


ETMIS: A New System for the Management of Information Relating to Education and Training

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ABSTRACT

Although there are many education information management systems (EMISs) that currently apply administrative development, they contain limited powers, thus leading to the emergence of problems—the most important and damaging of which being the loss of data quality and ensuring how to verify the validity the education and training information management systems (ETMIS) have all emerged within the world to solve these problems, and considering these systems are widely deployed within Arabian, regional educational, and training institutions, each system has both advantages and disadvantages. This study proposed a unique approach for the ETMIS utilizing an open platform with the goal of supporting management, planning, and dissemination of the education and training systems for all in order to support decision-making and is concerned with improving capacity and centralisation and reliability of information.

KEYWORDS

Education, ETMIS, Information Management System, MIS, Training

INTRODUCTION

Besides enhancing accurate and reliable data collection and verification (Lezhebokov et al., 2015) so that system users can make correct decisions and facilitate access from anywhere at any time (Alwan, 2004), the innovative use of information and communication technology (ICT) enhances comprehensive monitoring systems, such as the ETIMS (Ting-yan et al., 2011). An ETIMS can be defined as an electronic and intelligent digital repository system for collecting and analyzing data and information concerning training and development via the development of several indicators (Ben-Zion Barta et al., 2013) to monitor the performance of the training system (Dias, B. et al., 2010). These indicators also are used to manage the distribution of resources (Fetrina et al., 2017; Haikala et al, 1998) and training services (Alzubi, 2018). The latter is done to assist in the assessment and decision-making process (Nihal Baloğlu Uğurlu, 2008; Wei et al., 2013).

The purpose of this paper is to create a complete conception of the design of the ETIMS. To be compatible with the administrative development requirements of the state employees—as well as the employees within the Kingdom of Saudi Arabia—this paper is broken down into the following areas: a background overview of the ETIMS; a research methodology; an ETIMS proposal; and a conclusion, summary, and recommendations for further work.

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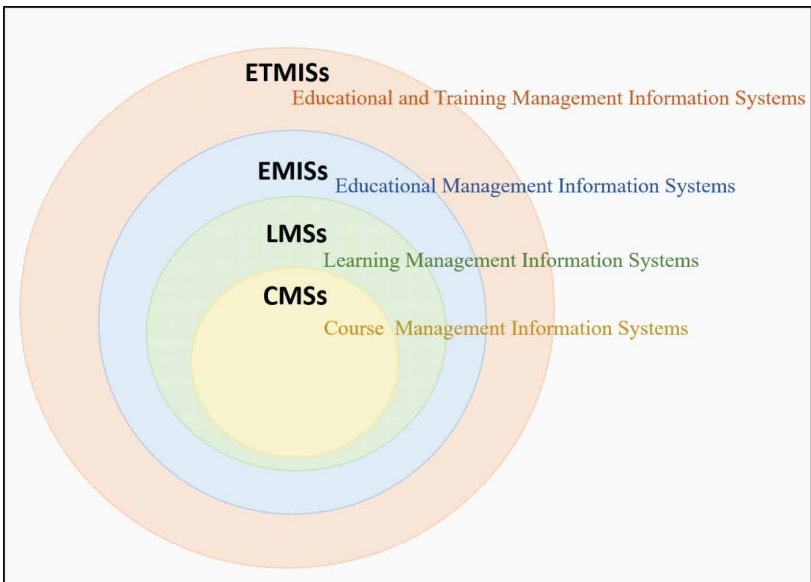
LITERATURE REVIEW

Software systems called ETMISes can be defined as “a set of formal operational processes, cooperative procedures, and agreements to produce, manage, and disseminate educational data and information for monitoring, analysis, and decision-making in a timely and reliable manner so as to meet the requirements of beneficiaries for training services” (Kotsifakos et al., 2020; Tkhagapsoyev et al., 2020). In addition, the system integrates and includes all other training and development systems within the relevant ministries (Kozlov et al., 2018). Thus, to achieve internal and external development goals concerning administrative development, it is important for all government departments to evaluate, implement, and monitor its personnel and staff training system (OpenEMIS, 2022).

