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Assessing Features for Malaysian Universities' Web Expert Directory from User Perspectives

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ABSTRACT

An expert directory is a system that contains information about the expertise of staff members working within an organisation. At Malaysian University, the directory commonly developed as a web application helps users find experts in a particular research area based on their publications, research grants, teaching subjects, and supervision experience. Despite the critical importance of expert directories, the responsibility for developing these resources primarily rests with the universities. Although expert directories are present in other domains, there are currently no published assessment or benchmarking studies focused on creating the most effective expert directories for higher education institutions. This research aims to propose an assessment tool on the expert directory focusing on the experts related to Malaysian University. This research first reviewed existing research on any expert directory, the critical features of the directory, and related characteristics, and identified search tool features and their characteristics. Next, the assessment tool is developed by adopting the related main features and their targeted characteristics. Two Malaysian universities were selected as case studies to showcase how this proposed assessment tool can be utilised. Findings show that the tool helps identify the strengths and weaknesses of the existing expert directory. Based on the findings, there is room for improvement that could be provided to the university management and be a guideline for any expert directory for the academic institution. In conclusion, this assessment tool contributes to developing expert directories in higher education institutions, especially in Malaysia.

1. Introduction

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An expert directory serves as a systematically organised database or a tool that encompasses details about the knowledge and expertise of individuals operating within a particular field, organisation, or professional community.
It aids in recognising and linking experts according to their specialised skills and areas of knowledge. These directories enhance knowledge sharing and collaboration by providing a searchable platform where users can find experts whose expertise aligns with their needs. In organisational settings, expert directories can recommend individuals with similar profiles based on shared topics or keywords [1]. Directories are regularly updated and indexed by characteristics such as keywords and countries, ensuring that the information remains current and accessible.

When utilising the expert directory, users are expected to locate appropriate professionals to assist them. In the context of a Malaysian University, users are expected to identify experts for a research area based on their publications, research grants, teaching subject and supervision. Such directories are essential for recruiting reviewers for academic submissions, matching partners for research proposals, and finding experts for problem-solving and detailed information dissemination [2]. The expert directory is a communication tool that optimises the media projection of an institution's intellectual capital, increasing its visibility, brand, and reputation. Besides, reputation is one of the factors influencing the selection of higher education in Malaysia [3]. The potential value of an expert locator is directly related to the size of the searchable population, and it is designed to provide instant searches based on qualifications, teaching experience, research activities, and other professional achievements [4]. In the context of the digital age, Web 2.0 technologies have enabled the globalisation of information, making it easier to create, disseminate, and discuss content. However, this has also led to information overload, making expert directories even more valuable as they help filter and validate information, ensuring that users can access high-quality, reliable knowledge [5].

Additionally, expert directories can describe staff knowledge and calculate weighted connections between employees based on shared topics, which can be used for recommending people with similar profiles. This is particularly important in educational settings where collaboration and knowledge sharing are crucial to innovation and progress [1]. Key features of an expert directory include the ability to describe and document the knowledge of staff members, often through weighted connections based on shared topics, which helps in recommending individuals with similar profiles [1]. Expert directories often incorporate advanced search functionalities, such as the knowledge directory concept, to identify clusters of people with similar expertise [6]. Some systems include mechanisms for verifying and amending the information on the skills of identified experts through feedback from multiple users, ensuring the accuracy and reliability of the data.

Malaysian University's expert directories are commonly developed as web applications, as shown in Figure 1. The user interacts with the system’s search interface to search for experts through a query parser. The query parser will then process the user's search query input. The searched query will be handled by the web server connected to the database and file system where all information related to experts is stored. The searched results are then ranked to determine the order in which search results are presented to the user through the search results interface. This article focuses on the user’s perspectives; therefore, only the components within the dotted line were considered.

