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**CUSTOMIZING ENTERPRISE RESOURCE PLANNING
(ERP) SYSTEMS APPLIED IN THE HOLDING COMPANY
OF WATER AND WASTEWATER
IN THE EGYPTIAN WATER AND WASTEWATER
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The information technology in The holding Company Water and Wastewater (HCWW) and its (27 subsidiary companies) is not advanced and all its systems are individual judgments for each company, Some of the subsidiaries have adopted the purchase of systems of foreign financing provided by some Egyptian software companies which are unable to provide integrated ERP, and There is a group of subsidiaries working on the systems of a company called Advac, which is an ERP supplier, but each of the subsidiaries buys some models inside this system, ERP different from the other (hr., billing system, payroll), finally There is also another group of subsidiaries working on systems for a company called NTG and Some of the other companies have done ERP work with their IT management staff, Some of these companies, which are the supplier of these systems, have been held the data from the subsidiaries to request more money in addition to the contract, which leads to the disruption of work.

After finishing the ERP standards and practical job for designing we applied the system for a year in some companies and the most important results were that: Companies that changed their policies to apply the proposed framework of the ERP succeeded more than others in the same sector, Companies that expanded applying the proposed framework of the ERP were performing more than others in the same sector, Companies that give great importance to the maintenance processes of the proposed ERP framework; their enterprise resource systems are more effective.

Keywords: ERP, Framework, Customization, Integration, HCWW, Egypt**1. Introduction**

Enterprise Resource Planning (ERP) is an important enterprise application that integrates all the individual department functions into a single software application. Despite the success of ERP in many aspects, the practical application in many institutions, suffered from some negatives in the presence of traditional legacy systems. (Shibly & et. al, 2022) Enterprise Resource Planning (ERP) systems are integrated, multi-module application software packages designed to serve and support several business functions across an organization.

ERP systems are typically commercial software packages that facilitate collection and integration of information related to various areas of an organization. ERP systems enable the organization to standardize and improve its business processes to implement best practices for its industry (Amini & et.al, 2020)

Recently, there has been a remarkable interest in developing models to improve the effectiveness of resource planning for management institutions (SAP, UFIDA, RAMCO, MAXIMO, EPICOR, SYSPRO, PEOPLESOFT, ORACLE....), Such interest has stimulated many software houses to develop their ERP products, in spite of ERP's significant growth from the late 1990s to the present day, there are a number of challenges that companies may encounter when implementing ERP (Mahmood & et.al, 2020), The enterprise business is a basic prop of the infrastructure in Egypt, and as a result there are many problems associated with the decisions of the senior management there has been the need to connect many of the applications in the network complementary mimic ERP, So it felt researcher and through experience that the research in a Proposed Framework for Enhancing the Integration of) ERP (Will be very useful for the holding company water and wastewater (HCWW).

2. Literature Review (1-2-3)

Integration, framework, and ERP, through reference books and references Arab and foreign articles, journals, reports, and conferences in Arabic and English on the subject of study in order to take advantage of these concepts in the study and exposed the researcher of the literature of contemporary dealt, the researcher depended on the collection of data on the manner of the questionnaire, finally, researcher used some data gathering techniques to collect and analyze different forms of data, these data gathering techniques include:

questionnaire: which was written and on google websites (google forms) with closed-ended or open-ended questions that are given to respondents to gather their opinions about their ERPs.

Focus group: which was used with experts determine a Checklist for the Most Relevant Standards and Main Components for HCWW ERP.

Secondary data: which used with existing data that was collected from all HCWW subsidiaries which was relevant to the company ERP as labs - computers - networks - it staffs and much more.

researchers have indicated Basic Architecture Concepts, Components of the Enterprise Data Architecture, Business Architecture Requirements Phases and ERP systems architecture. AND we have also reviewed what Customization is? Benefits of ERP Customization, How to Manage ERP Customization and Typologies of ERP Customizations, their development phases and their existing and comparable software packages, clarifying the risk factors implemented, the relationship between ERP and business integration, and a simplified explanation of the advantages and challenges of ERP systems (Mijac & et.al, 2013).

2.1 Concepts and Goals

The concept of ERP system is illustrated. In back-office, ERP system manages and coordinates the enterprise operations such as financial, manufacturing, inventorying etc., which interacts closely with suppliers. In front-office, it mainly faces to customers, and applications that are related to customer such as sales, distribution, services etc. are administered by ERP system. Corporate reporting and human resource management are throughout. The resulting data are stored in central database, which can be monitored and audited Dimitrios (Maditinos& et.al, 2011), (Kundurur& et.al, 2023).

