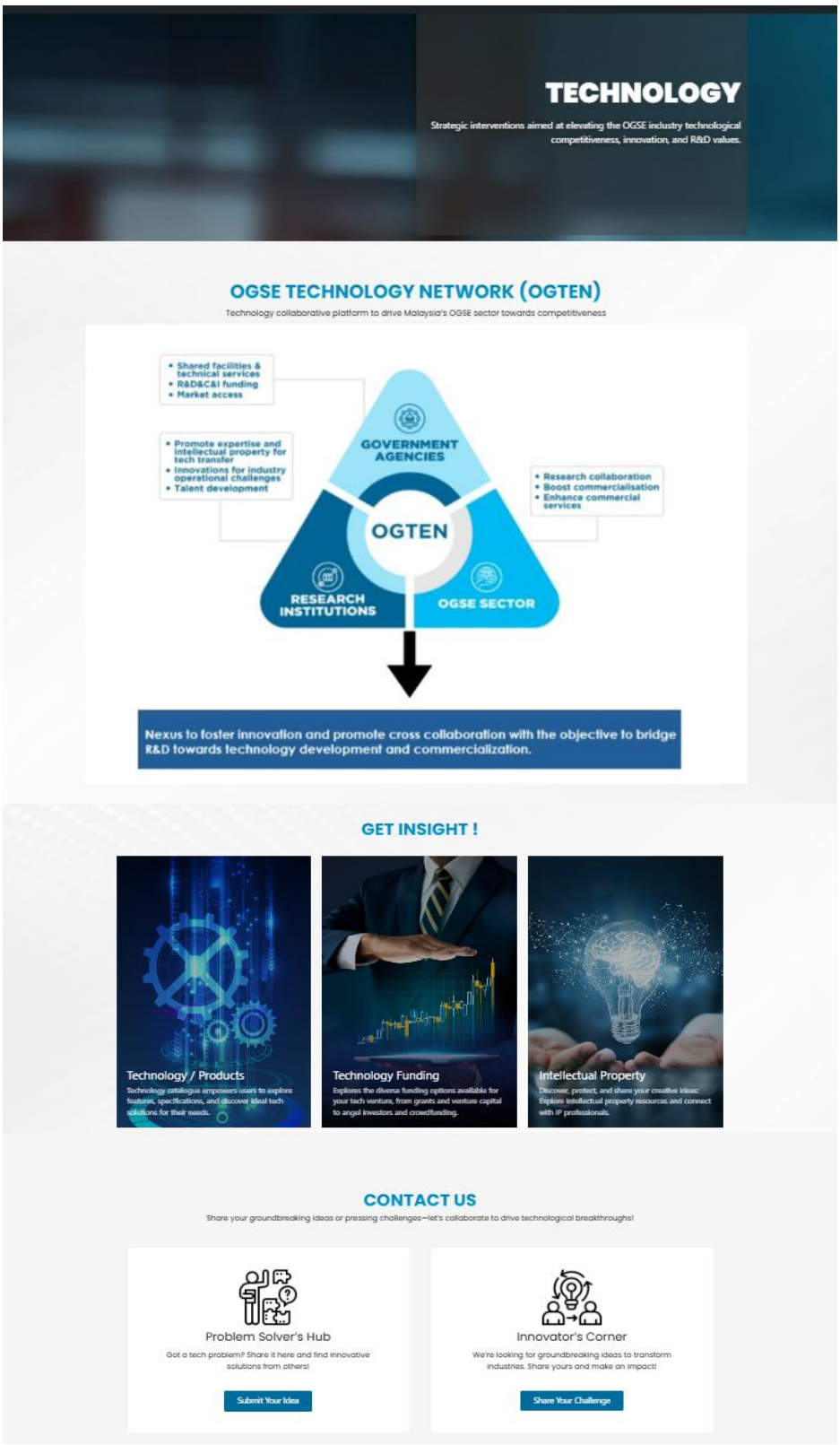

Figure 5. Front page website of technology unit XYZ company

The modern background design with the abstract tech components supports the idea of advancement and innovation, adding aesthetic appeal to the platform. Besides being beautiful to the eye, the general interface is also solid in functionality, making it very easy to use for people of different degrees of technical ability. This interactive web-based solution greatly enhances accessibility, organization, and user engagement compared to traditional spreadsheet-based IP management. Now, stakeholders may access the platform from a distance, browsing through organized content and learning more about the items and technologies on display. This platform is an important component in the oil and gas industry, linking up the creators of technology with potential users. The industry's innovative ability and capability to adapt to changing demand will be highlighted through various technologies in this exhibition, some of which are already