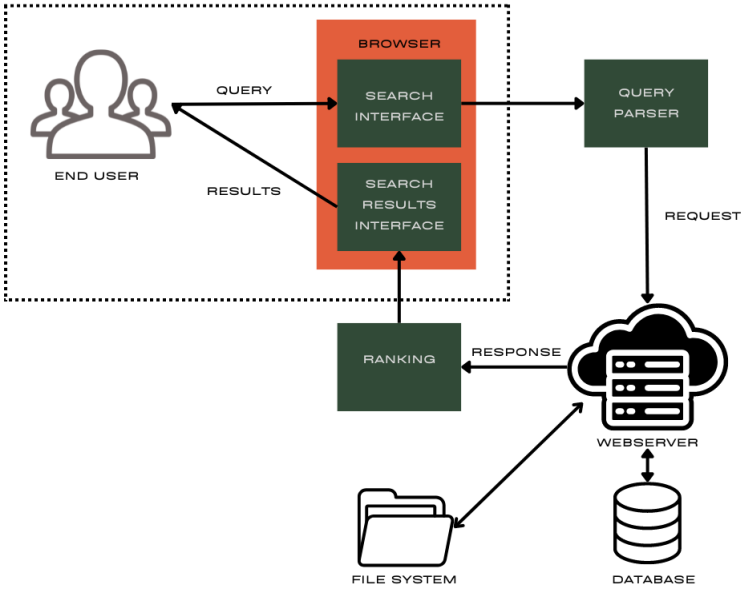

Fig. 1. Web expert directory architecture

Overall, the use of expert directories is important to boost the exchange of knowledge, academic networking, and collaboration. Their approach provides an organized and effective method for identifying and engaging with experts and further enhancing the efficiency and effectiveness of educational and research activities.

Despite the critical importance of expert directories, the development of these expert directories is primarily left to the universities, leading to various levels of effectiveness. The lack of specific assessment on developing the most effective expert directories for higher education institutions further intensifies this challenge. Moreover, the fast-paced globalisation of information and information overload poses difficulties for users in filtering and validating the expertise found in these directories. There are expert directories in other domains such as forest management by Battisti and Faccolli [7], corporate directory by Kraß and Försterling [1] and Ehrlich and Shami [8]. There are also several research on expert directories in education such as the work conducted by Angelova *et al.,*[2], Bayraktar and Kaya [9] and King [10]. However, based on the authors' knowledge, to date, no specific assessment studies have been published on creating the most effective expert directories for higher education institutions. This gap indicates a need for a structured approach to evaluate and improve the quality of expert directories in higher education institutions.

Therefore, this article addresses the challenges by proposing an assessment tool crafted to evaluate the effectiveness of expert directories in Malaysian universities. Introducing a standardised method for assessment, the tool aims to provide a structured approach to provide valuable insights into the strengths and weaknesses of current expert directories. This contribution is essential for guiding universities in enhancing their directories while bridging the gap between expert directories in the education domain and other domains.

The primary objective of this article is to develop and propose an assessment tool that can evaluate the effectiveness of expert directories within Malaysian universities. The tool is intended to measure various aspects of these directories, including their components, critical items, and affecting criteria based on the web interfaces. By focusing on user perspectives, the study seeks to ensure that the assessment tool is practical and user-centric.

The expert directories of Malaysian universities are mainly located in institutional repositories, which are highly visible and well-indexed by external publishers, search engines, and social media

platforms. Therefore, the implications of this study are significant for higher education institutions in Malaysia and beyond for highlighting the academic and research capabilities of the universities. By providing a standardised assessment tool, the study offers a method for universities to systematically evaluate and improve their expert directories. This enhancement can lead to better knowledge sharing, more effective academic networking, and increased visibility of the institutions' intellectual capital. Furthermore, the study supports the Malaysian government's initiatives to globalise academic and research endeavours, with the goal of elevating quality standards and increasing global significance within the nation's higher education sector, ultimately solidifying Malaysia's position as an educational hub. This focus can further increase the visibility and accessibility of expert directories within these institutions.

The contents of this article are structured as follows: Section 2 presents the methodology used; Section 3 provides the assessment tool; the evaluation of Malaysian higher institutions' expert directories utilising the assessment tool, discussion and limitation of the study; and Section 4 concludes this research and presents the future work.

2. Methodology

The research is carried out according to stages such as literature review, analysis of current literature, development of assessment tool, and case study. These stages are shown in Figure 2.