Enterprise Resource Planning (ERP) is an important enterprise application that integrates all the individual department functions into a single software application. Despite the success of ERP in many aspects, the practical application in many institutions, suffered from some negatives in the presence of traditional legacy systems (Babhulkar& et.al, 2021), Enterprise Resource Planning (ERP) systems are integrated, multi-module application software packages designed to serve and support several business functions across an organization. ERP systems are typically commercial software packages that facilitate collection and integration of information related to various areas of an organization. ERP systems enable the organization to standardize and improve its business processes to implement best practices for its industry (Hartley & et.al, 2019), Recently, there has been a remarkable interest in developing models to improve the effectiveness of resource planning for management institutions (SAP, UFIDA, RAMCO, MAXIMO, EPICOR, SYSPRO, PEOPLESOFT, ORACLE....). Such interest has stimulated many software houses to develop their ERP products, In spite of ERP's significant growth from the late 1990s to the present day, there are a number of challenges that companies may encounter when implementing ERP (Seo, 2013), ERP is software that standardizes, streamlines and integrates business processes across finance, human resources, procurement, distribution, and other departments. Typically, ERP systems operate on an integrated software platform using common data definitions operating on a single database (Perkins, 2019), ERP is a process used by companies to manage and integrate the important parts of their businesses (Gibson & et.al, 2020), Enterprise resource planning (ERP) is a business process management system that compiles, organizes, aligns, and automates various aspects of a

company's workflow. The idea is to have all business functions in one place to increase efficiency and make sure all bases are covered. ERP software is often enlisted by companies to help with the management of a wide variety of back-office functions (Israde-Alcántara & et.al, 2021).

ERP system's goal is to make information flow be both dynamic and immediate, therefore increasing the usefulness and value of the information. In addition, an ERP system acts as a central repository eliminating data redundancy and adding flexibility. Another goal of ERP system is to integrate departments and functions across an organization onto a single infrastructure that serves the needs of each department. This is a difficult, if not an impossible (AbdElmonem & et.al, 2016).

2.2 ERP's components

(Xiao & et.al, 2019) showed how is an ERP system has components such as hardware, software, database, information, process, and people which work together to achieve an organization's goal of enhanced efficiency and effectiveness in their business processes. An ERP system depends on hardware (i.e., servers and peripherals), software (i.e., operating systems and database), information (i.e., organizational data from internal and external resources), process (i.e., business processes, procedures, and policies), and people (i.e., end users and IT staff) to perform the input, process, and output phases of a system. The basic goal of ERP, like any other information system, is to serve the organization by converting data into useful information for all the organizational stakeholders. The key components for an ERP implementation are hardware, software, database, processes, and people. These components must work together seamlessly for the implementation to be successful. The implementation team (Hussain & et.al, 2020), must carefully evaluate each component in relation to the others while developing an implementation plan. Hardware, software, and data play a significant role in an ERP system implementation. Failures are often caused by a lack of attention to the business processes and people components. Both people involvement and process integration will need to be addressed from the very early stages in the implementation plan. Staff must be allowed to play a key role in the project from the beginning.

2.3 History of ERP

During the 1960s and 1970s, most organizations designed silo systems for their departments. As the production department grew bigger, with more complex inventory management and production scheduling, they designed, developed, and implemented centralized production systems to automate their inventory management and production schedules. These systems were designed on mainframe legacy platforms using such programming languages as COBOL, ALGOL, and FORTRAN. The efficiencies generated with these systems saw their expansion to the manufacturing area to assist plant managers in production planning and control. This gave birth to material requirements planning (MRP) systems in the mid-1970s, which mainly involved planning the product or parts requirements according to the master production schedule. Later, the manufacturing resources planning (MRP II) version was introduced in the 1980s with an emphasis on optimizing manufacturing processes by synchronizing the materials with production requirements. MRP II included such areas as shop floor and distribution management, project management, finance, job-shop scheduling, time management, and engineering. ERP systems first appeared in the early 1990s to provide an integrated solution to the increased complexity of businesses and support enterprise to sustain their compatibility in the emerging dynamic global business environment. Built on the technological foundations of MRP and MRP II, ERP systems integrated business processes across both the primary and secondary activities of the organization's value chain, including manufacturing, distribution, accounting, finances, human resource management, project management, inventory management, service and maintenance, and transportation. ERP systems' major achievement was to provide accessibility, visibility, and consistency across all functions of the enterprise (Zheng & et.al, 2021).

2.4 ERP risk factors

Furthermore, the literature indicates that ERP implementations have sometimes failed to achieve the organization's targets and desired outcomes. Much of the research reported that the failure of ERP implementations was not caused by the ERP software itself, but rather by a high degree of complexity from the massive changes ERP causes in organizations (Ehie & et.al, Identifying critical issues in enterprise resource planning (ERP) implementation, 2005; Phusavat & et.al, 2008) (Scott & et.al, 2000; Maditinos & et.al, Spreadsheet error detection: an empirical examination in the context of Greece, 2012). These failures can be explained by the fact that ERP implementation forced companies to follow the principle of 'best practices' in most successful organizations and form appropriate reference models. (Zornada & et.al, 2005) According to (Ehie & et.al, Identifying critical issues in enterprise resource planning (ERP) implementation, 2005; Phusavat & et.al, 2008), "Unlike other information systems, the major problems of ERP implementation are not

technologically related issues such as technological complexity, compatibility, standardization, etc. but mostly about organization and human related issues like resistance to change, organizational culture, incompatible business processes, project mismanagement, top management commitment, etc.”. (Huang & et.al, 2004) presented the top ten risk factors causing ERP implementation failure which are: Lack of senior manager commitment, Ineffective communications with users, Insufficient training of end-users, Failure to get user support, Lack of effective project management methodology, attempts to build bridges to legacy applications, Conflicts between user departments, Composition of project team members, Failure to redesign business process, and misunderstanding of change requirements.