Training providers and learning and development departments use ETMISes to organize their training processes (Siyao et al., 2021). Users may build, manage, scale, and sustain training programs with the aid of these technologies (Tomlinson et al., 2009). When it comes to scheduling, tracking, and evaluating training efforts while keeping an eye on employee training progress and certifications, ETMISes frequently provide solutions for all learning professionals, including training providers and learning and development departments (Hryhorova et al. 2018; Traxler et al., 2005). ETMISes also provide tools that aid in the development and marketing of training events and courses by training providers (Xuefen, 2021). These systems also offer training materials, program budget monitoring, staff performance tracking, and other tools to learning and development departments (Zarwono et al., 2020).

ETMISes are created to administer, track, and manage employee training (Cuiling et al., 2021; Wang, 2021). To offer online courses and monitor employee development, they are frequently employed in business settings (Wu et al., 2011; Shuai et al., 2021). They can also be used for other purposes, such as consumer education or compliance training. As seen in Figure 1, ETMISes ought to have various features connected to a course management system (CMS) for posting courses online directly (Cuiling et al., 2021), from ETMISes and a learning management system (LMS) to provide eLearning courses whenever needed (Bogatenkov et al., 2020), and an EMIS for providing a significant amount of support in the initiatives taken to evaluate the effectiveness of the educational system and closely monitor the fair allocation of resources (Li et al., 2022; Ni, 2022).

Figure 1. Main components of ETMISes



For the purpose of gathering information on education and training, both at the level of the school or institute and the district provincial levels, many countries allocate various duties and responsibilities to various departments (Wu et al., 2011). Data collecting for various educational subsectors may be under the purview of several ministries in some nations. Although many large nations, including China, India, Indonesia, and the Philippines, have highly decentralized educational systems, others, including Cambodia, Myanmar, and Vietnam, have only recently begun the process of decentralization (OpenEMIS, 2022; Li et al., 2022). For instance, the government of Myanmar has set up decentralized funding procedures and school district offices (Traxler et al., 2005; Wu et al., 2011).

Several nations have successfully adopted decentralized data system architectures (Yi Peng, 2010). With information systems at the school, county, and state levels, the State of Maryland in the United States has a highly decentralized organizational structure. Maryland has a number of information-sharing protocols and processes in place to guarantee that data are efficiently shared between systems. All of the counties in the state that were looked at for the Maryland EMIS assessment had a common data warehouse or database that included administrative data with learning outcomes data. Schools have access points to the county's information system, and this structure is essential for compliance-related reasons (Abdul-Hamid et al., 2017; Cuiling et al., 2021).

Nigeria likewise features a decentralized EMIS framework that is useful and essential for the most populous country in Africa. It would take much time and effort to send data on individual schools to the central government for gathering, disseminating, and using. Although a decentralized structure with subsystems may be more expensive, it guarantees that data may be made available for use quickly and that it will be applied locally (Abdul-Hamid et al., 2017; Rodrigues, 2020).

The data system for education in Germany is rather decentralized. Germany's 16 states are in charge of running their respective educational systems. These states cover the creation of policies, curriculum, and data management. In actuality, the Abitur (German high school diploma) differs in each state and has a distinct level of difficulty. According to reports, Bavaria has the hardest, with other states having more mild ones (Abdul-Hamid et al., 2017; Ni, 2022).

Afghanistan serves as a compelling example of how an effective EMIS might be established in a delicate context. Prioritizing education data and creating an EMIS framework especially suited to the needs of a fragile country were two important elements of this country's EMIS planning. Data collectors who previously had to travel great distances over dangerous terrain experienced fewer safety worries as a result of the decentralization of the data-gathering process and the greater use of contemporary information and communication technology.