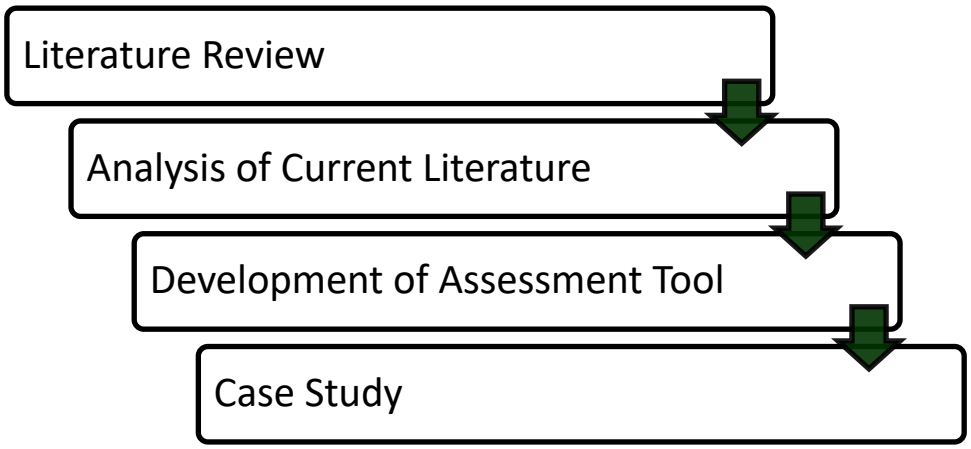

Fig. 2. Research stages

The objective of the literature review is to gather comprehensive insights into existing works and best practices in evaluating expert directories from sources, including journals and conference papers. The assessment tool is expected to focus on the search function. Therefore, several articles were downloaded and reviewed based on keywords such as “search tools”, “evaluation”, and “expert directory recommender” in Google Scholar. Only relevant articles were further selected. Next, the assessment tool is developed based on a content analysis of the current literature. Based on Figure 1, the assessment is focused on the search interface and search results interface. Assessment for the search is focused on the searching feature, while assessment for the search results interface is focused on the information organisation. To demonstrate the utility of the proposed assessment tool, it will be used to evaluate the expert directories of several Malaysian universities as a case study. These case studies will provide practical examples of how the tool can be applied and highlight areas for improvement, thereby contributing to enhancing the quality and visibility of expert directories in Malaysian higher education institutions.

3. Results and Analysis

3.1 Assessment Tool

In Saunders' [11] study, a comparison was made among several search engines, including Google, Yahoo, Lycos, and Excite. Saunders assessed whether the web expert directory architecture supported advanced search features such as domain search, domain-subdomain search, boolean searching, stemming, proximity searching, truncation, case sensitivity, and spelling suggestions. These features were then incorporated into the assessment tool.

The query property is also mentioned as one of the critical features of any search engine [12]. A query property in a search engine refers to the specific attributes or criteria a search engine uses to process and retrieve relevant information from a database or across the web. Query properties can be tailored to meet specific search criteria, optimise data retrieval, and provide valuable insights across various domains. Hence, it is also incorporated into the assessment tool to compare all expert directories.

System effectiveness is a measure of how well a system achieves its objectives. It refers to the accuracy and completeness with which users achieve specified goals when interacting with the system.

The search feature within the interface functions similarly to a search engine. Its effectiveness can be measured using criteria such as retrieval performance, ranking, and relevance judgement. Indicators of effectiveness also include the quality of the solution and error rates [13].

- Retrieval Performance: This is assessed by how well the search engine retrieves relevant information using various search features, including title search, basic search, exact phrase search, Portable Document Format (PDF) search, and Uniform Resource Locator (URL) search [14] or quality of the retrieved items [15].
- Ranking: This involves the search engine's ability to rank the most relevant webpages higher in the search results, thereby making it easier for users to find the information they need [14].
- Browsability: This involves ease of understanding results and easy-to-use format for finding and viewing the information [15].
- Relevance Judgement: This is measured by the relevance scores assigned by judges to the retrieved web pages, indicating how closely the search results match the users' queries [14].
- User Effectiveness: This refers to the accuracy and completeness with which users achieve specific goals. According to Al-Maskari and Sanderson [13], user effectiveness is the degree to which users accomplish their intended tasks accurately and completely. In the context of User Interface/User Experience (UI/UX), this concept is similarly defined as the accuracy and completeness with which users achieve specified goals when interacting with a system [16]. The following criteria can measure user effectiveness:
    - The number of tasks completed.
    - The number of relevant results obtained.
    - The time taken by users to complete set tasks.

To identify the quality of the solution, metadata on the experts in the higher institution field are also compared. Existing expert directories contain valuable metadata about experts, including their qualifications, educational background, professional history, relevant certifications or accreditations and research contributions, which is crucial for fostering academic collaborations and managing academic activities [17]. Such profiles typically include personal data, education and qualifications, expertise and specialisation, work and administrative experience, teaching and supervision

experience, research and consultancy experience, committee involvement, publication records, and awards and recognitions.