at advanced development stages. Moreover, bringing together technologies that are not yet commonly available provides excellent opportunities for collaboration, financing, and commercialization. It acts as a platform where strategic relationships and innovation can take place aside from being a base of knowledge. Figure 6 showed the Technology-based Product's page section

The website has a dedicated section on "Intellectual Property," showing the company's commitment to technical innovation. A call to "Explore our extensive portfolio" and a prominent display of "Registered Patents" immediately point out the intellectual property of the company. Adding a search bar to this further enhances the user experience, making it easy to navigate and find specific patents. The visual presentation is neat and sleek, having a well-structured layout and an attractive background. What it accomplishes with the display of patent cards, together with associated visuals, is providing a short and interesting summary of each registered patent. Since important details such as the patent number, application year, and a brief description are prominently displayed, users can quickly get an overview of each invention. This gives the user a chance to understand each patent further and encourages them to learn more. The selection of the patents, ranging from processes related to chemistry, drones, structures offshore, and capture of harmful gas, shows the huge scope of technological advancement in oil and gas fields. This represents the wide variance in issues it takes interest in and possibly researches directions toward its technological development. In all, the "Intellectual Property" web page shows very nicely the intent of the organization to be truly committed to innovation with valued intellectual assets. Easy navigation and pleasing presentation allow different stakeholders to study and cognize the company's portfolio of patents easily, thus establishing transparency and a showcase in technology leadership. Figure 7 shows page of Intellectual Property section.