The Afghan EMIS's functionality was assured by ongoing evaluations, comments, and improvements as well as personnel training in all facets of data collection, entry, verification, and analysis. Tracking teacher compensation and student attendance, particularly for female students, has shown to be quite helpful with the EMIS. EMIS data is increasingly used for policymaking, extending data use beyond school monitoring. Under donor initiatives, boosting the EMIS and using ICT more often in education have been top priorities. The Education Quality Improvement Project (EQUIP), supported by the World Bank and the Afghanistan Reconstruction Trust Fund, was started in 2004. EQUIP, which has a US\$460 million budget, is now the largest education-related initiative in the nation (Abdul-Hamid et al., 2017; Kotsifakos et al., 2020). Decentralizing Afghanistan's educational data system required two measures: (1) distributing responsibilities within the MoE; and (2) distributing data entry down to the provincial level (Abdul-Hamid et al., 2017). ETMIS follows the Directorate General for Planning and Evaluation, which aims to consult with each department to expand and maintain information systems, as well as to integrate these systems into one central system (Ting-yan et al., 2011). Such a system would be responsible for:

- Providing security and backup systems: To ensure that data is safe, as well as to avoid losing information (Wu et al., 2011).

- Ensuring that all basic information databases within the Afghan Ministry of Education are properly linked to streamline information collection and processing, additionally minimizing the duplication of data among systems (Abdul-Hamid et al., 2017).
- Providing regular technical support (Yi Peng, 2010).
- Contributing to the decision-making process by analyzing requirements, as well as by collecting and designing multiple databases (Hryhorova et al. 2018).

The OpenEMIS Classroom program allows teachers to oversee every element of their classes, including attendance, incidents, and student performance, in schools with reliable internet access. This data may be entered into the comprehensive information management system built into the school software. The ministry-level EMIS system, OpenEMIS Core, then receives this data.

Jordan uses OpenEMIS, an information system created to manage information inside the educational system, which is a repository for data collecting, processing, analysis, and reporting representing the reality of the educational system—that is, schools, students, teachers, and staff (Alwan, 2004; Tomlinson et al., 2009). The OpenEMIS School was gradually being introduced into a handful of pilot schools in December 2015, with intentions to extend to the rest of the nation in the next years. More than 2,160,000 pupils and 140,000 employees in 6,893 institutions across the nation are anticipated to be covered (Abdul-Hamid et al., 2017). Moreover, the OpenEMIS system was implemented for a multitude of reasons, such as to provide urgently needed basic data to the Ministry of Education within Iraq; to develop educational indicators; and to assist the ministry in its tasks with regard to the planning and management of education systems and policy formulation. On this note, UNESCO has provided the Ministry of Education within Iraq with an integrated training of all system characteristics for the education departments (Haikala et al., 1998; Traxler et al., 2005).

As a way to be able to report brief data on orphans and vulnerable children to government officials, education workers within Tanzania implemented Tanzania SMS—as well as many open source tools on mobile phones. These workers are also using these tools to manage education information cost-effectively and efficiently (Alwan et al., 2004; Dias, B. et al., 2010).

In addition, Tanzania is using the geographic information system (GIS) of FHI 360 to map 5,500 schools spread across the nation. Once the system is up and running, vital school performance metrics will be reported on in real time using the EMIS on tablets, smartphones, or computers. The quality of education data is expected to increase since all government employees at all levels of the educational system will have access to this information via mobile devices.

To enhance school management and link school data directly from schools to information systems geographically, the Ministry of Education and Sports of Uganda commissioned the Agile Learning Company (2010) to design and develop a national integrated education information management system. The ministry completed this plan by implementing EMIS within selected schools to demonstrate its ability (Lezhebokov et al., 2015; Wu et al., 2011). To support the development of the SMS system—as well as to explore its applicability within Kenyan schools—Kenya launched an EMIS with the support of the U.K. Department for International Development to lobby policymakers, technologists, and education professionals. The preliminary results of the project concluded that SMS is a viable and innovative technique when it comes to the improvement of EMIS within Kenya. For example, mobile phones can be used at each school to enable teachers to send a weekly message containing statistics concerning the students (e.g., age and gender) to a specific phone number (Fetrina et al., 2017; Wei et al., 2013).