Recent technological advancements encourage using artificial intelligence elements in the current expert directory for more intelligent, context-aware, and accurate recommendations. Advanced features in expert recommender systems include a variety of sophisticated techniques and methodologies aimed at improving the accuracy and relevance of recommendations. One significant feature is the integration of textual semantic relevance, which allows for a more comprehensive modelling of users and their queries [18]. Another advanced feature involves using data mining and Natural Language Processing (NLP) technologies to evaluate the influence of literature dynamically. This includes analysing word frequency statistics from literature abstracts, titles, and full texts to recommend experts based on search terms accurately.

Following research by Al-Maskari and Sanderson [13], general questions, such as the strengths of existing search tools, are included in the assessment tool to emphasise their value and avoid overlooking essential aspects. Relevant questions based on these criteria are added and incorporated into the assessment tool, as shown in Table 1.

Table 1
The proposed assessment tool

Interface	Components:	Assessment Questions		Affecting Criteria
Search	Search Feature	i.	Does it allow domain search?	Effectiveness of search function
		ii.	Does it allow domain-subdomain search?	
		iii.	Does it allow boolean searching?	
		iv.	Does it allow stemming?	
		v.	Does it allow proximity searching?	
		vi.	Does it allow truncation?	
		vii.	Is it case-insensitive?	
		viii.	Are there any spelling suggestions?	
		ix.	What are the query properties?	
Search Results	Information Organization	x.	Does it sort and rank by relevancy?	Accuracy - Completeness/ Comprehensiveness - Information Redundancy - Real time update. Relevancy Response Time Readability
		xi.	Are there no duplicated search results?	
		xii.	Does it consider only exact matches?	
		xiii.	Is it updated in real-time?	
		xiv.	Does it display the total number of search results?	
		xv.	Does it display the amount of time taken?	
		xvi.	Does it display 10/20 results per screen?	
Both	Language	xvii.	Is there any language option provided?	Ease of Use
	Extra documentation	xviii.	Is there any extra documentation provided for user assistance?	Ease of Use
	Expert Meta-data	xix.	What are the expert meta-data displayed?	Ease of Use, Effectiveness of search results, Completeness/ Comprehensiveness
	Expert Recommender System Features	xx.	Are there any emerging technology features?	Ease of use, Effectiveness of search results
	Additional note	xxi.	Is there any other strength that can be highlighted from the expert directory?	

3.2 Case Study

Two Malaysian university expert directories were evaluated as case studies to demonstrate the usage of the proposed assessment tool. These include Universiti Pendidikan Sultan Idris (UPSI) [19] and Universiti Sains Islam Malaysia (USIM) [20] which was later assigned as University A and University B randomly to provide anonymity.

Table 2
Case studies using the assessment tool

Interface	Components:	Assessment Questions	University A	University B
Search	Search Feature	i. Does it allow domain search?	No	No
		ii. Does it allow domain-subdomain search?	No	No
		iii. Does it allow boolean searching?	No	No
		iv. Does it allow stemming?	No	No
		v. Does it allow proximity searching?	No	No
		vi. Does it allow truncation?	No	No
		vii. Is it case-insensitive?	Yes	Yes
		viii. Are there any spelling suggestions?	No	No
		ix. What are the query properties?	• Name • Faculty/ Department • Admin Position • Position/Grade • Specialization • Research • Publication	• Name • Areas of Expertise • Faculty
Search Results	Information Organization	x. Does it sort and rank by relevancy?	No	No
		xi. Are there no duplicated search results?	Yes	Yes
		xii. Does it consider only exact matches?	Yes	Yes
		xiii. Is it updated in real-time?	N/A	N/A
		xiv. Does it display the total number of search results?	No	No
		xv. Does it display the amount of time taken?	No	No
		xvi. Does it display 10/20 results per screen?	No	No
Both	Language	xvii. Is there any language option provided?	No	Yes, but it does not work properly.
	Extra documentation	xviii. Is there any extra documentation provided for user assistance?	No	No