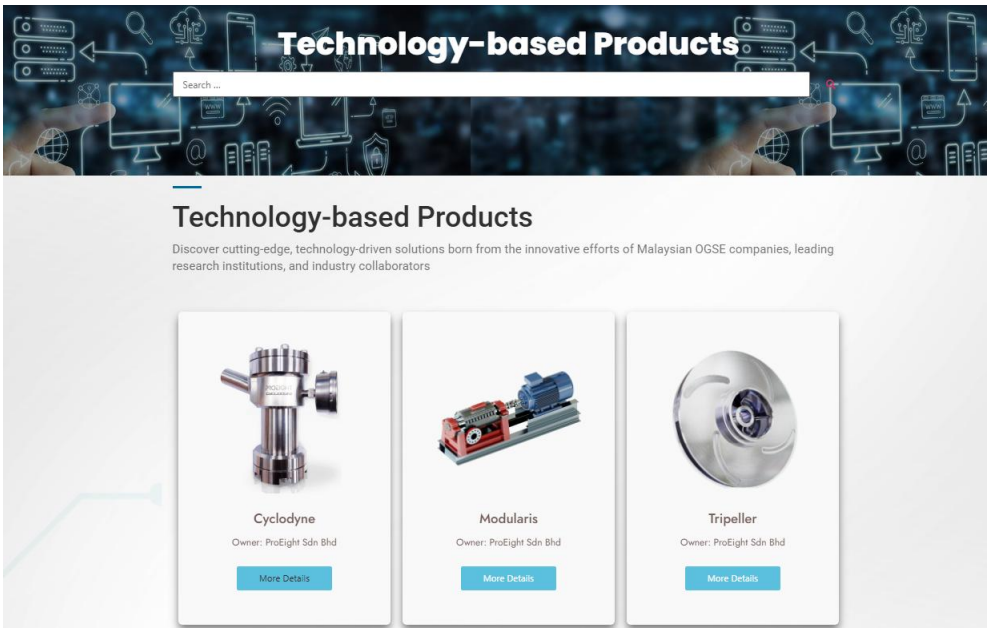

Figure 6. Page website of Technology-based Product section

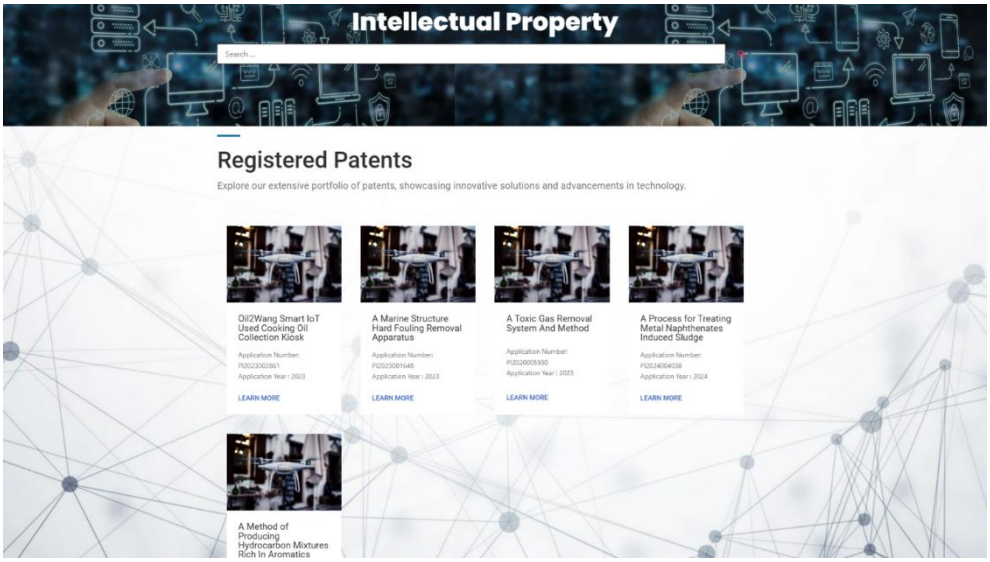

Figure 7. Page website of Intellectual Property section

Figure 8 shows the "R&D&C&I Funding Landscape" in Malaysia. Particular attention is paid to the OGSE industry. Key information with respect to the various financing programs and organizations that support technology development and innovation in this industry is efficiently conveyed via this graphic interface. The flowing path from "Early Adopter" to "Mature Market," for example, is a metaphorical drawing of a graphic image that works pretty well to present the dynamic character of the technology development process. Contrasted with just a simple list of financing programs, this graphic relationship improves comprehension and makes more interesting and memorable the information on. Also, clear categorization and structuring of information enhance the user experience. The landscape is divided into four distinct stages: technology development, early adopter, growth market, and mature market. This division provides a clear framework for understanding the funding choices available at different junctures in the technology lifecycle. It is useful for a customer, as through this structure, one can easily find the funding program relevant to their unique demands, given a certain stage of technological growth. Adding MOSTI, MTDC, and MRANTI- key stakeholders- expresses an enhanced idea about financial landscapes. Technology development is really a joint collaborative process, and this graph underpins that collaboration among key governmental organisations, academia, and business leadership.