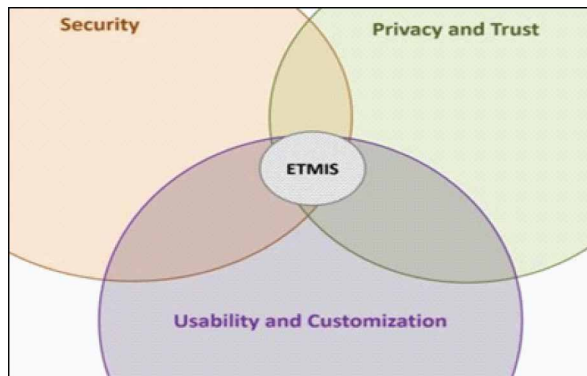
RESEARCH METHODOLOGY

The majority of EIMSeS centered solely on the educational aspect, as opposed to the training and development aspect. Thus, to improve the outputs—as well as to make appropriate decisions for

the strategic plans for training—this paper is concerned with the use of the structure of information management systems, but for the purpose of training, development, and administrative development.

Given the multiple aspects of the educational and training information management system to be used for administrative development, Figure 2 illustrates the project gap. Educational leaders seek to solve this gap by designing a system that centers on three elements: the security level; privacy and trust; and usability and customization.

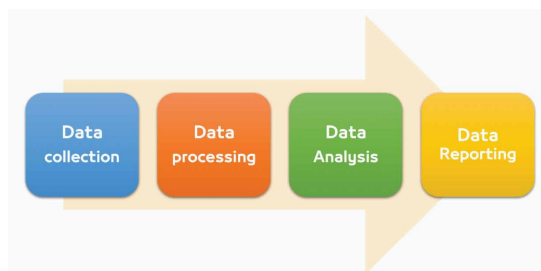
Figure 2. The project gap



To effectively evaluate the three levels shown in Figure 2, the project gap will center on the evaluation of the system periodically to check that its outputs are commensurate with the expectations of its users. This process will be undergone by forming a proposal concerning a four-stage training information management system (Figure 3):

- **Data collection:** This stage is concerned with the designing of multiple statistical tools (e.g., quantity or quality) to survey and collect data in different ways from the employees and employees of the state, thus saving them in a digital repository.
- **Data processing:** This stage is concerned with the organization, processing, examination, and validation of data by linking this information with the databases in the administrative development systems within the Kingdom of Saudi Arabia.
- **Data analysis:** This stage is concerned with the analysis and interpretation of data.
- **Data reporting:** This stage is concerned with publishing the analyzed data in the form of comprehensive reports.

Figure 3. The four stages of ETMIS



The first stage of the designing of ETMISes is gathering information concerning the employees, trainers, institutes, various training programs, requirements of the government sectors, financial data, data in other training systems (e.g., the nomination system at the Institute of Public Administration), or data within external sources on the system of training and professional certificates within Saudi Arabia, such as census data and data of professional and professional certificates (Yi Peng, 2010; Abdul-Hamid et al., 2017)).

Following the compilation of the aforementioned data, the second stage within the ETMISes concerns the processing and validation of data via a number of subsystems within the Ministry of Human Resources. This ministry deals with a number of things, such as personnel management; management of trainers; management of accredited training institutes; infrastructure management and maintenance periodicity; testing; certification distribution and certification; and human resources management (Rodrigues, 2020).

The importance of these subsystems lies in the facilitation of the research and planning that goes into the Institute of Public Administration and the Ministry of Human Resources within Saudi Arabia to implement the third phase of the system of management of educational and training information and data analysis. The third phase facilitates conducting reliable research and objective studies. This information is then reliable and accurate for use in the evaluation of the quality of current programs and training within Saudi Arabia to explore the future in terms of decision-making, as well as the preparation of various educational and training policies and strategies for specific short-, medium-, and long-term objectives (Zhou, 2021).

However, the existence of the data obtained within this time series is not sufficient; instead, it should be placed in the form of reports (as described within the fourth phase of the management system of educational and training information). These reports help educators pinpoint disparities with minimal effort; the reports also help educators study shortcomings, weaknesses, and problems within the current training system to identify strategies to try to solve them. In addition, these reports can include reliable indicators and rapid forecasts of the future capabilities and requirements of staff, trainers, institutes, and training programs, as well as in the identification of educational and training equipment and devices, infrastructure, financial resources, training materials, and future expectations in terms of management (Abdul-Hamid et al., 2017; Zhou, 2021).