2.5 ERP Critical Success factors

Over the years, market analysis and industry research have thoroughly studied the primary root causes of most ERP failures. It is the proactive addressing of these causes which undoubtedly will help ensure an ERP project ends as a success story rather than a failure, which can cost a company untold sum of money, wasted time and resources and damage the bottom line. Below are the Top 10 Critical Success Factors which directly address those root causes of ERP failures and offer a framework to a successful implementation. These are not revolutionary or even new ideas, but ones that have been used for hundreds of successful ERP implementations in a variety of industries. These Success Factors are tried and tested and offer real world consulting insight into the most challenging of IT projects: the ERP implementation. Outlined below are the Success Factors which are critical to the successful deployment of an ERP solution as Strong Executive Sponsorship, Focused Project and Scope Management, Minimize / Eliminate Customizations, Approved Solution Design, User/SME Participation and Engagement, Process Owner Led User Training and Sign-off, Documented User Procedures, Targeted Data Migration Strategy, Thorough System Testing, and Knowledge Transfer, these factors and technology planning, strategy, design, scope of process changes, testing, level of customization and the “people effect” all influence a successful implementation, can make an ERP implementation a smooth process and one that quickly delivers efficiency and ROI across the business.

2.6 The challenges of implementing an ERP system

When a company decides to rollout an ERP system as part of its core business processes, they must consider and provide solutions for the following general challenges. It is important to note that this list is generic and that every ERP system that rolls out is as distinct as the companies that are trying to implement the system. [De Soete, (2016)] all of : Upper Management Support, Reengineering Existing Business Process and Applications, Integration of the ERP with other existing departmental applications, Implementation Time, Implementation Costs, Employee Training, Integration Challenges, and The true challenges of integration span far across business and technical issues (Schraw & et.al, 2011), Enterprise integration requires a significant shift in corporate politics, Because of their wide scope, integration efforts typically have far-reaching implications on the business, Despite the wide-spread need for integration solutions, only few standards have established themselves in this domain, Operation and maintenance of the integrated enterprise resource planning major challenge.

2.7 The tools fulfilling the ERP requirements

To meet the needs of the above-mentioned functional requirements, the following tools and applications are mandatorily integrated into the ERP system.

2.7.1 Database Management/Data Warehouse/Information Management Tools

Data storage and information management with established workflow across different departments and functions are the backbone of any ERP system. Multiple solutions and tools are available for data storage, which include relational databases from companies like Oracle, Sybase, and DB2 and open-source free offerings like Microsoft MySQL, PostgreSQL, Apache Derby, etc. Other information management tools may include Content Management Systems (CMS) and repository applications, Depending upon the industry and required functions, an appropriate one needs to be selected. A manufacturer may find a transactional database like Oracle or MySQL to be more relevant as transaction-based data moves through different statuses (from manufacturing to inventory to order capture to sale to supply status). On the other hand, an online content writing company may find a CMS repository system with version control a better fit for their needs, The database or repository can be either a single centralized one, or multiple with automatic data flow from one database to the other. The defined workflow ensures seamless data movement. Databases can be hosted locally or remotely, or even in the cloud.

2.7.2 Applications and interfaces with suitable permission control

Data storage and management requires read-only or editing access to process the data. Once items are manufactured, they need to be marked as ready inventory. The stock management department then updates it as ready for sale. Following a purchase, the item should be updated to sold status and so on. To accomplish this, easy to use applications and interfaces make an integral part of any ERP system which also has defined controls and permissions. For e.g., once an item is marked as sold, only logistics department operators should be able to update it further, while the ones from manufacturing or inventory department should get a view only access. Similarly, for a content writing ERP tool (Banerjee & et.al, 2015) once a writer submits the content to the editor for review, only the editor should be able to modify it, to avoid any duplication and content conflicts, to enable such permission-based controls, applications and interfaces to be built in, any ERP solution which may be browser based, desktop installations or tablet/mobile apps. A manufacturing team at a stationary location will prefer a desktop-based interface, while a sales team constantly on the move will benefit from a browser-based interface or mobile app.

2.7.3 Workflow Management Tool

An ERP system (Corsini & et.al, 2020), constitutes of multiple modules and data repositories where data updates and actions follow a logically defined sequence based on the business needs. This constitutes the workflow. Workflow can be thought of as the mind controlling the various body functions (flow of blood, air, and food and other supplies, body parts movement, etc.). A clearly defined workflow with appropriate access at various levels is the necessary part of any ERP solution (Columbus, 2022). Commonly used tools implemented within ERP framework include Agiloft Workflow, orkflowGen, Inceptico DMS, IntelxBusinessManagement, SimpleECM, etc.

2.7.4 Reporting Tool / Dashboard

Management level, department level, team level or individual level report generation is another important requirement for an ERP system. It is usually available in either a dashboard form (with a real-time data view – showing such info as orders received but not yet shipped, failed payments of the last week, etc.) or customizable reports generated in common word- or data-editing applications like spreadsheets, most reporting tools and dashboards operate in real-time (or with a minimal time lag). Like the applications used by departments for data updates, these reporting tools/ dashboard views are available as browser based or desktop installations. They also include end-of-day reporting features offering emailing of reports with charts/graphs/tables as Microsoft Excel or Word attachments.