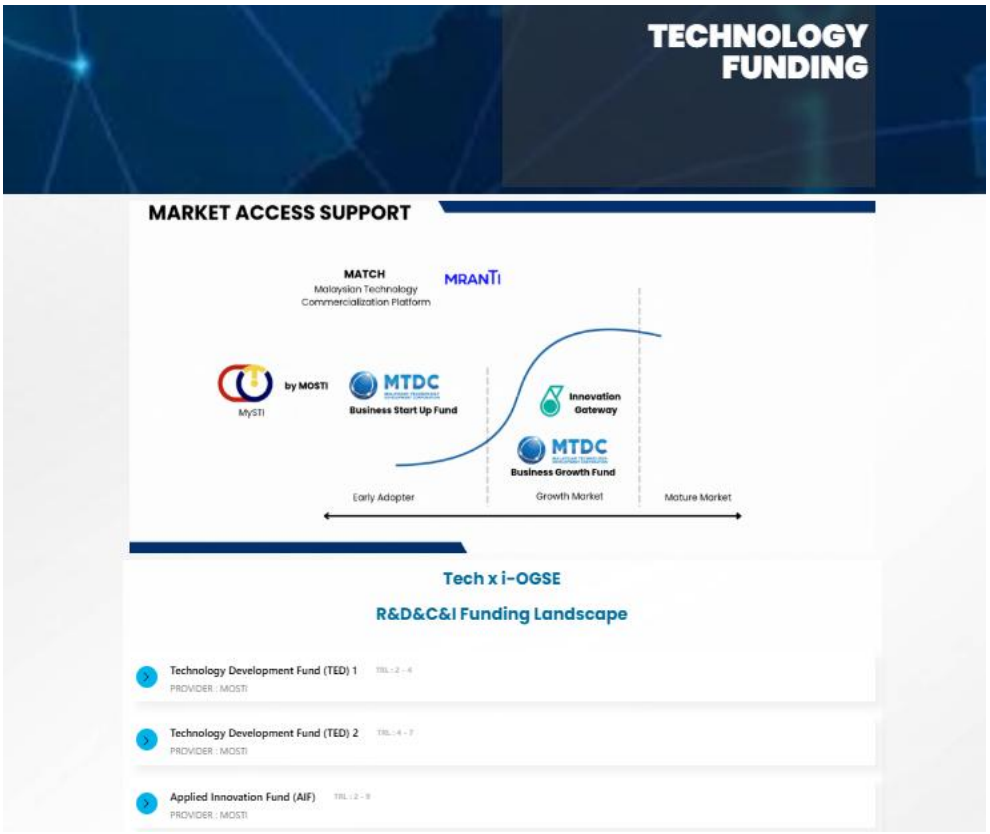

Figure 8. Page website of Technology Funding section

Ultimately, a useful framework for comprehending the financial environment is provided by the combination of Technology Readiness Level (TRL) and the Technology Development Fund (TED). It links funding opportunities to specific phases of technological development and thus helps researchers and innovators identify appropriate funding sources based on the maturity level of their technology. The interface offers a valuable tool to researchers, innovators, and entrepreneurs through the use of visual metaphors, unambiguous classification, and involvement of key stakeholders and TRL levels to better understand the funding landscape and secure the support they need to bring their inventions to the marketplace. Innovation, commercial potential, technical feasibility, legal protection, competitive advantage, and team capability were the six key elements on which the rubric focused. Each of these elements was assessed on a 5-point Likert scale for an appropriate and uniform framework of weighing the advantages and disadvantages of an IP asset. This structure accurately identified high-value IPs with strong potential for commercialization and industry impact. Innovation has also become one of the key elements since it points to the novelty and originality of the technology. Highly innovative intellectual properties were selected based on their ground-breaking innovations, inventive problem-solving, and capacity to provide notable advancements over current technology. Technologies scoring higher, such as "Excellent" or "Very Good," were found to be disruptive and had the potential to open up new markets. On the other hand, technologies that scored lower showed little innovation and only minor advancements, diminishing their competitive advantage.

Other factors that determined the outcomes included commercial potential. With regard to intellectual property that had the most market demand, thereby bringing in revenues, these were considered the likeliest cases of becoming profitable and hence more favourable. The assets graded "Excellent" demonstrated the presence of a sizable market characterized by very slight commercialization risks and with adequate capability of generating regular streams of cash flow through sales or licensing. However, IPs characterized by low market demand and consequently low profitability

were more likely to stall or never be commercialized. Technologies whose feasibility was better regarding passing the commercialization process based on technical survivability, results indicated higher TRL. Well-developed, well-established systems characterized feasible technologies whose score was either "Excellent" or "Very Good" category with minimum technical hazards: Scalability was another critical component, which ensured that the technology would match up to the increasing market demands. Most of the technologies that fit into lower ranking categories were either unproven, immature or presented huge technical barriers inhibiting further development.

