International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 04 | Apr 2022 www.irjet.net p-ISSN: 2395-0072

Digitalization of operations of micro industries using web-based ERP system.

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Abstract - *The aim of this study is to develop an easy to use and cost-effective web-based operations management system for micro manufacturing industries using Enterprise Resource Planning (ERP) concepts. The ERP solution primarily focuses on digitalizing ongoing processes and link them to a central database. The website will automate ongoing operations in a manufacturing firm to increase production and efficiency. With the ERP solution the firm will aim to reduce its dependence on manual processes. The website portal will help to manage raw material procurement and inventories. The portal will also assist with employee management and will keep records of machine related details like work installed, maintenance schedule, person assigned etc.*

Key Words: Micro Industries, Manufacturing, Operations management, Production, Enterprise Resource Planning, Website development, WIX

1. INTRODUCTION

The secondary sector or the manufacturing sector plays a vital role in an economy. Industrialization is a symbol of economic growth. The share of secondary sector in the India's economy is close to 25%. The sector is still subjected to low efficiency due to unnecessary manual work being involved. Automation delivers more efficiency and hence boosts the growth of this sector. Automation helps to make the working of these industries more organized and minimizes cost incurred. Automating proves to be extremely beneficial while performing recurring tasks and helps to streamline processes. An Enterprise Resource Planning software is deployed to automate operational processes of any organization. In a conventional enterprise system, departments are quite isolated with little interaction among them on a real-time basis. Data needs to be fetched from the relevant branch every now and then which makes the process very time consuming and also leads to duplication of data. ERP software consists of a central database that incorporates packages such as financials, human assets, income control, and inventory control which allow interactions among the departments. ERP package also tend to increase human productivity as it eases off burden and employees can rather focus on designing better business strategies. The applications of ERP can be extended and aligned with micro-scale industries. The ERP solution can be used to digitalize day to day activities of a manufacturing firm and help to integrate disparate data to a single database. A brief analysis of already existing ERP packages is carried out to identify possible improvements and to implement those changes in the ERP model developed in the research work. Industries have been continuously improving and becoming more efficient. Franco Malerba and Luigi Orsenigo [1] in their work have referred to the evidence, major facts, current explanations and the relevant unanswered questions concerning the dynamics and evolution of industrial structure. Three levels of analysis of dynamics and evolution of industry are discussed. Jeremy Atack et al. [2] discuss the American industrial revolution and how production was mechanized to increase efficiency. The manual labour was digitized. Various production models were analysed to understand the effects of automation on jobs and how economists moved away from the famous "black-box" model. The research also highlights the need of elaboration on task-based automation models to be considered. Andreas Schumacher et al. [3] have discussed on concepts of Automation, digitization and digitalization and their differentiated applications. People continue to use these terms without proper knowledge. Digitalization refers to increased use of digital elements and is therefore related to social science. Automation and digitization have their links in the field of manufacturing. All these terminologies complement each other and automation can't take place without the help of digital elements. Reference [4] points out the use of intelligent technologies and efficient computing systems in order to make business operations run smoother. Business processes are aligned with technological advancements to meet global competitive levels. The authors have also acknowledged some limitations of automation such as man-machine interaction, huge investments, complex implementation process etc. Through a thorough study of the available literature, this research work presents an automation-environment connection grid and outlines restrictions in automation design, adoption, and effective implementation by companies. Research work [5] reviews various already existing portals for industries and also discusses their limitations. Contract Manufacturing is being used as a case study. The authors have emphasized on changing trends of manufacturing industries and how e-commerce is going to have a high impact on it. The research discusses a framework to for the development of an enterprise information portal to support business strategies. SME's need to link their daily operations with an enterprise portal to strengthen themselves for future uncertainties. F.