2.7.5 Communication Tools:

Within any system working across multiple departments, communication is mandatory. ERP systems facilitate this by offering tools for action based automated mail generation, instant messaging, chat or general broadcast features at individual and group levels. Say once an order is marked as “Ready to Ship”, an automated mailer should be triggered to logistics department to initiate the dispatch process; or if a pizza shop kitchen has developed a problem, a general broadcast message can be sent to all other departments to stop taking further orders. Further instant messaging functions (like those from Lync, Chatter or Yammer) are incorporated to enable easy and instant communication. In addition to the above tools that are an integral part of any ERP system.

2.7.6 Analytical Tools

A lot of analytical tools can be integrated within ERP system for business intelligence, predictive analysis, data mining and related analysis. These analytical tools are used to get valuable insights for creating strategic business decisions based on available data (like tracking consumer behavior around holiday shopping, comparative results for products in red colored shelf having more sales than those in blue colored shelf, etc.) (Kulkarni, 2019).

2.7.7 Resource Allocation & Task Scheduling Tools.

ERP systems can also integrate tools for allocating resources across departments and tasks (for labor intensive industries). These tools work on the simple principle of defined time taken by a task/project against the resource availability schedule. On task completion, the resource is automatically assigned a new task matching his skills, or is put in a pool for the next assignment. Tools have functionality for manual intervention at the supervisor level in case a task is delayed. Benefits include clear visibility about current and future workload, optimum resource utilization, exploring possibilities for automation, etc (Quirk, 2020), ERP systems can integrate modules for Human Resource Management, Project Management, Time Tracking systems, Document

Management, etc., as per the business needs. There are a large number of tools available specific to each industry and function type, and ERP vendors provide their assistance to interested clients on selecting the best fit. Internet is always available for self-help on getting required info.

3. Research methodology

3.1 Research Problem

This research is Proposed Framework to Customize Enhancing the Integration of Enterprise Resource Planning (ERP) Systems that reduce failure factors of the ERP projects, Following Objectives are targeted: In depth study identify recent techniques, frameworks of Enterprise Resource Planning Systems, Identify limitations and problems facing developing efficient framework to customize of Enterprise Resource Planning (ERP) Systems, Analyze the target area (water and wastewater sector in Egypt), Developing an applicable framework., and testing and validating the efficient and applicability of the proposed framework, despite the success of ERP in many aspects, the practical application in many institutions, suffered from some negatives in Integration of the ERP, the main problem of this research is the Lack of well-defined Framework to Customize Enhancing the Integration of Enterprise Resource Planning (ERP) Systems rather than vendor oriented because of Many diverse ERPs systems in subsidiary companies in addition to different data structure and incompatibility between adapted tools.

3.2 Research Hypotheses

Researchers designed and implemented a program for enterprise resource planning systems for the Holding Company for Water and Wastewater and its subsidiaries. they disseminated the proposed program in several companies, and designed a questionnaire that collects data on the existing enterprise resource planning programs in these companies, according to the questionnaire, The main objective of the questionnaire was Determine the extent of the impact of using the proposed program on these companies through a set of direct and closed questions and using a five-point Likert scale, researchers assume a set of hypotheses that would be tested.

- Companies that change their policies to apply the proposed framework of the ERP succeed more than others in the same sector.
- Companies that Expanding in apply the proposed framework of the ERP are performing more than others in the same sector.
- Companies that give great importance to the maintenance processes the proposed ERP framework; her enterprise resource systems are more effective.

3.3 Research Questions

- How the support of the holding company affects application of efficient Framework dedicated to Enhancing the Integration of Enterprise Resource Planning (ERP) Systems?
- How can the expansion in apply the proposed framework of ERP affect the performance of the company?
- How maintenance processes affect the effectiveness of the proposed framework of the ERP?

3.4 population and sample

The central idea behind data integration is that clean data can be entered once into the system and then reused across all applications, As a result of the state's sense of the great necessity to restructure the drinking water and sanitation sector, to ensure the achievement of the desired strategic goals for the benefit of the Egyptian citizen; The state decided to establish the Holding Company for Drinking Water and Sanitation and the regulatory body for drinking water, sanitation, and consumer protection, according to Republican decisions in 2004, The Holding Company for Drinking Water and Wastewater was established by Republican Decree No. 135 of 2004 to establish a holding company for drinking water and wastewater, its subsidiary companies, and it has legal personality and is subject to the provisions of Law No. 203 of 1991 and its executive regulations, According to the third paragraph of the Republican Decree, economic public authorities and public sector companies for drinking water and sanitation have been transformed into subsidiary companies of the holding company subject to the provisions of the Public Business Sector Companies Law promulgated by Law No. 203 of 1991, so that the number of subsidiary companies becomes 25 affiliated companies serving 27 governorates. These subsidiary companies are distributed as follows- :

-Water companies only (Cairo Drinking Water Company – Alexandria Drinking Water Company - wastewater companies only (Cairo Sewage Company - Alexandria Sewerage Company -(Water and wastewater companies (Kaf El Sheikh - Damietta - El Gharbia -Menoufia - Qalyubia - Eastern -

Canal Cities - Red Sea - Beheira - MarsaMatrouh - North and South Sinai - Dakahlia - Giza - Fayoum - BeniSuef – Minya - Assiut and the New Valley - Sohag - Luxor - Qena – Aswan)