While evaluating the IPs on their long-term viability, the legal protection component became an essential basis. In order to generate a competitive advantage and avoid illicit exploitation, strong copyright protection, trade secret policies, and patent protection had to be created. Strong legal regimes allowed the IPs to maintain their exclusivity and protect their market position, reflected in their superior rankings. Conversely, innovations that enjoyed limited or no legal protection were found to be more vulnerable to competition and imitation, which reduced their overall value. The high-scoring IPs had also differentiated themselves on their competitive advantage. These resources allowed them to be market leaders, offering differential value and having high entry barriers. In addition to ensuring consumer interest, a highly competitive advantage also beats back potential competitors. Accordingly, the IPs with low competitive advantage struggled in differentiating themselves from rivals, almost always at the risk of easy imitation. The capability of a team to lead a venture in placing capital was gauged lastly with the use of Team Capability. IPs with knowledgeable and capable teams with sufficient funding scored higher because such groups can surmount various obstacles involved in placing capital and successfully launch technologies. For IP teams that were relatively weaker, due to either experience or resources, their potentials are below expectations.

In evaluation, the 5-point Likert scale was used to provide consistency and dependability. The useful information obtained indicated strong candidates for commercialization were technologies that scored high in each of the six criteria, providing great opportunities for income generation, market leadership, and industrial expansion. These findings also point out that using a structured approach to the evaluation of IP ensures that funds are being funnelled into the most promising inventions while pinpointing those areas where weaker assets may be strengthened. In summary, this project shows structured assessment tools playing a major role in driving innovation and technology commercialization for the oil and gas industry. Table 1 shows the Rubric for IP evaluation. Each criteria is rated on a 5-point Likert scale, and for each level, a range of numbers has been allocated: Excellent-between 10-9, Very Good-8-7, Good-6-5, Fair-4-3, Minimal-2-1. For each criterion, the numerical ranges act like pointers to elicit more objective and measurable data. For example, a score of 10-9 would be for an idea that is fresh and revolutionary in the category "Innovation," while a score of 2-1 would describe little or no novelty with slight improvement. This numerical representation allows for a more accurate and consistent assessment among various evaluators. Each level within the rubric is assigned a numerical value; this enhances objectivity and comparability of evaluations. It offers the possibility of making the evaluation more methodical and data-driven regarding the IP assets, which makes the analysis and decisions easier. The numerical scores can undergo statistical analysis, by which comparisons in the performance of various IP assets can be made, trends determined, and averages computed.

Following is the result of the IP assessment in the oil and gas sector, conducted for 9 intellectual property assets. Using a rubric that defined the scores, each of these IP assets was given a score on a scale of 1-10 for each of the six key criteria: Innovation, Commercial Potential, Technical Feasibility, Legal Protection, Competitive Advantage, and Team Capability. Then the average score per each of these six criteria had been calculated for evaluating the overall asset score. These results reflect a diversified portfolio of different intellectual property assets that had varying potentials. Scoring 9.0 in the aggregate, the "AI-Powered Predictive Maintenance System" stands out as "Excellent." This high score denotes high innovation with great commercial potential, highly technically feasible and legally well protected, enjoying a substantial competitive advantage, while there is an adequate team behind its development and commercialization. Other intellectual property assets rated as "Very Good" and with high marks included: "Enhanced Oil Recovery Technique," "Subsea Corrosion Inhibitor," and "Improved Oil Spill Response Technology." These assets demonstrated excellent overall performance based on good ratings in several important categories. "Novel Fracking Fluid Additive" and "Lightweight Drilling Rig Design," scored lower, showing that they do need improvement. These resources may need more work or enhancement to enhance their competitive advantage, solve technical problems, or realize their economic potential.

The analysis underlines the significance of a full-fledged, multi-dimensional valuation framework beyond mere innovation. Therein, valuations would provide a complete and insightful assessment of the pros and cons of every IP asset based on commercial opportunity, technological feasibility, legal enforcement, competitive power, and competency of the team, let alone innovation. These can be very useful when it comes to deciding on the best resource allocation, prioritizing development projects, and formulating an overall IP strategy. Table 2 shows the result evaluation of 9 Intellectual Property Asset within oil and gas sector.