Interface	Components:	Assessment Questions	University A	University B
	Expert Meta-data	xix. What are the expert meta-data displayed?	• Expert's name • Expert's admin position • Expert's email • Expert's phone number • Expert's Academic Qualification • Expert's Researchers ID in Scopus, Wos and Google Scholar • Expertise • Resume for download • Curriculum Vitae (CV) for download • Research details ▪ Research title ▪ Year ▪ Role ▪ Type of Research ▪ Research Status • Publication details (Article, Proceeding or Others) ▪ Publication title ▪ Journal Name ▪ Year ▪ Indexing ▪ Role • Supervision details ▪ Thesis title ▪ Year ▪ Program ▪ Local or International ▪ Role ▪ Status • Consultation and Adulation details ▪ Name ▪ Agency ▪ Year ▪ Role ▪ Status • Commercialisation details ▪ Name ▪ Year ▪ Role • Award/Recognition details ▪ Name of Award ▪ Year ▪ Level ▪ Type of Award • Total number and amount of research grants as principal investigator • Total number of publications	• Expert's name • Expert's position • Expert's email • Expert's faculty • Expert's area of expertise • Must click button View ▪ Expert's Researchers ID in Scopus, Wos and Google Scholar, Research Gate, Orcid ▪ Total number of Research Awards ▪ Total number of Professional Membership ▪ Histogram of recent 5 years publication ▪ Pie chart of completed and ongoing research projects ▪ Button to view all publications (Article, Proceeding or Book) ✓ Publication title ✓ Year ▪ Button all research project ✓ Research title ✓ Year ✓ Role ✓ Status

Interface	Components:		Assessment Questions	University A	University B
				• Total number of PhD and Master supervision • Total amount of consultation	
	Expert Recommender System Features	xx.	Are there any emerging technology features?	No	No
	Additional note	xxi.	Is there any other strength that can be highlighted from the expert directory?	• The use of colour coding for category representation. • Resume and CV can be generated in pdf form • Display the amount of research grant received • Display the total number of publications • Display the total number of supervisions. • Display the total number of consultations • List of research, publication, supervision, consultation, commercialisation and awards are displayed without clicking a new window.	• Display the number of awards received, professional membership, and publication statistics in the last 5 years in histogram. • Display the publication record 10 results per screen • Display the research project record 10 results per screen

Based on Table 2, the comparisons were made on the search interface functionalities of expert directories from two Malaysian universities, focusing on the presence and capabilities of various search features. The assessment criteria include the ability to perform domain and subdomain searches, boolean searching, stemming, proximity searching, truncation, case insensitivity, and spelling suggestions. The findings reveal that neither University A nor University B expert directories support domain or subdomain searches, boolean searching, stemming, or proximity searching. Both interfaces also do not allow truncation, are case-insensitive, and do not provide spelling suggestions. Regarding query properties, both directories support searching by Name, Faculty/Department. However, University A's expert directory provides additional query properties such as admin position, position or grade, research and publication. This comparison highlights the need for enhanced search functionalities for both universities to improve the efficiency and accuracy of expert identification in academic directories. While University B's expert directory could enhance its search query by providing additional query properties.

Focusing on the information organisation of the search interface, key assessment questions explore whether the systems support sorting and ranking by relevancy, preventing duplicate results, considering only exact matches, real-time updates, displaying the total number of results, the time taken for searches, and providing options to display 10 or 20 results per screen. The findings indicate that neither expert directories support sorting and ranking by relevancy or displaying search time and result counts. Whether the information is updated in real-time is suitable for evaluation by the university staff. The search process effectively eliminates duplicate results and only considers exact matches. Suggestions that can be provided to both universities are to implement a sorting and ranking algorithm, display the total number of results, display the time taken for searches, and offer the option to display 10 or 20 results per screen. Both expert directories display the results based on only exact matches because these expert directories rely on keyword searching. Therefore, Large

Language Models (LLM) could be implemented to leverage its advanced natural language processing capabilities, such as searching for words with similar meanings. This could help to identify and match synonyms or related terms, allowing searches to encompass a broader range of words. For example, a search for "information hiding" could also yield results such as "information concealment" or "steganography". By expanding queries with related terms and concepts, LLMs can increase the likelihood of finding relevant results. For instance, a search for "cybersecurity" might also consider related areas like "information security," "network security," and "cryptography."

In the assessment of the user experience of the expert directories of Universities A and B, certain features aimed at improving accessibility and usability were found to be either absent or not functioning properly. For example, for the language options availability, it was discovered that while there is a language selection feature, it did not function properly, possibly inhibiting users from having full interactions with the system. The evaluation also showed no supplementary documentation was provided to aid users. The lack of additional materials can significantly impact users' ability to utilize the system, particularly for those in need of comprehensive guidance. The inadequacies in these areas highlight the need for improvements to ensure the system is more user-friendly and accessible to a broader audience.