All of them are using ERP systems or at least parts of it. The researcher designed a questionnaire to collect some data to investigate the existing situations of the already implemented ERPs in the HCWW and its subsidiaries, the sample used in this study is an intentional cross-sectional sample due to its ability to adapt to the specific nature of the study. Where the opinions of company heads, executive directors, and information technology managers were taken from 23 companies as a sample from total 27 companies, the sample size was 384 units. The questionnaire was completed electronically to reduce turnaround time and enable response rate. (Abugabha et al., (2015)

3.5 Questionnaire Form Design

This questionnaire is designed to check the reliability, interactivity and usability of ERP. For the evaluation of the system the questionnaire is the most important tool to get the data from users, this questionnaire has been designed to collect information about the present situation to evaluate the actual need for the ERP in the HCWW and consequently to be generalized as a new Management of subsidiaries companies in the HCWW. The questionnaire is the qualitative approach for gathering the user's data and may be useful and cheap than any other approach. To design the evaluation criteria (Faisal, Nadeem Muhammad Chaudhry, 2009). The questionnaire is designed (see appendix 2), questionnaire is explaining the objectives of the case study. The questionnaire is composed of five parts as follows :

3.5.1 First part

This section of the questionnaire consists of all the data and information which can be categorized as general information about the basic organization, or the subsidiaries or any related business units. This section not only provides a general orientation of the topic that a questionnaire directed to analyze study, but also describes informed consent.

3.5.2 Second part:

This part contains significant information about the employed ERP and the implementation decisions. This part contains 8 basic questions. These questions aim to collect all the details about ERP to assess how to improve and modify if these is a necessity to modify to increase the adaption of the system for the existing future needs. The questions cover 8 areas; (Alejandra; 2021)
consist of five sections as follows;

3.5.3 Third part:

This section assesses ERP implementation assessment and contains the following issues: the assessed implementation of ERP modules, the timing of the starting of the implementation, the timing of the ending of the implementation, the key functions and strategic objectives gained from the implementation of ERP, the ERP implementation problems, Assess the difficulty of the employment. (Mohammad, 2013), assess the satisfaction, software; ERP SW, vendor, ERP implementer, updating technology, updating reporting and visibility, and application operational efficiency(Mohamed; 2015).

3.5.4 Fourth part:

This section assesses ERP implementation knowledge transfer. This will cover the following key areas: implementing ERP and improved interactions and communications with suppliers and consumers served, ERP system functionality and its content and how logical employed fits. (T. Kahkonen, 2013), the implementation of ERP has resulted in changing the policies of the organization, the implementation of ERP in the organization has led to the possibility of linking it to global system in the same field, implementation of ERP has resulted in restructuring of the organization. (Xu; 2018), how to assess the ERP system implementation projects result in the organization? (Laura; 2021), the biggest impact of the ERP system for the organization and the related externalities for the key stakeholders' parties (Rajagopal; 2020) and more.

3.5.5 Fifth part:

This section can focus on the customization of ERP integration. The section covers the following areas: The degree of the customization, the need for ERP integration, the key benefits of ERP integration the organization needs. (Marcus; 2009), the strategic benefits from automated billing processes. (Seyed, 2013), any comments or suggestions regarding the implementation of ERP in Egyptian public sector. (Maged, 2018), and more.

4. ERP Frameworks, Main Standards, and Components in literature

ERP purports (Rosemann ,2014) to support all business functions of an enterprise, as procurement, material management, production, logistics, maintenance, sales, distribution, financial accounting, asset management, cash management, controlling, strategic planning, and quality management. In addition to these general business functions, also says that : ERP often supports industry specific functions like patient management in hospitals, student administration at universities and high-volume warehousing transactions for retailers. All of these functions can be called as An ERP requirements list, or ERP selection template which is a document catalogues the requirements for an ERP project used during a request for proposal interactions between organizations and ERP suppliers. This stage both of organizations and ERP suppliers can deal about standards also not only component.

4.1 Frameworks

Choosing or designing a framework on a large scale institute as The Holding Company for Drinking Water and Wastewater and its subsidiaries in Egypt is very difficult, especially when we see (Soh and Sia, 2004) define customization evaluation as a problem of misalignment between the business and the underlying technology that supports its operations, (Morton and Hu, 2008) treat customization as part of examining the issue of fit between organizational structures and ERP systems. They propose a framework of contingency fit between ERP and organizational types, (Akkiraju and Van Geel ,2010) treat ERP customization from a cost estimation perspective by combining an artifact-centric approach and linguistic analysis approach. The authors adopt a technical perspective on counting business objects in ERP projects that use service-oriented architecture design style, (Pries-Heje, 2010) takes the socio-technical theory as a lens through which to explore the socio-technical misfit in ERP-adopting organizations, (Haines, 2009) views ERP customization from a cost ownership perspective using customization as a specialization of a business asset, (Qin and Wang, 2010) adopt a quality defect perspective to come up with an algorithmic model for predicting the quality of a customized ERP system,(Uwizeyemungu and Raymond, 2012) developed a framework that establishes a relationship between the essential characteristics of an ERP system (termed “ERP capabilities”) and the contribution of the system to organizational performance, (Sarfaraz et al. (2012) developed a framework to support managers involved in ERP package selection. This framework deploys fuzzy analytical hierarchy process to analyze the match between the organizational needs and the ERP system,(Zach and Munkvold, 2012) identify two categories, namely “prior to ERP going-live” and “after ERP going live”,(Ng, 2012) developed a model for predicting the benefits and cost of subsequent maintenance and upgrades to the system, Furthermore, so we have a lot of (ERP) frameworks can be showed in two perspectives: The technical which solves the technical problems like cost estimation, quality defect prediction and the tracing back of defects to system design activities and The managerial perspective or the institutional perspective which can answer the question of how to translate the high-level business requirements into application and design requirements (DRs) in such a way that allows for the evaluation and prioritization of the various possible arrangements of the customization options available in an ERP package and all of these ERPs can be classified into three categories: the application requirements (ARs), the process requirements (PRs) and the DRs, taking a look to (Luo and Strong, 2004) words when he said: were the first to propose a framework that unites the business processes of the enterprise with their ERP system. The goal of this framework is to help organizations understand which customization options are available and which of these are feasible given an organization's capabilities. The framework rests on the idea of combining customization options with the technical and process change capabilities required for system and process customization.