The plan for each of the stages above includes a method for gathering feedback data as well as built-in mechanisms for monitoring and assessment. Some of this strategy's benefits are improved communication between ETMIS staff and users, the growth of the ETMIS' collaborative culture, and improvement of the ETMIS's ability to adapt to changing conditions. Moreover, a deeper knowledge of how the various components of ETMIS interact to produce the desired results and improve the user experience will be put into practice (Wei et al., 2013; Abdul-Hamid et al., 2017; Bogatenkov et al., 2020; Ni, 2022).

A NEW PROPOSED SYSTEM

The proposed ETMIS uses OpenEMIS and is a part of UNESCO's response to the increasing demand for support within the education and training system sectors, as shown in Figure 4. Notably, the research objective is to use it for education and training perspectives together, whereas the objective of the ETMISes is to strengthen the evidence-based education strategy and policy formulations by obtaining reliable statistical information in an efficient, flexible, and cost-effective fashion. This information must also be easily adapted to the needs of producers and users of educational and training information from all ministries, statistical offices, and administrative units at both regional and local levels. This educational and training information is presented within tables, graphs, and user-friendly maps, all of which will help key decision makers to quickly identify any gaps (Abdul-Hamid et al., 2017).

Figure 4. OpenEMIS architecture diagram

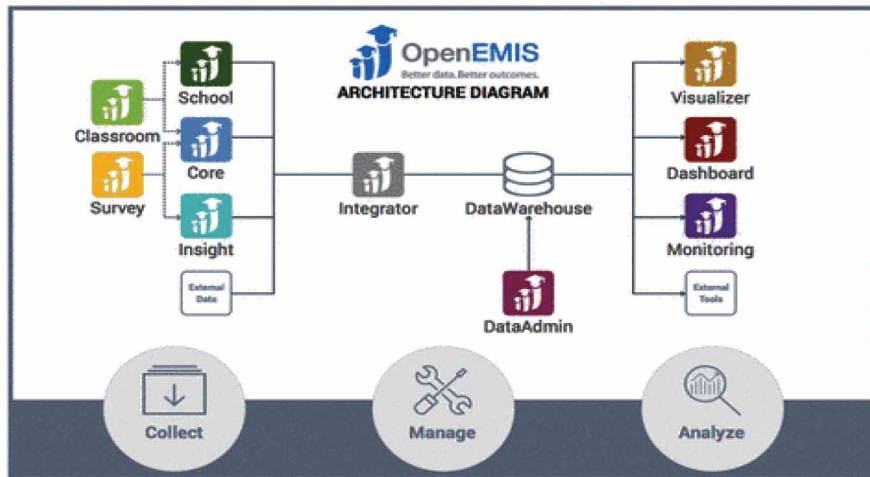


Figure 5 illustrates the lifecycle design of the data via the educational and training information management system, which was founded on the grounds of the four phases of the system. The first stage involves collecting information, such as data about employees, trainers, institutes, training programs, and financial items. The second stage is centered on the processing of the collected data related to the information contained within lifecycle through the information management system the systems of other government sectors (particularly from the Ministry of Human Resources) before storing them within secure digital repositories. Furthermore, in the third stage, the data is analyzed in the form of graphs and maps before the reports are issued in the final stage to make decisions and amend educational and training policies.