For the assessment question “What are the expert meta-data displayed?”, it was observed that University A displayed more information compared to University B. This inclusive display allows users to gain a comprehensive understanding of each expert’s information, improving decision-making when seeking expert options, collaboration, supervision or consultation. On the other hand, University B's expert directory provided a smaller number of metadata and necessitated more clicking to access the complete information, which could limit the user's capacity to thoroughly evaluate an expert's suitability for specific needs. By providing richer information, University A’s expert directory enhances the visibility and accessibility of its intellectual capital, hence supporting the broader goals of academic and professional networking.

Both expert directories have not yet adopted any emerging technology features such as intelligence elements. Several examples of the use of intelligence elements are suggesting an expert only based on the research topics or research proposals, predicting the future direction of the expert’s expertise based on their current data, self-generated CV or resume based on a user’s query in the form of a chatbox. Therefore, improvements in this matter can be further explored by integrating emerging technologies, such as artificial intelligence, machine learning, or natural language processing, to enhance search capabilities.

Referring to the last item in the assessment tool, the strengths of both expert directories are highlighted by the assessment tool. These strengths encompass the use of colour-coded category presentation, the capability to generate and download resumes and CVs, and the display of the total number of experts' metadata in a visual format. These features can be regarded as best practices for both universities.

3.3 Limitations

In this research, user interface and user experience are out of scope. However, the use of colour coding falls under usability. It can be observed that it is one of the strengths of the University A’s expert directory, as it enhances information delivery to the user. Usability testing can be done to provide a seamless and satisfying user experience. Usability heuristics, which are universal and independent of devices and operating systems, should be followed to enhance the intuitiveness and satisfaction of the end user [21]. These heuristics include principles such as visibility of system status, the match between system and the real world, user control and freedom, consistency and standards,

error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognise, diagnose, and recover from errors, and provide help and documentation [21]. Furthermore, various dialogue styles such as menus, fill-in forms, question and answer, command languages, function keys, direct manipulation, and natural language should be considered to cater to different user needs and preferences [22]. The organisation and functionality of the UI, along with screen layout and design, response time, error handling, and user documentation, are also critical components that need careful attention [22]. The design principles align with recent research in mobile user interface development by Soumay *et al.,* [23]. However, there are several differences due to the unique characteristics and constraints of mobile devices. Mobile interfaces require a more streamlined and simplified design approach than web interfaces [24]. Therefore, detailed usability testing can be conducted, which includes the suggestion to use colour coding for information representation, can be conducted in the future.

Furthermore, only two Malaysian universities were used as case studies. While all higher institutions can generally use the assessment tool, the findings and the suggestions provided here may reflect more of the characteristics of these two institutions than the Malaysian higher education landscape. Additionally, the initial focus is only on Malaysian higher education institutions; therefore, the ability to broadly apply the conclusions to other universities in different geographical areas is not emphasised.

4. Conclusions and Future Works

This article has provided a comprehensive analysis of the existing expert directory, proposed a new assessment tool for the expert directory consisting of 21 items and used two Malaysian universities as case studies to explore the use of the proposed expert directory assessment tool. The analysis revealed that although most universities have an expert directory, there are a lot of improvements that can be made. Additionally, the study emphasises the significant need for an intelligence element, which was far behind compared to other domains and applications, and this has noteworthy implications for university management.

The benefits of this research are multifaceted. First, it provides a detailed examination of the new assessment tool, which can serve as a foundation for further studies. Second, the findings offer practical guidance for policymakers, educators, and administrators in improving their existing University expert directory. Through an in-depth examination of these institutions, the implications of this study are significant for both theory and practice. Theoretically, the findings contribute to a deeper understanding of the requirement of an expert directory for a higher institution, offering a basis for future research to explore similar phenomena in different contexts, generally for education and artificial intelligence areas. Practically, the study provides actionable insights that can be applied as best practices that could guide future practices for developing a Malaysian higher institution expert directory.

However, the study also acknowledges certain limitations, mainly focusing on only two Malaysian universities. While this provided a deep dive into specific contexts, it also restricted the generalizability of the findings. In the future, a more extensive scope to include more universities would be carried out to enhance the robustness of the assessment tool. Moreover, a usability study specifically for web and mobile versions will be conducted to continue providing insights to the university management for improving the expert directory. Additionally, a survey of the organisation's staff could be conducted to gain insights into further areas for improvement.

In conclusion, while the study’s scope is limited, its contributions to the understanding of a higher education expert directory are substantial. By addressing the identified limitations and building on

these findings, future research can further enhance the field, ultimately leading to more effective strategies and outcomes in higher institutions. Generally, this work bridges the gap between expert directories in the education domain and other domains.

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