Table 1. Rubric of intellectual property categorization

Indicator	Excellent	Very Good	Good	Fair	Minimal
Criteria	(10-9)	(8-7)	(6-5)	(4-3)	(2-1)
Innovation	Ground-breaking, revolutionary	Highly innovative, significant improvement	Moderately innovative, incremental improvement	Minor innovation, limited novelty	Minimal novelty, slight improvement
Commercial Potential	High market demand, strong revenue potential, low risk	Moderate market demand, good revenue potential, moderate risk	Limited market demand, potential for niche market, high risk	Very limited market demand, low revenue potential, high risk	Minimal market demand, negligible revenue potential
Technical Feasibility	Highly feasible, well-developed technology, low technical risk	Feasible, mature technology, moderate technical risk	Partially feasible, developing technology, high technical risk	Limited feasibility, immature technology, very high technical risk	Minimal feasibility, high technical risk, potential for significant hurdles
Legal Protection	Strong patent protection, high likelihood of enforcement	Moderate patent protection, potential for trademark or copyright protection	Limited patent protection, reliance on trade secret protection	Weak or no legal protection	Minimal potential for any form of legal protection
Competitive Advantage	Significant competitive advantage, strong barriers to entry	Moderate competitive advantage, some barriers to entry	Limited competitive advantage, weak barriers to entry	No competitive advantage, low barriers to entry	Minimal competitive advantage, potential for rapid imitation
Team Capability	Strong team with relevant expertise and experience	Competent team with some relevant expertise and experience	Limited team capability, lack of expertise in key areas	Weak team, significant lack of expertise and experience	Minimal team capability, lack of skills and resources

Table 2. The result evaluation of 9 intellectual property asset

IP Asset Name	Innovation	Commercial Potential	Technical Feasibility	Legal Protection	Competitive Advantage	Team Capability	Overall Score	Average Score
Enhanced Drilling Mud Formulation	9	8	7	8	7	9	48	8.0
Subsea Corrosion Inhibitor	7	6	8	7	6	8	42	7.0
AI-Powered Predictive Maintenance System	10	9	8	9	9	9	54	9.0
Novel Fracking Fluid Additive	8	7	7	6	7	8	43	7.2
Improved Oil Spill Response Technology	9	8	7	8	8	8	48	8.0
Enhanced Reservoir Simulation Software	8	9	9	8	8	9	51	8.5
CO2 Capture and Utilization Technology	10	8	7	9	9	8	51	8.5
Lightweight Drilling Rig Design	7	6	7	7	6	7	40	6.7
Autonomous Underwater Vehicle for Inspection	9	8	8	8	8	8	49	8.2
Novel Method for Enhanced Oil Recovery	8	7	8	7	7	7	44	7.3