Figure 5. Designing the data lifecycle through the information management system

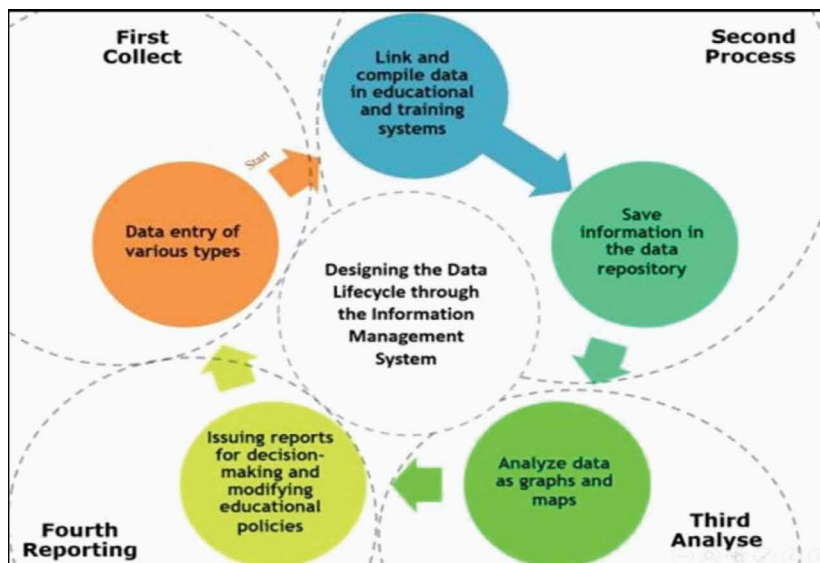
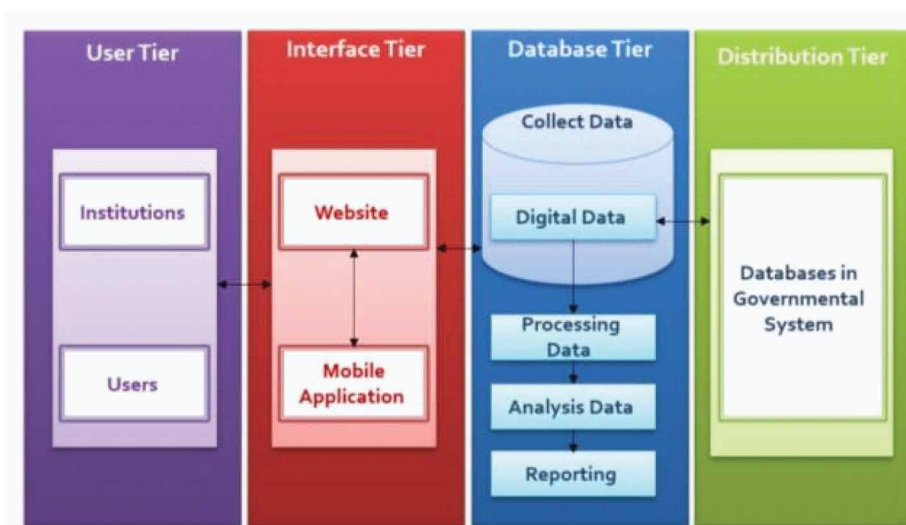


Figure 6 illustrates the design of the system structure (based on what has been read and seen within most systems and programs) on the grounds of the data lifecycle via the ETMIS. The system is divided into four layers:

- The User Tier
- The Interface Tier
- The Database Tier
- The Distribution Tier (contains all the systems and departments of the current Ministry of Human Resources)

Figure 6. Design for the structure of the proposed ETMIS



So that users can use the website/smartphone application as the user interface of the system, data transfer across the User Tier is initiated by the human resources departments of government sectors, employees, and employees within the country. The data are then saved and collected in the Database Tier within the digital repository and linked to the databases within the existing systems of the Ministry of Human Resources. The data are then being transferred to data processing before being analyzed. This analysis is done to be able to issue periodic reports. These reports can then be managed by the government departments—or even by the Institute of Public Administration—to be used within the decision-making process, the modification of policies, and the implementation of important programs, depending on the tasks of employees, as well as the requirements of the labor market.

The system consists of two parts: the website and the application of smartphones. Key features and features of the proposed ETMISes include an electronic system, which can be operated either via the internet using a cloud security application or via an intranet. The system also provides an application for smartphones to be integrated to disseminate educational information easily. The system complies with all World Wide Web Consortium (W3C) standards and supports multiple languages. It processes and analyzes data within the system automatically via the assembling of standard education indicators. The system is integrated with national data (e.g., population censuses) so that its results can be reviewed, analyzed, and identified by using tables, charts, and maps of all information and

data within the system. It is integrated with the rest of the current systems of the Ministry of Human Resources and provides different analysis methods for comprehensive reporting within various file formats (e.g., Microsoft Excel, Adobe Acrobat, and Google Maps).