4.2 Standards

The very good questioner was that Rosemann asked ERP experts and answers was containing two questions we can discover the ERP standards or what ERP has to be as follows: complete set of integrated software modules (e.g. Production, logistics, finance, human resources, output design and much more), cross-functional integration (intra-organization), configurable software, best practice (especially new models) process models, timely (real time interact for local and cloud) enterprise-wide database, cross-enterprise business processes (inter-organisation), hooks to other systems (e.g. output design), multi-tier, client/server architecture, and easy and attractive UI/UX

4.3 components

also, Rosemann asked ERP experts about: - what significant, further developments do you see coming? The answers can lead us to the next generation of ERP modules as:e-business solution, emergence of 3rd-party electronic markets, data warehouses, middleware, customer relationship management, partner Relationship

Management (PRM) with normal modules as: Invoicing and Accounting, Inventory Management, Credit and Cashflow Management, Taxation, Banking, Online Access, Cost Control and Cost analysis, Security Management, Payroll Management, and Business Reporting.

4.4 Main Layers of the Proposed ERP Diagram

management of cost accounts, asset management, Managing warehouse accounts. Inventory control, Personal Covenant Management, Contracts and Procurement Administration, Follow up on electricity bills, Follow-up of temporary and permanent advances, Primary and final insurance documents, Managing financial accounts, Ongoing processes, usage and resources, and need all standards except some as Flexibility to support newly discovered customer trends, Improving customer service/support, low difficulty of Organizational Change, and Creates work orders ad-hoc or according preventative maintenance schedules,

4.4.1 automated cost accounting system

The automated cost accounting system aims at automating the work and functions of the cost accounting departments in water and wastewater companies so as to replace the manual labor work with automation, The system provides the possibility of registration of all entries which represents the detailed costs for each production unit or marketing units (Sub-cost centers). Entries include all costs: salaries, supplies and commodities, and services. The system provides the possibility of calculating the average cost per cubic meter of drinking water, and also calculate the cost per cubic meter of treated wastewater. The system provides the possibility of issuing of cost statements on the level of each sub-cost center or station, as well as issuing statements of total costs at the level of each activity, in addition to issuing a statement of total costs at the company level, The automated cost accounting system is integrated with other automated systems such as payroll, so as to automatically obtain salaries costs distributed to cost centers. The system is also integrated with Inventory Control System in order to automatically obtain data on commodities and supplies allocated to cost centers. The system is also integrated with the fixed assets system to obtain data on the depreciation of fixed assets allocated to cost centers. The system is also integrated with general ledger system and to obtain entries related to services allocated to cost centers. The system is also integrated with Document Management System in order to save the annual reports,

4.4.2 proposed framework procedures

researchers designed a list of experts to determine the criteria and components of the enterprise resource planning system for the drinking water and wastewater companies and the Holding Company for Drinking Water and Wastewater, and examined this list and formed the intellectual framework for the enterprise resource planning system and its component sub-systems with defining the general work standards, which may be in the system In full or on a component of the system according to the opinion of experts, it also added a set of standards that are specific to work in drinking water and wastewater companies, or that may be required by the deployment and operation of the enterprise resource planning system. In the next chapter, it will be exposed to the proposed system and test it statistically, researchers collected data about the ERP used in Holding Company for drinking water and wastewater companies and its subsidiaries in the Arab Republic of Egypt, whether the ERP is complete or not, and she determined the characteristics of each of them, and she also presented a proposal for an ERP framework for the Holding Company for Drinking Water and Wastewater and its subsidiaries, for the success of implementing this framework, the researcher had to determine and identify the risk factors that surround the application of this framework. Therefore, the researcher took into account all the standards and components that were agreed upon by the experts' list and also took into account the factors for establishing ERP and the use of programs and tools that can last over time (database software - creating websites) such as the use of SQL and ASP software, and program testing.

4.5 other considerations

Researchers considered other considerations as: Success Factors, prioritize ERP customization based on customers' requirements, and Risk Factors.