Robert Jacobs et al. [6] briefly talk about the history and foundation of Enterprise Resource Planning (ERP) and showing relations with pre-existing MRP and MRP II. Enterprise Resource Planning was introduced by the Gartner Group in the early 1990's. ERP is defined as a criterion for evaluating software and its extent in integrating various functional silos. The research discusses how various firms adapted to ERP methodologies and how ERP evolved through the years. The major ERP suppliers are covered, as well as the industry's primary influence from advances in computer hardware and software. There's also a discussion on the current industry mergers. Reference [7] Briefly explains ERP as a software package integrating various operations in an organization along with various tools and techniques. The research work highlights the customer centric nature of ERP and its role in being competitive. ERP implementation resolves the lack of integration among different departments. Criteria for selecting ERP Methodology is mentioned which includes budget, knowledge domain of suppliers, local support, upgradation and technology used. The work also mentions ERP applications and selection criteria for small and medium organizations. Reference [8] presents ERP methodology and how it's implementation can prove to be quite tedious. The paper critically analyses various implementation procedures which are adopted by companies and identifies key differences in them. The findings show that a variety of factors impact performance, ranging from pre-implementation planning to system configuration, which managers should be aware of when deploying systems like ERP. Looking at the complexity of ERP systems E.J. Umble et al. [9] discuss critical success factors, some of which are; clear understanding of goals, strong leadership and strong management. Software selection steps and implementation procedures is highlighted. The research work lists down various functions supported by a ERP Package. Various reasons for the failure of a ERP system are briefly discussed. The applications of ERP are not only limited to industries. Sai Kumar Maddiboina[10] discuss the use of ERP develop a web based application for retail shops. The website's goal is to digitalize and automate the whole shopping process, making it convenient for customers. Reference [11] addresses the problems faced by students during room allocation in colleges. The aim of this project is to create an online room allocation procedure that will replace the traditional room allocation approach used by many large institutions or colleges. Reference [12] aims to study the important elements that lead to ERP system deployment failure. According to the research, critical failure factors (CFFs) occur in the deployment of ERP systems that support various organisational levels. SAP is a leading ERP solutions vendor. Vidyaranya B. Gargeya and Cydnee Brady [13] have analysed the implementation of SAP ERP package and the critical factors associated with it. The primary elements for successful implementation of an ERP system include working with SAP functionality and maintained scope, and project team/management support/consultants. On the other hand, the factors contributing to the unsuccessful implementation include inadequate internal readiness and training, and inappropriate planning and budgeting. Reference [14] discuss the architecture and performance of Oracle, another prominent ERP vendor. Oracle solutions have helped companies streamline their business operations. With the growing use of internet, Oracle's web-based ERP systems are developed to revolutionize small and medium scale industries. Research work [15] compares various cloud-based ERP solutions being used in the industry namely SAP, Microsoft Dynamics 365, and Oracle ERP Cloud. They are assessed on the basis of Return on Investment (ROI). The research concludes that every ERP system is different and should be chosen according to specific needs. Reference [16] demonstrates the use of ADDIE Model (Analyse, Design, Develop, Implement, and Evaluate) for developing the Wix websites. The analysis focuses on target audience set for website application and their needs and expectations. Developers should try to make the website user friendly making it easy for the visitors to surf through the website. Making the website simple also boost the user's confidence.

2. OBJECTIVES

The objective of this work is to develop a ERP solution specifically for micro industries. The solution is easily customizable depending on the type of industry it needs to be deployed for. A detailed analysis of the already existing ERP models is done and it is concluded that they do not seem to be fit for Micro industries where initial capital is very low. Existing ERP models require huge investments to install the ERP package and for employee training purposes. They are meant to handle large scale production activities. SAP ERP system charges $150-$220 per month per user, similarly Oracle ERP costs $80-$175 per month per user. IBM solutions start from $44 per month per user. Hence, freshly set up micro scale manufacturing firms tend to do most of their jobs manually in order to keep the initial investments low. In order to boost the efficiency of emerging micro industries, a low cost and easy to use ERP package is developed. The web-based ERP package can also be used by companies shifting to full-fledged ERP systems during their transition period to train their employees. The ERP solution will serve as a central database to automate and connect different operations such as employee management, machine management, Finance, Inventories, Raw material procurement and Client Details. Many advance machines can now be controlled over Wi-Fi and thus can be linked to the ERP Portal. The portal will digitalize conventional documentation processes and important data can be accessed by anyone authorized anywhere, anytime. This integration will increase the efficiency of the firm and make the data handling process more sophisticated. The ERP package will also assist with record-keeping and eliminates traditional way of storing data into hard copies.