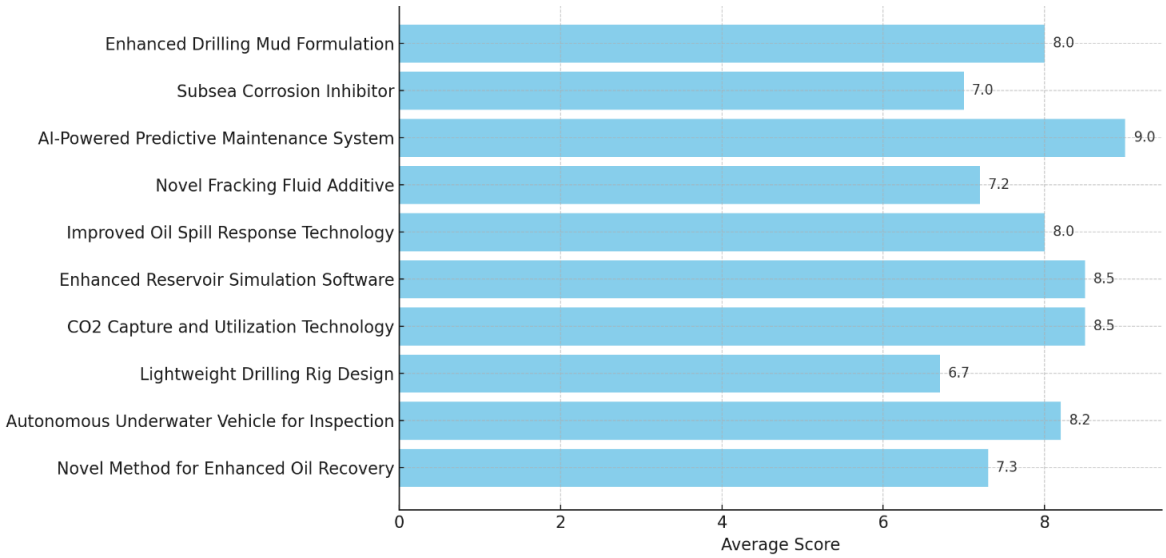

Figure 9. Bar chart of average evaluation scores of intellectual property assets

The bar chart illustrates the average scores of various Intellectual Property (IP) assets scored by a defined rubric. Among the ten assets assessed, the AI-Powered Predictive Maintenance System scored the highest average of 9.0, reflecting its good performance in all the dimensions analysed such as innovation, commercial feasibility, technical practicability, legal protectability, competitive advantage, and team capability. This reflects its high maturity, high market relevance, and well-justified development process. Two other technology, Enhanced Reservoir Simulation Software and CO_2 Capture and Utilization Technology are rank in second, with an average score of 8.5. These results suggest these assets are also well-developed and highly likely to be commercialized and exert strategic impact. On the other hand, the Lowest Weight Drilling Rig Design has the lowest average score of 6.7, which suggests comparatively poorer performance, possibly due to limitations in innovation, practicability, or team capability.

The majority of the IP assets were between 7.0 and 8.5, reflecting that the majority of technologies are quite mature and viable but contain areas for improvement, such as scalability, legal protection, or competitive distinctiveness. Particularly noteworthy are technologies like Autonomous Underwater Vehicle for Inspection and Improved Oil Spill Response Technology, who did extremely well, both garnering over a mean score of 8.0, reflecting their potential high operational and environmental value. Overall, the chart highlights the varying degrees of readiness and strategic value of each IP asset to enable decision-makers to prioritize additional development or commercialization based on sound evaluation criteria. Application of an organized evaluation matrix has been an efficient and systematic approach for ascertaining the quality and potential of intellectual property (IP) assets. Through the use of uniform criteria in six important dimensions which are innovation, commercial viability, technical feasibility, protection in law, competitive strength, and team ability, the rubric facilitated a thorough and unbiased comparison between the IP assets being assessed. The outcomes gave insightful information regarding the merits and demerits of each asset, indicating which technologies are most developed, strategically sound, and available for commercialization.

The rubric also assisted in more informed decision making by segmenting highly performing IPs such as the AI-Powered Predictive Maintenance System, which had the highest overall. Conversely, the low-scoring assets showed where more development or investment is needed. This systematic review not only facilitates better prioritization but also satisfies strategic innovation planning, and it guides companies like XYZ Company to allocate resources towards the most promising technology. In conclusion, use of the rubric enhances transparency, consistency, and effectiveness in IP administration and serves as a practical tool to create innovation governance for the oil and gas sector.

5. LIMITATION

One of the primary limitations encountered in this study relates to a technical fault involving the availability of the web-based Intellectual Property Management System. During the testing phase, the users were confronted with the challenge of accessing the system due to a persistent server failure that displayed the error message, "Error establishing a database connection." The error directly affected the availability of critical data within the system, including the evaluation rubric, which is at the centre of assessing and categorizing intellectual property records. The error is an indication of a communication failure between the application and its associated database. Potential causes include incorrect database credentials, server settings, network interruption, or an unresponsive database server. As a result, users were unable to open or interact with the rubric, thereby inhibiting the effectiveness of the system at a very important stage of the research. The disruption underscores the importance of a robust digital infrastructure in ensuring stable access to necessary data. Moreover, these kinds of technical faults can make research work delayed, operational efficiency disrupted, and users' trust in the system lost.