5. the framework of the Proposed ERP for HCWW in Egypt

Any good enterprise resource planning system requires addressing the user so that he can determine his data needs, storage locations, abbreviation for some operations, or executing and canceling a set of commands. Therefore, dialog boxes are the best means for determining these needs. Therefore, the researcher allocated a set of dialog boxes for the user of all categories. and its levels.

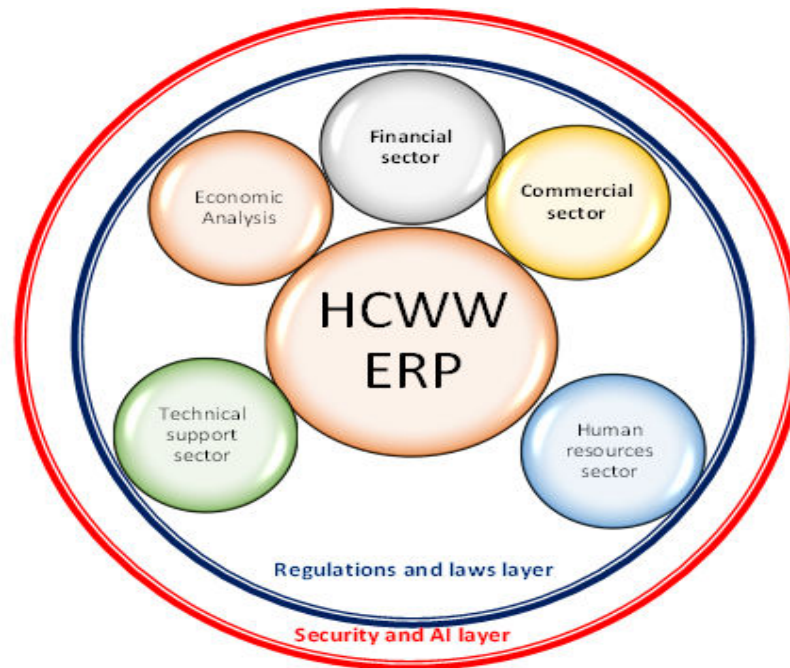


Figure no (1) proposed HCWW's ERP and its main components

Source: (Researchers, 2024)

The researcher designed the proposed enterprise resource planning system after the experts identified the different frameworks for each sub-system of the program's systems, taking into account all the criteria set by the experts, in addition to the basic criteria of securing data, documents, and users' powers, as well as the criteria for turning on and off some software.

6. Proposed ERP customization for HCWW in Egypt

First of all, researchers has found: All of The water and sanitation holding company and its subsiders have their own ERP , historical data and a lot of systems which are valuable, and ERPs of the water and sanitation holding company and its subsiders used a long time ago so it can be a familiar to employee works in these ERPs(Schubert and Williams, 2011; Eckartz et al., 2012) said that Any successful ERP implementation requires a complete fit between the ERP system and the business processes it supports as Past research studies on ERP projects reveal that companies should be extremely careful with ERP customization. because both over-customization (failure to reap the full benefits of it as (Ghost et al., 2002; Serrano and Sarriegi, 2006; Tiwana and Keil, 2006)) and under-customization pose a variety of risks to ERP implementation (inflexible to the implementing enterprise and does not meet all of their business requirements as (Zach and Munkvold, 2012; Ahmad et al., 2012; Seethamraju and Sundar, 2013)) AND implementation team need to explore and evaluate the different ERP customization choices to HAVE THE ability to make well-grounded decisions on the degree of customization for the ERP system,past studies pointed to developing the ERP customization process by many theoretical ways as Brehm et al. (2001) whom used Technical tailoring perspective, Luo and Strong (2004) Resource-based perspective and capability-based perspective, Soh and Sia (2004) Institutional perspective, organization adaptation perspective, Morton and Hu (2008)Structural contingency theory perspective, Haines (2009) Cost ownership perspective , Akkiraju and Van Geel (2010) Artifact-centric cost estimation perspective, Pries-Heje (2010) Socio-technical theory, Qin and Wang (2010), Quality defect perspective, Uwizeyemungu and Raymond (2012) Resource-based perspective, Sarfaraz et al. (2012) Package selection perspective, Zach and Munkvold (2012)

Technical customization taxonomy perspective, Ng (2012) Perspectives of system fit, user attitude and acceptance, Summary of related work maintenance and upgrade cost and theoretical, Saravanamuthu et al, (2013) Ethics, social learning and problem solving perspective perspectives applied, Sudhaman, (2013) insure that: the best method is Taking the customer's requirements as the starting point, it helps to evaluate the various ERP customization choices for the implementing organization, captures three dimensions of the customer's requirements, which are the application, the process and the design, which are used to identify the possibilities to fine-tune both the ERP-adopter's business processes and the ERP system itself, especially when using analytical hierarchy process (AHP) to the ERP customization framework, it can prioritize ERP implementation choices and enable management decision making with regard to customization, he assumes that Customer's requirements can be about Application requirements (ARs), Process requirements (PRs), or Design requirements (DRs) with a desire of No change (NC), Incremental change (IC), or Radical change (RC), The system was then applied for a full year on some companies.