Fig -1: Functions of web-based ERP solution

3. METHODOLOGY

A micro enterprise is an enterprise where investment in plant and machinery does not exceed Rs. 25 lakhs. Due to financial constraint the investment on ERP package development and training needs to be minimal. Web based ERP solution is found to be suitable for small businesses as it can be accessed remotely from anywhere. They are also easy to maintain and offer trouble free installation and upgradation. Website is designed using WIX Editor. It is a free user-friendly platform for webpage development without the knowledge of any coding skills. WIX also offers pre built templates and elements which makes it very a convenient and hassle-free process. The web page user interface is made lightweight to reduce unnecessary data consumption. The web page is made to be accessible by authorized people only where they can login using their Employee ID and password. All the features are displayed as Tabs on the left side of the web-page making it easy for the users to navigate through the website. The website displays Notice/upcoming events in the spotlight section. The website portal stores employee data such as Department, Designation and Check in-out time. The portal also links employee bank account and salary slip. The website proves to be very beneficial in handling invoices and inventories. There are various types of machinery deployed in an heavy industry and managing them can prove to be quite complex. The website offers critical machine information such as machine name, type and maintenance schedule. A successful enterprise always focuses on continuous learning and improvement. Training modules and ERP user guides are integrated within the portal system which can be accessed by the employees.

4. INDUSTRY PORTAL WEBPAGE

Login Page is shown in Fig 2. The home page is shown in Fig 3 where users can find various tabs, each assigned for different function. The Notice section is displayed at the center of the home page. Fig 4. displays bills and invoices of various spare parts, raw materials, lubricants etc. The machine details are tabulated as shown in Fig. 5. The website aims to digitize almost all operations which take place in a micro-scale industry. From storing Employee data as shown in Fig 6 to Client Information shown in Fig 7. The website is easily editable and easy to manage.