The system also provides customized services for entering and validating multiple segments of data and must provide technical support 24 hours a day. The system provides a service to locate educational and training institutions within the desired geographical area for employees within the country; this service uses the data generated from the proposed system to provide the necessary data for any GIS, such as Google Earth, Google Maps, or DevInfo, for statistical data. The system also includes additional mapping services for accredited training institutes within regions, districts, and cities. It provides robust security architecture, allowing users to create roles that grant permission for access to different jurisdictions (depending on geographical regions and administrative positions); this access control is done within the system using identity management and authentication standards (e.g., SAML and OAuth) to provide one-way access to all systems via single sign-on.

To assist in overall decision-making, the ETMIS was designed with the intent to strengthen management, planning, and dissemination capacities for all users at all levels of the education system. To achieve this goal and get the expected results, the designers of the proposed system were concerned with the following points:

- Improving capacity within the collection, processing, storage, analysis, and dissemination of reliable data in a timely manner for dissemination to decision makers, administrators, managers, and others.
- Providing centralized, reliable information and coordinating scattered efforts pertaining to obtaining, processing, analyzing, and disseminating data on training and administrative development within the kingdom.
- Streamlining the flow of information required for decision-making by reducing and eliminating duplication.
- Linking and compiling various information systems existing within the Ministry of Human Resources (e.g., the system of functional data).
- Integrating and classifying the analysis of both quantitative and qualitative data and information into one system that deals with the training and administrative development of state employees.
- Improving data collection and the use and dissemination of information to all government sectors in an effort to continuously respond to the needs of the development and administrative development services of state employees and staff.

The proposed main objectives of the ETMIS are to encourage the use of information for educational and training development and to support the collection, organization, and reporting of accurate, timely, and relevant data for planning and decision-making reasons. The specific goals are to establish a structured system within the ministry for the collection, processing, analysis, publication, storage, and dissemination of educational and training information.

Another goal is to promote the use of educational and training information both internally and externally by improving quality. Moreover, ETMIS employees can use the system to develop skills in survey administration, hone data processing (hardware, software, and networking) skills, and improve their ability to analyze and use educational information, as well as manage, monitor, and evaluate the activities of ETMIS and actively participate in similar activities in other sectors of the ministry (Wu et al., 2011; Abdul-Hamid et al., 2017).

The difficulty with the suggested administration of ETMIS is finding committed professionals and employees with the vision to better the situation, to enter a continuous learning and training environment, and to do away with “command-and-control” style management. The central ETMIS is in charge of fostering a goal-oriented, user-focused team environment in the provincial training

offices and schools, with a focus on the usage and organization of information systems at the local level (Abdul-Hamid et al., 2017; Cuiling et al., 2021).

CONCLUSION

In this paper, a new ETMIS was proposed, with the goal of improving the national ability to supply precise, timely, and pertinent information to planners, policy makers, decision makers, and decision-support systems. Administrators of the ETMIS must acquire the skills necessary to:

- Create a clear vision for the creation of an information system that supports the overall advancement of the education and training system.
- Engage in conversation and collaboration with information users (and continuously pick their brains).
- Create an effective plan for change management, put it into action, and help the ETMIS staff as a whole and the user community learn from the experience.

The development of education and training systems will go more quickly if quality information is used more effectively in the proposed ETMIS. Therefore, to maintain the system's quality across the board, the ETMIS leadership must strive for and demonstrate success. The quality of the entire system cannot be attained without quality output in each of the four tiers: User, Interface, Database, and Distribution. Understanding that one of the major elements in enhancing the ETMIS system is ongoing training is crucial. Thus, it is essential to practice skill development, training, and inventive leadership, given how new technology is altering the training and education environment and the rise in demand in the future.

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DECLARATION OF CONFLICTING INTERESTS

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