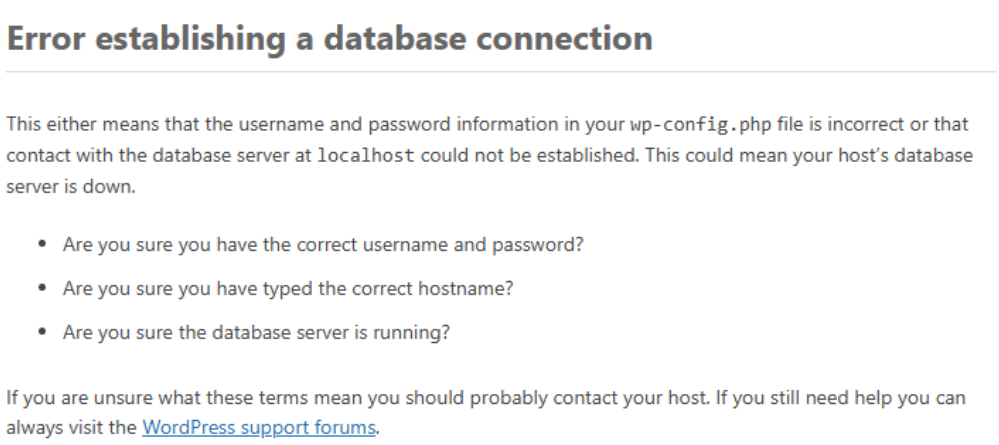

Figure 10. Error to access to the system (Wordpress)

6. RECOMMENDATION

To mitigate the said limitation, there are measures proposed to assist in enhancing system stability and data availability. Firstly, the institution of a full backup and disaster recovery procedure is a must. This entails regular system backups, redundant servers, and automatic failover procedures to minimize downtime and ensure business continuity. Second, it is strongly advisable that the system is moved to a cloud-based infrastructure. Cloud platforms offer greater scalability, more consistent uptime, and improved data redundancy features, all of which work together to make the system more robust. The use of distributed systems or hybrid models of data storage can also ensure data access even in situations of localized server failure. These techniques not only guard against loss of data but also facilitate uninterrupted operation of the IP management system and thus offer round-the-clock access for users and researchers.

7. CONCLUSIONS

This study has proposed a Web-Based Intellectual Property (IP) Management System for XYZ Company as an actual solution to the shortcomings of traditional, manual IP management processes in the oil and gas sector. Instead of spreadsheet-based monitoring, the system allows data access with greater ease, improves decision-making, and enhances collaboration among stakeholders. Implementation of this online tool facilitates better categorization, visualization, and valuation of IP assets, thus aligning with organizational innovation efforts and long-term planning. The study brings into focus the necessity of adopting digital transformation tools towards strengthening the operating efficacy and strategic intelligence of IP management in high-resource sectors. Given that the oil and gas sector is prone to rapid technological changes and increased global competition, in-house system upgrade is unavoidable. This study sheds light on the usefulness of applying digital platforms, like those developed through WordPress, to enable secure, scalable, and user-friendly IP administration frameworks. Lastly, the research provides a basement model for other oil and gas organizations to improve their IP management systems. Future research can explore the integration of state-of-the-art features such as automated analytics or artificial intelligence to enhance system potential further and incorporate adaptability to future industrial requirements.

ACKNOWLEDGEMENT

The researchers would like to acknowledge Universiti Malaysia Pahang Al-Sultan Abdullah for supporting this project.

FUNDING STATEMENT

This study was not supported by any grants from funding bodies in the public, private, or not-for-profit sectors.

AUTHORS CONTRIBUTION

Hanifah Hatif (Methodology; Writing - original draft)

Khai Loon Lee (Conceptualization; Supervision; Revision; Editing)

AVAILABILITY OF DATA AND MATERIALS

The data supporting this study's findings are available on request from the corresponding author.

ETHICAL STATEMENT

Not applicable.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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