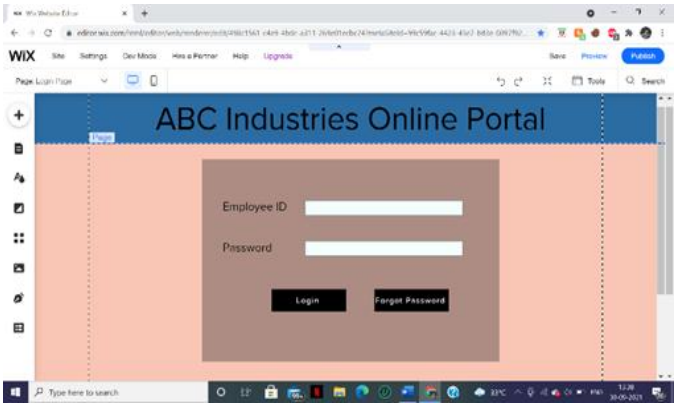

Fig -2: Login Page

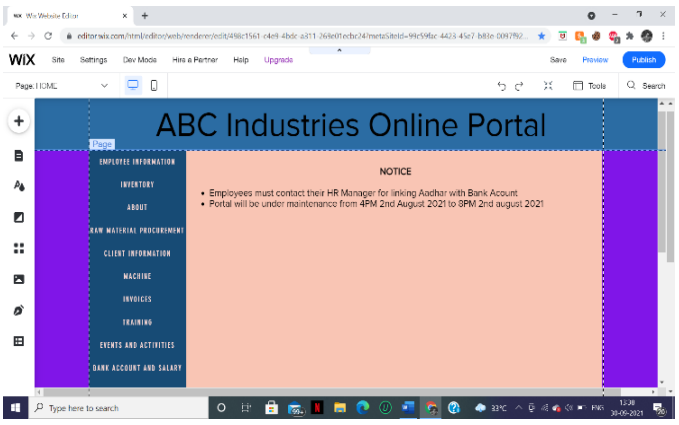

Fig -3: Home Page

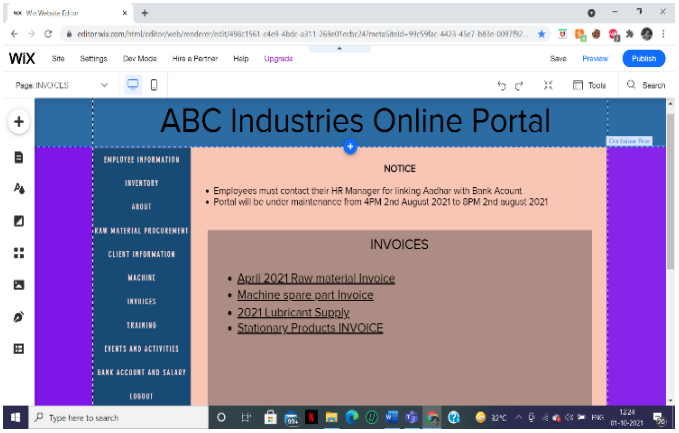

Fig -4: Invoices Section

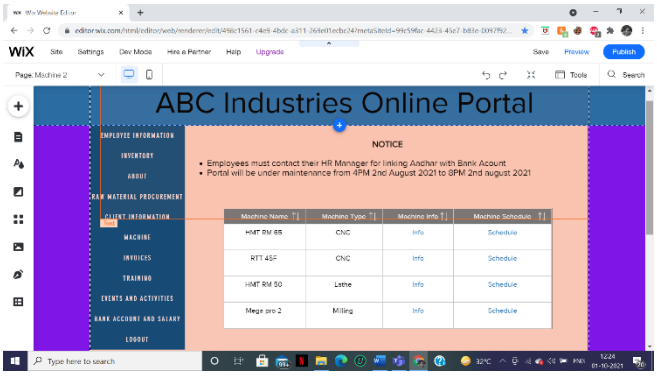

Fig -5: Machine Information Section

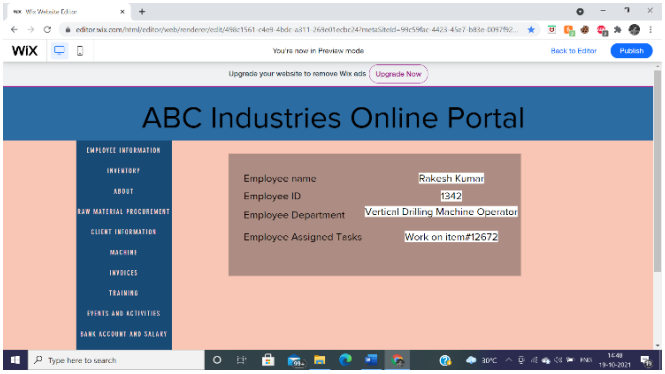

Fig -6: Employee Details

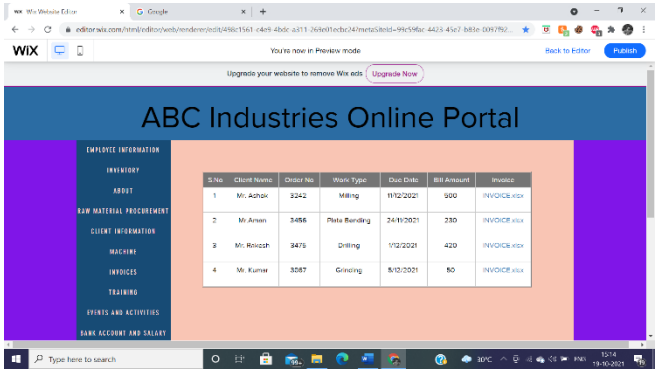

Fig -7: Client Information

3. CONCLUSION

The website developed can be a prototype ERP solution for micro-scale industries. Such firms can develop their own ERP solution using free website development platforms like WIX. The sole aim of an ERP being able to digitalize on-going business operations should be met. The ERP solution must align with business needs.

The prototype example developed in the course of research is user friendly, easy to maintain and cost-effective. Use of simple website elements and tabs to navigate makes it easy for users to navigate through the portal and avoids the need of any employee training. The website can be edited and managed using a central server and can be accessed using phone or desktop PC.

Micro-scale industries are capable of solving unemployment problems and in order for them to grow, they need to be efficient and ready to adopt to latest technological advancements. Digitalizing basic enterprise operations helps to perform tasks efficiently and also makes it convenient for the management to keep records of all necessary documents.

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