7. Implementing of the Developed Proposed Framework

System implemented and used for 1 year in the departments of Files, Vacations, and Systems integrated with files integrated with all other systems like payroll, insurance, and vacations we find Companies that change their policies to apply the proposed framework of the ERP succeed more than others in the same sector, The study sample Divided (Strongly Agree) 32.6%, (Agree) 52.9 %, (Neutral) 3.6 %, (Disagree) 7.8 % and (Strongly Disagree) 3.1 % of the study sample and Which shows the high level of approval of the study sample members that companies that change their policies to implement the proposed framework for enterprise resource planning succeed more than others in the same sector were mean is 4.039 and S.D 0.978 and this indicates the correct of the first hypothesis of the study, Companies that Expanding in apply the proposed framework of the ERP are performing more than others in the same sector, and the study sample Divided (Strongly Agree) 47.9%, (Agree) 39.8 %, (Neutral) 6.8 %, (Disagree) 3.6 % and (Strongly Disagree) 1.8 % of the study sample and Which shows the high level of approval of the study sample members that Companies that Expanding in apply the proposed framework of the enterprise resource planning are performing more than others in the same sector were mean is 4.284 and S.D 0.882 and this indicates the correct of the second hypothesis of the study, and Companies that give great importance to the maintenance process the proposed ERP framework; her enterprise resource systems are more effective, and the study sample Divided (Strongly Agree) 50.8%, (Agree) 37.5 %, (Disagree) 5.5 % and (Strongly Disagree) 6.3 % of the study sample and Which shows the high level of approval of the study sample members that Companies that give great importance to the maintenance processes the proposed enterprise resource planning framework; her enterprise resource systems are more effective were mean is 4.211 and S.D 1.117 and this indicates the correct of the third hypothesis of the study, and results were:

- The important key business drivers behind the ERP implementation are Identify the critical path activities, functions, and equipment for each business function.
- The strategic approach of your planning ERP software are Single ERP application with other systems (home-grown, legacy, specialized functionality, etc.).
- The ERP Application Planning Selection criteria are Ease of integration with other systems.
- The type of ERP systems has planned to implement in organization are own software then Other Open-source software and SAP.
- The planning selected ERP modules are Finance & Accounting, Human Resource and Stock control/ Inventory.
- The type of deployment is Cloud then Hybrid Cloud.
- The implementation start is (3-5 Years), (2-3 Years) and (Less than 1 Year).
- The implementation end is (Less than 1 Year), other and (3-5 Years).
- The function/Objective gained from the ERP implementation are Ease of use, Integration of business operations/processes and Improved information accuracy and improved decision-making capability.
- The ERP Implementation Problems Are It takes a long-time causing cost overrun, Organizational resistance to change may be high and Lack of training.
- Most of the study sample members)89.3%) indicated that the ERP system implementation project was successful.

- The High level of Customization of ERP Integration and High level of ERP implementation decisions and High level of ERP implementation evaluation and High level of ERP Implementation Knowledge Transfer Assessment in the Holding Company of Water and Wastewater (HCWW).

8. Results

The Results can be divided to:

8.1 Framework results

- HCWW's ERP framework contains:

financial sector

- management of cost accounts
- asset management
- Managing warehouse accounts. Inventory control
- Personal Covenant Management
- Contracts and Procurement Administration
- Follow up on electricity bills
- Follow-up of temporary and permanent advances
- Primary and final insurance documents
- Managing financial accounts
- Ongoing processes, usage and resources

Commercial sector

- Invoicing management
- Management of government interests and senior subscribers
- Prepaid meter management
- Assay management
- Customer Service Department

Humanresources sector

- Training Administration
- Medicare Administration
- Entitlement management
- Vacation management
- File management, recruitment and financial disclosure
- Insurance and pension administration

Technical support sector

- Vehicle management
- Technical asset management
- Operation and maintenance department
- Projects management

Economic Analysis

- Managing and monitoring performance indicators
- Five-year plan and performance appraisal
- ✓ With two hidden components which are Regulations & laws layer, and Security & AI layer for ERP system results

8.2 recommendations

Technical and sector standards result

- | | |
|---|---|
| <ul style="list-style-type: none"> ▪ Inefficient and error-prone data management in applications ▪ high degree of customization ▪ improved decision-making capability ▪ low difficulty of Organizational Change ▪ Automate validate readings and bills for accuracy ▪ Maintain a list of all assets and manage documents electronically ▪ Creates work orders ad-hoc or according preventative maintenance schedules | <ul style="list-style-type: none"> ▪ Ease of integration with other systems ▪ high applications Operational Efficiency ▪ low Organizational resistance. ▪ Ease of use ▪ Automate billing runs with schedule plans ▪ fits existing business processes ▪ Flexibility to support newly discovered customer trends ▪ Integration of business operations/processes |
|---|---|

- low difficulty of Technical Aspects
- Sharing the experiences and ideas to work-related problems.
- considering to any later allocation and any developments.
- variety of Reporting and Visibility
- Lack of Access to Critical Data whenever required
- Does not need to lots of training and training time
- Top management requests
- Replace legacy systems
- Simplify and standardize systems
- Improved information accuracy
- Schedule and maintain multiple billing and reading cycles simultaneously.
- Reliability
- Improving customer service/support
- simplified and standardized sub systems of the ERP.
- considering achieving compatibility with other systems.
- improving interactions with suppliers and customers
- considering will linking with global systems in the same field.
- logical and fit ERP system
- considering will changes of the organization policies.
- considering will restructuring of the organization.

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